Jordan

National Micronutrient & Nutrition Survey 2019

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ABBREVIATIONS

AAS	Atomic absorption spectrometry
AGP	α-1-acid glycoprotein
AME	Adult male equivalents
BMI	Body mass index
CRP	C-reactive protein
DHS	Demographic and Health Survey
DOS	Department of Statistics
EA	Enumeration area
ELISA	Enzyme linked immunosorbent assay
HAZ	Height-for-age z-score
JNMNS	Jordan National Micronutrient and Nutrition Survey
MAM	Moderate acute malnutrition
MENA	Middle East and North Africa
MET	Metabolic Equivalent Time
MICS	Multiple Indicator Cluster Survey
MoH	Ministry of Health
MRDR	Modified relative dose-response test
MUAC	Mid-upper arm circumference
NCD	Non-communicable diseases
NPW	Non-pregnant women (15-49 years)
PCR	Poly-chain reaction
PFHS	Population and Family Health Survey
ppm	Parts per million
PSC	Preschool-age children (0-59 months; 6-59 months for blood markers)
PSU	Primary sampling unit
PW	Pregnant women
RBC	Red blood cell
RBP	Retinol-binding protein
RNI	Recommended Nutrient Intake
SAC	School-age children (6.0-12.9 years old)
SAM	Severe acute malnutrition
sR	Serum retinol
UNHCR	United Nations High Commissioner for Refugee
UNICEF	United Nations Children Fund
WAZ	Weight-for-age z-score
WFP	World Food Programme
WHO	World Health Organization
WHZ	Weight-for-height z-score

EXECUTIVE SUMMARY

Introduction

Despite sustained economic growth and reductions in some forms of malnutrition, progress on reducing micronutrient deficiencies has been mixed in Jordan. The most recent survey from 2010 reported that the prevalence rates of iron and vitamin D deficiencies are high in both pre-school children and non-pregnant women of reproductive age and that vitamin A deficiency affected about one fifth of pre-school children. Folate and vitamin B12 deficiency in non-pregnant women were reported to be relatively low in 2010. There are mixed reports about the anemia prevalence: while the 2010 national survey reported anemia in about one fifth of pre-school children, subsequent Population and Family Health Surveys (2012 and 2017-18) reported over one third of pre- school children to be affected. To address the issue of micronutrient malnutrition, the Jordan Ministry of Health has a longstanding policy of salt iodization. More recently, in 2002, it established a flour fortification program whose scope was broadened over time to include zinc, vitamin A and D, and several B-vitamins in addition to the initially included iron and folic acid.

As a country going through 'nutritional transition' (i.e. evolving from undernutrition to adequate or over-nutrition), Jordan experiences the increasing problem of the double burden of malnutrition, where in a population undernutrition and overweight occur concomitantly.

In the recent past, the Syrian crisis has led to an influx of refugees that are living both in camps and in the host community in Jordan. The number of refugees in Jordan is among the highest globally, both in absolute numbers and as a proportion of the resident population. In response, three refugee camps were established, Zaatari, Mrajeeb al Fhood and Azraq, but a large proportion of registered Syrian refugees resides within the host community in Jordan. Although overall, food security is relatively good in both refugees in the camps and in the host community, there were some concerns about poor dietary diversity and subsequently, poor nutritional status.

Objectives

The Jordan National Micronutrient Survey (JNMNS) had a twofold aim: a) to provide a comprehensive assessment of various forms of malnutrition in Jordan as well as an evaluation of various risk factors for malnutrition in women of reproductive age, pre- school children, and school age children; and b) to assess trends for key micronutrient indicators with the 2010 national nutrition survey for women of reproductive age and pre- school children. Sampling was designed to provide useful estimates at the national level and for each of the four strata. The strata consisted of Northern governorates, Central governorates, Southern governorates, and Syrian refugee camps.

Key nutrition and health indicators of interest identified by the Ministry of Health, United Nations Childrens Fund (UNICEF), the World Food Programme (WFP) and other stakeholders covered a wide range. These indicators are listed in Table 0-1 which gives the summary of nationwide results for the settled population.

Design

The JNMNS 2019 was designed as a national cross-sectional survey with four strata. In each stratum, 40 primary sampling units (PSUs) were selected with probability proportional to size from the list of primary sampling units in that stratum from the 2015 Jordan census. In each selected PSU, a household listing exercise was conducted by teams from the Department of Statistics (DOS) in order to provide an updated sampling frame for household selection. In the Northern stratum, non-Jordanian households represented a larger proportion of the total population than in other strata. To obtain a sufficiently large sample of Jordanian households in the Northern stratum, 20 households were selected in each selected PSU, whereas in other strata, 15 households were selected. The required number of households was selected with random sampling and equal probability in each selected PSU. This resulted in a planned sample size of 2600 households in total.

For households and each target group, separate assumptions were made about response rates for interview, anthropometric measurement, and biologic specimen collection. Non-pregnant women were recruited in only one half of selected households. Applying response rates and the expected number of individuals in each household, we projected that the JNMNS 2019 would collect data on 2210 households and completed interviews and anthropometry measurements from 1232 pre-school children, 1472 school-age children, 1152 non-pregnant and 158 pregnant women. We also expected survey teams to collect blood samples from 992 pre-school children, 1288 school-age children, 1256 non-pregnant women, and 152 pregnant women. Bread samples were collected from a random sub-sample of one quarter of the households.

Results

In this executive summary, only national estimates are presented. The rightmost column of Table 0-1 and Table 0-2 identifies the report table containing more detailed results.

Table 0-1. Summary results of the JNMNS for the settled population, Jordan, 2019

Target group	Indicator[a]	Result	Table[b]
Pre-school children			
6-59 months	Anemia	11.9%	Table 3-7
	Iron deficiency	26.0%	
	Iron deficiency anemia	5.1%	
	Vitamin A deficiency (retinol)	8.1%	Table 3-9
	Vitamin A deficiency (retinol-binding protein)	4.3%	
	Vitamin D deficiency	27.7%	Table 3-10
	Vitamin D insufficiency	33.0%	
	Zinc deficiency	11.5%	Table 3-11
	Hemoglobinopathies, sickle cell disorder	0.2%	-
	Hemoglobinopathies, α-thalassemia	4.5%	
	Hemoglobinopathies, β-thalassemia	4.1%	
0-59 months	Stunting (i.e. HAZ < -2)	7.4%	Table 3-13
	Wasting (i.e. WHZ < -2)	0.6%	-
	Underweight (WAZ < -2)	2.7%	-
	Overweight (i.e. WHZ > +2, ≤ +3)	7.0%	Table 3-14
	Obesity (i.e. WHZ > +3)	2.2%	
School-age children (6-12 years)			
	Anemia	6.0%	Table 3-25
	Iron deficiency	30.6%	
	Iron deficiency anemia	1.8%	
	Vitamin A deficiency (RBP)	7.2%	Table 3-27
	Vitamin D deficiency	44.2%	Table 3-28
	Vitamin D insufficiency	43.3%	
	Zinc deficiency	3.6%	Table 3-29

Target group	Indicator[a]	Result	Table[b]
School-age children (6-12 years) CONTINUED			
	Folate deficiency	0.6%	-
	B_{12} deficiency	6.9%	Table 3-30
	Marginal B_{12} status	22.7%	
	Stunting (i.e. HAZ < -2)	3.4%	Table 3-32
	Thinness (i.e. BMI-for-age z-score <-2)	1.4%	-
	Overweight (i.e. BMI-for-age Z > +2, ≤ +3)	11.8%	Table 3-33
	Obesity (i.e. BMI-for-age Z > +3)	16.0%	
Non-pregnant women (15-49 years)			
	Anemia	23.9%	Table 3-43
	Iron deficiency	65.6%	
	Iron deficiency anemia	21.5%	
	Vitamin A deficiency (RBP)	3.0%	-
	Vitamin D deficiency	63.5%	Table 3-47
	Vitamin D insufficiency	17.8%	
	Folate deficiency	10.6%	Table 3-45
	B_{12} deficiency	19.0%	Table 3-46
	Marginal B_{12} status	34.1%	
	Underweight (BMI≤18.5)	5.3%	Table 3-48
	Overweight (BMI≥25, <30)	29.3%	
	Obesity (BMI≥30)	30.2%	
Pregnant women			
	Anemia	19.1%	Table 3-56
	Underweight (MUAC <23 cm)	0.0%	-

[a] See text of method section for case definitions.
[b] Refer to the table indicated for more detailed analysis of the outcome, including group-specific results by age, region, wealth quintiles and other analyses.

Table 0-2. Summary results of the JNMNS for the Syrian refugee population living in refugee camps, 2019

Target group	Indicator[a]	Result	Table[b]
Pre-school children			
6-59 months	Anemia	25.2%	Table 4-6
	Iron deficiency	36.3%	
	Iron deficiency anemia	14.3%	
	Vitamin A deficiency (retinol)	8.9%	Table 4-8
	Vitamin A deficiency (RBP)	3.5%	
	Vitamin D deficiency	9.7%	Table 4-9
	Vitamin D insufficiency	36.7%	
	Zinc deficiency	12.7%	Table 4-10
	Hemoglobinopathies, sickle cell disorder	1.4%	-
	Hemoglobinopathies, α-thalassemia	3.2%	
	Hemoglobinopathies, β-thalassemia	2.3%	
0-59 months	Stunting (i.e. HAZ < -2)	13.9%	Table 4-12
	Wasting (i.e. WHZ < -2)	1.1%	-
	Underweight (WAZ < -2)	3.7%	-
	Overweight (i.e. WHZ > +2, ≤ +3)	5.0%	Table 4-13
	Obesity (i.e. WHZ > +3)	1.1%	
School-age children (6-12 years)			
	Anemia	11.0%	Table 4-24
	Iron deficiency	35.1%	
	Iron deficiency anemia	6.4%	
	Vitamin A deficiency (RBP)	7.1%	Table 4-26
	Vitamin D deficiency	15.5%	Table 4-27
	Vitamin D insufficiency	43.2%	
	Zinc deficiency	9.0%	Table 4-28
	Folate deficiency	2.2%	-
	B_{12} deficiency	2.1%	Table 4-29
	Marginal B_{12} status	9.8%	
	Stunting (i.e. HAZ < -2)	4.8%	Table 4-31
	Thinness (i.e. BMI-for-age z-score <-2)	1.4%	-
	Overweight (i.e. BMI-for-age Z > +2, ≤ +3)	15.9%	
	Obesity (i.e. BMI-for-age Z > +3)	6.3%	Table 4-32
Non-pregnant women (15-49 years)			
	Anemia	35.5%	Table 4-42
	Iron deficiency	68.2%	
	Iron deficiency anemia	30.9%	
	Vitamin A deficiency (RBP)	2.7%	-
	Vitamin D deficiency	56.3%	Table 4-45
	Vitamin D insufficiency	33.9%	
	Folate deficiency	5.1%	-
	B_{12} deficiency	12.3%	Table 4-44
	Marginal B_{12} status	30.4%	
	Underweight (BMI≤18.5)	3.0%	Table 4-46
	Overweight (BMI≥25, <30)	28.9%	
	Obesity (BMI≥30)	40.3%	

Target group	Indicator[a]	Result	Table[b]
Pregnant women			
	Anemia	37.3%	Table 4-54
	Underweight (MUAC <23 cm)	1.7%	-

[a] See text of method section for case definitions.
[b] Refer to the table indicated for more detailed analysis of the outcome, including group-specific results by age, region, wealth quintiles and other analyses.

We also compared the JNMNS 2019 results with those of the National Micronutrient Survey 2010. For this comparison, JNMNS data and analysis were matched as much as possible to the 2010 survey. As such, these results from the comparison analysis should not be used to draw conclusions about the current nutrition and health status of the Jordan population. The comparison found a significant increase in coverage with bread containing ≥15 ppm iron from 44% to 84%. Anemia prevalence in both children 12-59 months and non-pregnant women decreased by 5-6 percentage points, whereas iron deficiency prevalence increased by about 7 percentage points in children and by 15 percentage points in non-pregnant women. The prevalence of iron deficiency anemia remained largely unchanged. Vitamin A deficiency prevalence decreased in both groups, although in non-pregnant women, the decrease was not statistically significant. The prevalence rates of both folate and vitamin B12 deficiency increased in non-pregnant women between 2010 and 2019. The prevalence of stunting and wasting in children 12-59 months decreased over this time period, while the prevalence of child overweight remained unchanged.

Discussion

Jordan settled population

Among children 6-59 months old, the high prevalence of vitamin D deficiency and insufficiency stands out as a potentially important public health issue, with almost two thirds of these children having sub-optimal vitamin D status. Given the importance of adequate vitamin D status for optimal growth and immune function, these results are worrisome. Children with less sun exposure are more prone to vitamin D deficiency.

Although the anemia prevalence is only 12%, the high prevalence of iron deficiency (affecting one quarter of children 6-59 months of age) is also noteworthy, since iron deficiency has been associated with impaired cognitive development even in the absence of anemia. The prevalence of vitamin A deficiency prevalence has declined over time and at present affects less than 10% of children. Nonetheless, the direct health consequences of vitamin A deficiency and its role in contributing to anemia mean that vitamin A deficiency is still of public health relevance.

The prevalence of child stunting, wasting, underweight, and overweight are low in pre-school children of the settled population.

Among school-age children of the settled population, vitamin D deficiency and insufficiency is common, with slightly less than half of children being vitamin D deficient and most children having sub-optimal vitamin D levels. Exposure to sun is an effective means to reduce the risk of vitamin D deficiency. About one quarter school-age children have marginal vitamin B12 status, but less than one tenth show vitamin B12 deficiency.

The prevalence of undernutrition is low in school children. However, overweight and obesity prevalence is concerning among school-age children, affecting around a quarter of these children, and older children (>12 years) are more often obese than their younger peers.

Iron from bread provided about 25% of the RNI in non-pregnant women. A quarter of non-pregnant women in the settled population are anemic, but iron deficiency prevalence is high and is the main driver of anemia, followed by inflammation.

Vitamin D deficiency is highly prevalent in non-pregnant women: two thirds of non-pregnant are vitamin D deficient, and over 80% have sub-optimal vitamin D status. These prevalence estimates are high but comparable to the 2010 national micronutrient survey. While undernutrition is rare, two thirds of women are overweight or obese, posing a serious public health problem.

Anemia prevalence in pregnant women is lower than in the non-pregnant women. No pregnant woman was diagnosed with undernutrition. Almost two thirds consume an adequate diet and iron and folic acid supplements are consumed by about 6 in 10 pregnant women. During antenatal care visits, pregnant women are provided with iron and folic acid supplements free of charge. The coverage in the JNMNS is slightly lower than that reported in the 2017-18 PFHS, where almost 8 in 10 women reported having received iron supplements in the previous pregnancy.

Syrian refugee population

A quarter of pre-school children residing in the camps are anemic, which is considerably higher than among pre-school children in the settled population. Overall, iron deficiency occurs in almost 4 in 10 pre-school children in the camps, and over half of the anemia can be ascribed to iron deficiency. Although almost half of the pre-school children in the camps have sub-optimal vitamin D status, it is to be noted that the majority falls into the category of ‘insufficiency’. Sun exposure reduces the risk for sub-optimal vitamin D status, reiterating the importance of the sunlight for the body to synthesize vitamin D.

Undernutrition is reassuringly low in this population group and only stunting merits particular mentioning with a prevalence of 14% among refugee pre-school children. Overweight and obesity prevalence is low compared to children of the settled population. Infant and young child feeding indicators are mostly sub-optimal with low rates of exclusive breastfeeding and a rather low dietary diversity and subsequently, low minimum acceptable diet, as well as low consumption or iron-rich foods in the past 24 hours.

Just over 10% of school-age children in the Syrian refugee camps are anemic, more than half of it being associated with iron deficiency. About every third child has iron deficiency. Vitamin A deficiency poses a mild public health problem, whereas over half of the children have sub-optimal vitamin D status, most of them vitamin D insufficiency. Thus, vitamin D deficiency is less of a problem in the camp school-age children than in their peers in the settled population. Sun exposure is a very important risk factor for vitamin D deficiency. Zinc deficiency is present in 9% of the camp children, which is almost a three times higher prevalence than their peers in the settled population, but still not alarming. Both folate and vitamin B12 deficiency are lower in school-age children residing in the camps, namely just over 2%. Overall, undernutrition is not very common in school-age children in this camp population. In contrast and similar to school-age children in the settled population, almost one quarter of children in the camps are overweight or obese, yet, obesity only affects 6%, which is considerably less than in the settled peers.

Iron from bread provided about 30% of the RNI in non-pregnant women. A third of non-pregnant women in the camps are anemic, while iron deficiency is found in more than two thirds of non-pregnant women. Almost all anemia can be ascribed to iron deficiency anemia. Two thirds of non-pregnant are vitamin D deficient, and 9 in 10 have sub-optimal vitamin D status, which is slightly higher than in the settled population. Sun exposure was not associated with vitamin D deficiency, but since virtually all women are completely covered whenever outside, this analysis may be of limited value. Undernutrition is rare, but overweight and obesity affect over two thirds of women.

Almost 40% of pregnant women in the camps are anemic, which constitutes a higher prevalence than among other surveyed women. Dietary diversity is adequate in about half of these pregnant women and also about half of pregnant women consume iron and folic acid supplements, with other supplements being negligible.

Strengths and limitations

The JNMNS yielded satisfactory response rates for households, school aged children and non-pregnant women. However, a relatively high refusal rate for blood sampling among pre-school children and some technical difficulties to successfully collect venous blood samples in children less than 2 years of age were experienced. While the survey yielded national estimates with satisfactory confidence intervals for pre-school children, the reduced sample size lead to slightly wider confidence intervals of stratum- and age-specific prevalence estimates.

The JNMNS was designed to yield data for three strata, each encompassing the settled population living in several governorates and a fourth stratum including the Syrian refugee camps to obtain data on the nutritional status of Syrian refugees. Given the sampling frame for the settled population, Syrian refugees living within the host community (out-of-camps) could only be included in small numbers compared to the actual proportion they represent of all Syrian refugees, since the sampling approach used proportionate to population size sampling without oversampling of Syrian refugees out-of-camps. Thus, while the JNMNS was able to adequately sample Syrian refugees in the camps, only few Syrian refugee households living in the host community could be included in the sample. Thus, results for Syrian refugees living in the host community will have to be interpreted with caution.

The JNMNS included school-age children 6-12 years old in addition to pre-school children and non-pregnant and pregnant women, enabling for the first time to comprehensively assess nutritional status in this age group. One challenge faced during the interpretation of the results was that for several blood biomarkers, no established thresholds exist for school-age children, thus thresholds from the literature were used, where available or, when lacking, thresholds from different population groups were applied.

Similar to the 2010 Jordan Micronutrient survey, the JNMNS collected venous blood samples, which removed the potential of sample dilution compared to capillary sampling. The anemia prevalence rates between the two surveys are somewhat comparable and importantly, are only about a third to half of the anemia prevalence reported in the 2012 and 2017-18 PFHS happening in between the 2010 Jordan Micronutrient survey and the JNMNS. The PFHS used capillary blood to measure hemoglobin on a portable hemoglobinometer (Hemocue Hb 201+). Since recent research indicates that hemoglobin measurements from capillary blood samples and portable hemoglobinometers likely yield reduced hemoglobin concentrations and thus, increased anemia prevalence, the anemia prevalence in the JNMNS are most likely valid.

1. INTRODUCTION

1.1. Country overview

Jordan is an Arab kingdom in the Middle East with a total population of over 10 million(1). The country is comprised of 12 governorates. Jordan has experienced remarkable development over the past decades. Between 1990 and 2017, Jordan's per-capita gross domestic product rose 10-fold, the total fertility rate dropped from 5.2 to 2.8, and life expectancy at birth rose from 70 years to 74 years(2). The increase in life expectancy and drop in fertility coincided with a progressive decline in under-5 mortality from 30 deaths of under-five year olds per 1000 live births in 1990, to 23 in 2000, 17 in 2010, and 14 in 2017 (2).

The Middle East and North African region has recently faced various challenges, including multiple conflicts, the most recent being the Syrian crisis. This led to considerable population movements to seek refuge in more secure places, including in Jordan. Jordan is among the leading host countries for refugees due to the Syrian crisis(3), and it is ranked second globally in the number of hosted refugees relative to its national population(4).

1.2. Nutrition situation in Jordan

Despite sustained economic growth and reductions in some forms of malnutrition, progress on reducing micronutrient deficiency has been mixed in Jordan. The last micronutrient survey in 2010(5) found that 13.7% of pre-school children and 35.1% of women of reproductive were iron deficient compared to 26.1% and 38.7% in 2002(6). In contrast, in preschool children the prevalence of vitamin A deficiency increased from 15.2% in 2002 to 18.3% in 2010, and the prevalence of anemia increased from 20% in 2002 to 32% in 2012 (7); it is to be noted though that the 2010 National Micronutrient survey found an anemia prevalence of 17%(8), while the 2017-18 Population and Family Health Survey (PFHS) reports an anemia prevalence of over 32%(9). In women, anemia prevalence remained high with over 30% in 2012The prevalence of folate and vitamin B12 was reported to be rather low, with only 13.6% and 11.1%, respectively, in 2010. The high prevalence (60.3%) of vitamin D deficiency reported in 2010 in women poses a significant public health problem(10). Of note, this high prevalence of vitamin D deficiency was measured just prior to Jordan adding vitamin D to the micronutrient premix formulation (11). Vitamin D is now mandated to be added to all Mowahad wheat flour brand, which is the most commonly consumed wheat flour in Jordan, with about 90% of wheat flour in Jordan being Mowahad(11). For zinc status, while a global report *extrapolated* that 16% of Jordanians have inadequate zinc intake (12), no national data on zinc deficiency has ever been collected in Jordan. The 2010 National Iodine Survey found that 96.3% of the salt in Jordan was iodized (13), while the National Micronutrient Survey from the same year reported 66% of salt samples to be adequately iodized(8).

In recent years, the "double burden" of malnutrition – where undernutrition (micronutrient deficiencies and child undernutrition) and overweight and obesity occur concurrently – has described to be an increasing problem globally(14). Jordan is considered a country undergoing nutritional transition characterized by the onset of overweight and obesity in several population groups, while undernutrition and micronutrient deficiencies remain a continuing challenge(15). Alongside persistent undernutrition (including micronutrient malnutrition) in parts of Jordan, non-communicable "life-style" diseases are on the rise; almost 54% of women of reproductive age are overweight or obese as reported in the most recent PFHS(9). Underlying causes of non-communicable diseases in Jordan are thought to include a more sedentary life style, consumption of energy-dense, high-calorie foods, and limited physical exercise[16].

Although data are lacking on nutritional and micronutrient status among school-age children and adolescents, recent reports posit that overweight and obesity rates in the 5-20 years age-group have dramatically increased [15].

In pre-school age children, although stunting is somewhat prevalent, it is considered a 'low' public health problem, and wasting and underweight are rather low[7]. Similarly, prevalence of overweight and obesity has been described as stable although at somewhat elevated levels. Notwithstanding, infant and young child feeding patterns have been described as sub-optimal with exclusive breastfeeding rates in children below 6 months of age of only 26% and a prevalence of having an acceptable diet among children 6-23 months of age of only 28% [9].

1.3. Programs to combat malnutrition in Jordan

Because nutrition is intertwined with other challenges, only looking at nutritional strategies may be a narrow approach, yet a full review of current country strategies would be beyond the scope of this report. A recent review of strategic plans provides an excellent overview of this interplay and the current strategies[15] and covers policies around economic growth, water, agriculture, employment, social protection, climate change and others. And although according to this source, no specific policies on food security exist, there have been several nutrition strategies and decrees, which are briefly summarized below.

Because of high goiter rates observed in the 1990's, the Jordan government has initiated a salt iodization program, rendering the iodization of salt for human consumption mandatory; shortly thereafter, Jordan joined the Iodine Deficiency Disorders Control Program. This led to the establishment of a monitoring and evaluation program in 2000, succeeding in implementing an effective iodization program including coverage of legislation, political buy-in, public education, and monitoring[17]. Surveys conducted in 2002 and 2010 found a consistent improvement of iodine nutrition in school-age children[13]. This was followed by an adjustment of mandated iodine levels down from 50 ppm to 20-40 ppm[18].

To tackle the burden of additional micronutrient deficiencies, the Ministry of Health initiated a flour fortification program in 2002, rendering the addition of iron and folic acid to the Mowahad wheat flour mandatory[19]. Later on, in 2006, the program was broadened by adding vitamins A, B1, B2, B3, B6 and B12 as well as zinc to the premix[20]. An impact assessment comparing the 2010 with the 2002 national micronutrient survey results found mixed results, with declines in the prevalence of iron deficiency and iron deficiency anemia in children but not women[6]. However, based on the results from the 2010 survey[5] which showed a very high prevalence of vitamin D deficiency, vitamin D was additionally included in the wheat flour premix.

To address the sequelae of vitamin A deficiency in children, vitamin A supplementation (100,000 IU) is recommended for infants along with the measles vaccine, and routine vitamin A supplementation (200,000 IU) recommended for children 18 months of age.

A school-feeding program was initiated in the late 1990's targeted to pupils in underprivileged areas; this program, initiated by the Ministry of Health and the Ministry of Education, has steadily increased and with the support of WFP is currently estimated to reach 350,000 pupils nationwide[15].

1.4. The Syrian refugee nutrition situation

Since the beginning of Syrian crisis in 2011, many vulnerable Syrians sought refuge in Jordan, and as of September 2019 UNHCR reported 657,445 persons of concern that are legally registered and distributed throughout Jordan in both camp and out-of-camp settings(3).

As an emergency response, Zaatari Camp in Mafraq was established in 2012 to serve as a safe space for Syrian refugees; Zaatari camp hosts the largest number of refugees – 76,602 in 2019. Subsequently, to cope with the large influx of refugees, the Emirati-Jordan camp (Mrajeeb Al Fhood camp) was set up in 2013 in Azraq, currently hosting close to 7,000 refugees. In 2014, Azraq camp was opened and with close to 40,000 refugees, it is the second largest camp in Jordan. While both Zaatari and Azraq camp are managed by the Syrian Refugee Affairs Directorate of the Jordanian government and UNHCR, Mrajeeb Al Fhood camp is managed by the Emirates Red Crescent and the Federal National Council.

Notwithstanding, many Syrians are residing outside of these camps throughout Jordan; as of 2019 this is the case for an estimated 540,000 Syrian refugees(21). In 2018, WFP/Reach conducted a food security assessment among Syrian refugees, reporting that 88% were food secure at the time of the survey(22). Data disaggregation by camp vs. non-camp Syrian refugees found that food security was slightly better in the camp population than in the non-camp population of refugees. Similarly, the dietary diversity was slightly poorer in the non-camp refugees (31% vs. 20%).

The most recently conducted nutritional assessment among camp and non-camp refugees, the "interagency nutrition surveys amongst Syrian refugees", reported results as of 2016(23). It stated that for children less than 5 years of age, the prevalence of acute malnutrition (wasting) was low and also, chronic malnutrition (stunting) was mostly within acceptable limits as per WHO categories(24), although the prevalence of stunting was higher in Azraq camp at 19.2%. The lowest prevalence of stunting was observed in non-camp refugee children with 6.4%. Anemia prevalence in children and women of Syrian origin were reported in the most recent Population and Family Health Survey. The prevalence was not considerably higher than in Jordanians (34% vs. 32% in children 6-59 months; 45% vs. 42% in non-pregnant women); the report did not disaggregate into camp and non-camp Syrians(9).

1.5. Nutrition programs among Syrian refugees

Due to the fact that the three camps are managed by different entities, there are differences in the available health and nutrition services in the camps. There are no formally established nutrition programs or health clinics covering nutritional programming in Mrajeeb al Fhood camp, while there are in Azraq and Zaatari camp. Various health facilities managed by different non-governmental organizations can be found in the camps. Those include primary health care clinics, reproductive health clinics, secondary and tertiary health care services, mental health care, counseling and management of non-communicable diseases.

In the Mrajeeb al Fhood camp, Save the Children Jordan implemented the nutrition program between 2013-17, focusing mainly on supplementary feeding for moderate acute malnutrition and infant and young child feeding (IYCF). Thereafter, the camp nutritionists were providing counseling but not within a formally established CMAM program (Community based Management of Acute Malnutrition).

In addition to nutritional services, these clinics also implement IYCF aspects, including education through individual or group counseling. Topics cover early initiation of breastfeeding, exclusive breastfeeding in infants up to 6 months of age, timely introduction and appropriate quality of complement feeding, feeding sick children and re-establishing breastfeeding after interruption. Additional topics are around hygiene promotion, family planning and others.

Further, the MOH flour fortification program is implemented as a nutrition program for the refugees by fortifying Komaji bread in the bakeries inside the camp with no additional cost.

1.6. Survey goals and objectives

The overall goal of JNMNS 2019 was to obtain updated and reliable information on the current nutritional and micronutrient status of pre-school children, school-age children, women of reproductive age and pregnant women in Jordan to develop evidence-based policies to improve the nutritional status of these target groups. The survey was stratified to yield a nationally representative results for the settled Jordanian population and for Syrian refugees separately.

Due to continued fortification of wheat flour in Jordan, it was hypothesized that the prevalence of micronutrient deficiencies and anemia will have decreased since 2010. In particular, it was anticipated that the prevalence of vitamin D deficiency will show a marked decrease as vitamin D was added to micronutrient premix for Mowahad wheat flour following the 2010 survey. Thus, this survey additionally aimed to document changes in nutritional status since 2010.

The JNMNS 2019 was nationwide in scope, and collected data from five target groups: 1) households, 2) children aged 0-59 months (6-59 months for blood biomarkers), 3) school-age children 6-12 years of age, 4) non-pregnant women of reproductive age (15-49 years of age), and 5) pregnant women.

1.7. Primary objectives

The primary objectives varied by population groups and are detailed below:

1. Estimate the prevalence of acute malnutrition (wasting) using weight-for-height, chronic malnutrition (stunting) using height-for-age, underweight using weight-for-age, and overweight and obesity using body mass index (BMI) for age in pre-school children.[24]
2. Estimate the prevalence of chronic malnutrition (stunting) in school-age children by calculating height-for-age z-scores; in the same age group, estimate the current prevalence of underweight calculated using BMI-for-age z-scores, overweight and obesity by calculating the BMI-for-age z-score.
3. Estimate the prevalence of chronic energy deficiency, and overweight and obesity in non-pregnant women by calculating the BMI.
4. Estimate the prevalence of undernutrition in pregnant women by measuring mid-upper arm circumference (MUAC).
5. Estimate the prevalence and severity of risk factors for obesity related to diet and physical activity in pre-school children, school-age children, and non-pregnant women.
6. Estimate the prevalence and severity of anemia in pre-school children, school-age children, non-pregnant women of reproductive age, and pregnant women by measuring hemoglobin concentration.

7. Estimate the prevalence and severity of iron deficiency in pre-school children, school-age children, and non-pregnant women of reproductive age by measuring serum ferritin concentration and calculating what proportion of anemia is associated with iron deficiency[1].
8. Estimate the prevalence of vitamin A deficiency and/or insufficiency in pre-school children, school-age children, and non-pregnant women of reproductive age by measuring serum retinol and/ or serum retinol binding protein (RBP)[2].
9. Estimate the prevalence of deficiencies of serum folate and vitamin B12 in non-pregnant women of reproductive age and school-age children; red blood cell (RBC) folate was measured in a sub-sample of non-pregnant women.
10. Estimate the prevalence of zinc deficiency in pre-school children and school-age children.
11. Estimate the prevalence of vitamin D deficiency in non- pregnant women of reproductive age, school age children and pre- school children.
12. Estimate the prevalence of sickle cell trait and α- and β -thalassemia among pre-school children.

1.8. Secondary objectives and indicators

Anthropometric data (i.e., length/height, weight) from pre-school children, school-age children, and non-pregnant women were used to assess the association between micronutrient status and anthropometric measures. Because CRP and AGP in children and women were measured, the prevalence of inflammation in these two population groups was also obtained.

In addition to anthropometric indicators and biomarkers, interview data on variables that may influence various types of malnutrition or play a causative role were collected. Such additional variables included socio-economic status, household food security, individual dietary diversity, infant feeding and breastfeeding practices, intake of micronutrient supplements (e.g. iron-folate supplementation in women of reproductive age and vitamin A supplementation in children), iron intake from bread in young children and women, and other factors.

Exploratory analyses were conducted to estimate the role of various causes of anemia, iron deficiency and other relevant micronutrient deficiencies by measuring the status of multiple micronutrients and inflammation, as described above.

[1] Unless otherwise stated, indicators of iron deficiency (including iron deficiency anemia) were adjusted for the presence of inflammation as indicated by elevated levels of C-reactive protein (CRP) and alpha-1-acid glycoprotein (AGP) [86].

[2] In order to compare the JNMNS 2019 results with those from 2010, serum retinol was measured in all pre-school children. RBP, although not measured in 2010, was measured in all non-pregnant women and school-age children in the 2019 survey. To ascertain comparability of results serum retinol was measured in addition to RBP in a sub-sample of non- pregnant women and school age children.

2. METHODOLOGY

2.1. Geographic scope and basic sampling frame

The sampling universe consisted of all households residing in Jordan at the time of survey data collection activities, regardless of citizenship and nationality. To account for Jordan's administrative and demographic differences, separate sampling frames were used in four sampling strata. Three of these strata consisted of the northern, central, and southern areas of Jordan. These strata combined adjacent governorates and took into account population density and the agro-ecological zoning. Similar stratified sampling has been used in recent surveys (e.g. national iodine deficiency survey) [13]. In addition, in order to produce separate estimates of health and nutrition indicators for the sizable population of Syrian refugees residing in refugee camps in Jordan, these camps were included in a fourth stratum.

Thus, the survey sample comprised four survey strata: 1) Northern governorates, 2) Central governorates, 3) Southern governorates, and 4) Syrian refugee camps. Each stratum had 40 clusters, with 15 households selected per primary sampling unit, except for the Northern stratum where 20 households were selected. This was to ensure sufficient Jordanian households because the population of the northern governorates is only 71.4% Jordanian. However, this sample size calculation could not ensure the desired precision for either stratum-specific or nationwide estimates among non-Jordanians not living in the refugee camps. Figure 2-1 shows the geographic strata and the governorates within each stratum.

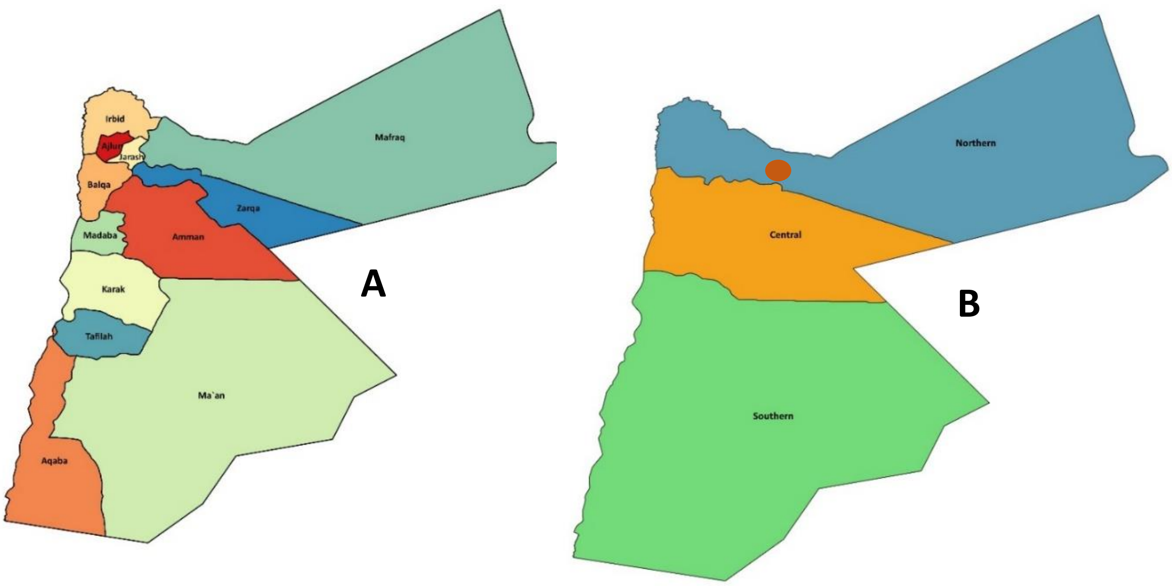

Figure 2-1. Map of Jordan showing governorates (A) and survey strata of the JNMNS (B)

1.2 Study participants

The study participants were drawn from households selected at random from selected primary sampling units. Table 2-1 lists the inclusion criteria for enrollment into the survey, disaggregated by target population group. No specific exclusion criteria were applied other than the negation of the inclusion criteria.

Table 2-1. Inclusion criteria by targeted population group

Target population	Inclusion criteria
Households	Household head or spouse or other adult household member gives oral consent for survey data collection
Children 0-59 months	Age between 0-59 months at the time of survey data collection (6-59 months for blood sample collection) Considered a household member by adults living in the household Mother or caretaker gives written consent for survey data collection
School-age children	Age between 6.0-12 years at the time of survey data collection Considered a household member by adults living in the household Mother or caretaker gives written consent for survey data collection
Non-pregnant women	Age 15-49 years at the time of survey data collection Currently not pregnant by self-report Gives written consent (in case of minors, written consent from their legal carers) for survey data collection Considered a household member by other adults living in the household Residing in household where non-pregnant women will be recruited
Pregnant women	Currently pregnant by self-report Gives written consent for survey data collection Considered a household member by other adults living in the household

2.2. Sampling approach and sample size determination

Sampling approach: The first stage of sampling for the JNMNS 2019 used the 2015 national census enumeration areas and subdivisions of the Syrian refugee camps (as defined by camp authorities) as the sampling frame. From this frame, 40 primary sampling units (PSUs) in each stratum were selected with probability proportional to size. As a result, the entire survey sample had an anticipated 160 clusters, but because one cluster in a refugee camp no longer existed by the time the survey was conducted, data collection could be completed in only 159 clusters. Before the first stage of sampling within each stratum, the PSUs of the Northern, Central and Southern strata were ordered by governorate, and within each governorate, by urban/rural classification. Within each urban/rural classification, the PSUs were arranged in serpentine geographic order. This ordering of PSUs resulted in implicit stratification within each of the three explicit strata. Because PSUs were selected using systematic random sampling, data analysis potentially achieved greater precision by accounting for this implicit stratification. Application of appropriate sampling weights allowed for urban/rural and national-level estimates for the settled population.

The second stage of sampling within each selected PSU consisted of a simple random selection with equal probability of 15 households in the central, south, and Syrian camp strata, resulting in an expected sample of 600 households in each of the central, south, and refugee camp stratum. In the Northern stratum, 20 households were selected in each of the 40 selected PSUs, resulting in a sample of 800 households. The entire survey sample consisted of 2600 households.

Sample size determination: An *a priori* sample size for the entire survey and each stratum was based on the estimated prevalence, the desired precision around the resulting estimate of prevalence, and the expected design effect for priority indicators of nutritional status in children 0-59 months of age, school children 6-12 years of age and non-pregnant women of reproductive age. Calculations assumed an expected household response rate of 85% and a 70-95% individual response, depending on the target group and indicator measured. The sample size was determined based on the desired precision for the different indicators (see tables in Appendix 8). For most indicators in most target groups using this sampling scheme, a sample of 2600 households were expected to yield estimates with approximately the desired precision.

The Fisher's formula for estimating the minimum sample size for prevalence descriptive studies was used as follows:

$$n = \frac{Z^2{}_{\alpha/2} P(1-P)}{d^2} * DEFF * \frac{100}{RR}$$

Where:

n	= minimum sample size, expressed as number of units of analysis,
Zα/2	= Z value corresponding to 95% confidence intervals
P	= the assumed prevalence
d	= the allowable sampling error, or ½ the desired confidence interval
DEFF	= design effect
RR	= response rate expressed as a decimal

Assuming 85% response rate among the 2600 selected households resulted in a calculated survey sample of 2210 households. All households were eligible for salt specimen collection and bread was collected from one quarter, or 552, of selected households. It was calculated that these 2210 consenting households have 1296 eligible pre-school children: 1232 with anthropometric measurements and 992 with blood specimens collected. Further, these 2210 households were expected to yield 1837 school-age children: 1472 with anthropometric measurements and 1288 with blood samples. The 2210 consenting households were thought to also have 2637 eligible non-pregnant women 15-49 years of age; however, because these 2637 women would yield greater precision than was required and unnecessarily increase survey costs, non-pregnant women were recruited in only one-half of selected households. As a result, 1552 women were eligible for recruitment. It was estimated that of these women, 1256 would have anthropometric measurements and 1056 have biologic specimens collected. The 2210 consenting households were anticipated to have 158 pregnant women: 152 with MUAC and 144 hemoglobin measured.

2.3. Household listing and random selection of households

Because the last national census took place in 2015, the household lists in each selected cluster were updated prior to random selection of individual households. The household listing exercise consisted of identifying the boundaries of the cluster by using the cluster maps provided by DOS for each of the selected clusters. During this exercise, all households within cluster boundaries were listed. For each household currently residing in the selected census unit Information about the head of the household (name, phone number if available) along with information helping to re-identify the household was collected.

This household listing exercise took place prior to the actual survey field work and was managed by DOS. Separate teams were deployed ahead of the actual field work. These listing teams were composed of two members per team. The household listing was done electronically using Open Data Kit (ODK) software. Completed household listing forms were uploaded daily onto the ODK database and from there, random selection of households were conducted after removal of permanently uninhabited buildings. Following this, pre-filled cluster control forms were generated which contained identifying information for selected households to facilitate access to the survey field teams.

2.4. Community mobilization and sensitization

As part of the community sensitization, the Ministry of Interior and Ministry of Health provided letters to the teams, and copies of these letter were sent to the local police departments prior to teams' arrivals. Further, staff of the Jordan Health Aid Society (JHAS) gave interviews on television about the survey, plus some other media channels were covered with short statements. To facilitate field work in the camp settings, UNHCR promote the survey within regular group meetings. Other circulars were sent to request the camp administration's support. In Zaatari Camp, JHAS had its own staff at the time of the survey and they facilitated field work there.

2.5. Training of survey teams

Prior to data collection, team members were thoroughly trained, and all survey instruments were pre-tested during the training. The training consisted of classroom instruction and practice, and of field testing of all survey procedures.

All survey field staff received extensive classroom training of each questionnaire, whereby interviewers and team leaders discussed each question, practiced reading the questions, and role-played interviews in Arabic. In addition, instructions were provided on how to record, save, and upload data on the tablet computers used during the survey.

As part of classroom training, anthropometrists and phlebotomists were trained on anthropometric measurement and blood collection techniques. A standardization exercise was conducted for the survey anthropometrists, whereby an anthropometrist, assisted by a phlebotomist, measured and recorded the length or height of 10 children, and their results were checked for precision as well as for accuracy when compared with instructor's "gold standard" measurements. Blood collection procedures were practiced, including training on labeling of samples, processing of samples, labeling of aliquots, pipetting procedures, and maintenance of the cold chain when transporting blood and urine specimens.

All survey samples were sent daily to Biolab for processing, storage and analysis or forward shipment. A one day classroom training for lab technicians on blood processing techniques and labeling of aliquots was conducted.

Following classroom training, two days of field testing was undertaken in two census enumeration areas (EAs) in the vicinity of Amman but which were not included in the survey sample. The teams conducted the community sensitization, interviewing, anthropometric measurements, and phlebotomy. Specimens were transported to Biolab Jubheya (Amman) for processing and thereby completing training of the blood processing teams. None of the samples from the field test were analyzed.

To ensure that all survey staff who were ultimately hired could appropriately implement the survey procedures, the training included 20% more than the required number of survey workers. To assess their understanding of field procedures, a short examination containing questions about various survey procedures was given to all survey staff. The results of this examination, the results of the anthropometry standardization exercise, and observations from the survey trainers were used to a) identify the best-performing team members and appoint a team leader for each team, and b) identify survey workers that could not adequately understand and implement the survey procedures. These individuals were released and were not included for the field work, or were retained as replacements in case of unexpected dropouts.

2.6. Field work

Data collection was conducted between 11th March and 2nd May 2019. Data collection was done by 11 teams, each comprised of 1 team leader, 2 interviewers, 2 anthropometrists and 2 phlebotomists, 1 Ministry of Health appointed medical doctor and 1 driver. Within a cluster, each team worked in sub-teams of 1 interviewer, 1 phlebotomist and 1 anthropometrist.

All reasonable attempts were made to recruit selected households. At least two repeat visits were made before dismissing a household as non-responding.

Interviews

For data collection at the household level, tablet computers were used for direct data entry. Skip patterns were built into the electronic questionnaires, which sped up interviewing as well as minimized erroneous entries. Interviewers administered the household questionnaire first, followed by the pre-school child, school child and woman questionnaires if the household had eligible children and/or women (as prompted by the tablet computer). During the household interview, a household roster was completed. Household and individual questionnaires were available in English and Arabic. Interviews were conducted in the interviewee's preferred language. All questionnaires can be found in Appendix 12

Bread (50g) specimens were sampled in every fourth household for later analysis of iron content and calculation of iron intake from bread. For selected women and children, interviewers prepared and labeled a biological form (see Appendix 12 for biological forms) before administering the individual questionnaires.

To help the respondents recalling food products, interviewers used a picture catalogue containing of commonly used food products, e.g. infant cereals, fortified foods. Further, interviewers showed an example of vitamin A supplements and of iron-folic acid tablets to assist the respondent's memory.

At the end of each day, the team leader reviewed and collated the biological forms and consent forms, and reviewed data collected in ODK. Interviewers were notified of any errors and/or omissions, whereupon they were instructed to make the necessary corrections, when possible.

Anthropometry and phlebotomy

The phlebotomists and anthropometrists worked as a sub-team; the phlebotomist acted as the anthropometry assistant and vice versa. One pair of them supported one interviewer, following him/ her from household to household. First, after completion of all interviews, anthropometric measurements from selected children and women were taken using standard methods [25] on a SECA scale (UNICEF, # S0141021). For children who could not stand by themselves, the mother or caregiver was first measured alone, then together with the child, so that the child's weight was obtained by automated subtraction using tared scales. Children's height or length was measured by using a standard wooden height board (UNICEF, #S0114540). For non-pregnant women, weight was measured using the same scale as used for children. Height was measured using the same standard wooden height board as used for the children. For pregnant women, only MUAC was measured to assess nutritional status. Anthropometry and blood pressure results were recorded on a paper form and later entered into ODK.

Phlebotomists collected blood via venipuncture: for non-pregnant women, a 2 mL EDTA-coated tube (Becton Dickinson [BD], #368841) and a 6 mL serum tube were used (BD, #368815); for pre-school and school-age children, a 2mL EDTA-coated tube and a 6 mL trace-element certified serum tube (BD, #368380) were used; for pregnant women, only 2 mL of blood was collected into an EDTA-coated tube. Blood tubes were placed in a cool box containing cold packs to ensure they are stored cold but not frozen at ~4°C and in the dark until further processing later the same day.

Participants found to have severe acute malnutrition or severe anemia were referred for treatment at the nearest health hospital or clinic (see Appendix 11 for referral form). No efforts were made to collect blood in a fasting state as this was unnecessary, since no biomarkers sensitive to fasting state were measured.

Cold chain and sample processing

Phlebotomists recorded the temperature inside the ice chests containing the cold packs every two hours. Every evening, when the field teams stopped their daily work, the blood and bread samples were picked up by a shuttle to be transported to the Biolab clinic in Amman for further processing and storage.

Upon receipt of the samples, the EDTA-coated tubes were separated from the serum tubes. The EDTA-coated tubes were used to conduct a complete blood count (Swelab Alpha Plus Standard). The remainder of the 2 mL EDTA-coated tube from pre-school children was placed in the refrigerator for analysis of hemoglobinopathies the following day.

The 6 mL silica-coated tubes from non-pregnant women, pre-school and school children were centrifuged at 3,000 rpm for 7 minutes to separate the serum from the erythrocytes and leukocytes. Serum was pipetted from the blood collection tubes and aliquoted into cryovials appropriately labeled with the respondents' ID numbers. These cryovials were frozen and stored at -20°C for later analyses before being dispatched to local laboratories or shipped to international laboratories for biochemical analyses.

From a 20% sub-sample of non-pregnant women, a blood sample for RBC folate analyses was prepared using 100 µL of whole blood and 1 mL of 10% ascorbic acid.

Serum samples were shipped on dry ice to international laboratories for analyses; dispatch to local laboratories was done using ice packs or dry ice, depending on the distance.

Bread samples were placed into Ziploc bags. At the end of each day, samples were placed in a dedicated box in an air-conditioned room; every second day, bread samples were transported to the Royal Scientific Society for drying and analysis.

2.7. Measurement and definition of outcomes

The principal nutrition outcomes measured in each of the target groups are presented in Table 2-2.

Table 2-2. Target groups and principal nutrition outcomes measured

Condition measured	Indicator	PSC[a]	SAC[a]	NPW[a]	PW[a]	HH[a]
Anemia	Hemoglobin concentration[b]	✓	✓	✓	✓	
Iron deficiency	Serum ferritin, markers of inflammation (AGP and CRP)	✓	✓	✓		
Iron deficiency anemia	Concurrent anemia and iron deficiency measured using ferritin	✓	✓	✓		
Vitamin A deficiency	RBP and retinol	✓[c]	✓[d]	✓[d]		
Folate deficiency	Serum folate (RBC folate sub-sample)		✓	✓		
Vitamin B12 deficiency	Serum vitamin B12		✓	✓		
Zinc deficiency	Serum zinc	✓	✓			
Blood disorders	Sickle cell and α-and β-thalassemia	✓				
Vitamin D deficiency	Serum 25[OH]D	✓	✓	✓		
Wasting/thinness	Weight-for-height z-score	✓				
	BMI-for-age z-score		✓			
	BMI			✓		
	MUAC				✓	
Stunting/shortness	Height-for-age z-score	✓	✓			
	Height			✓	✓	
Overweight and obesity	Weight-for-height z-score	✓				
	BMI-for-age z-score		✓			
	BMI			✓		
Iron in bread[e]	Bread iron content					✓

[a] PSC, pre-school children (0-59 months for anthropometry, 6-59 for blood biomarkers); SAC, school-age children (6-12.9 years); NPW, non-pregnant women; PW, pregnant women; HH, households;

[b] A complete blood count was conducted, comprising 22 parameters (e.g. MCV, hematocrit, etc.);

[c] For PSC, serum retinol was measured from all samples;

[d] For SAC and NPW, RBP was measured, with a sub-sample analyzed for serum retinol.

[e] Bread samples were collected for analysis of iron content to calculate iron intake from bread for children 12-59 months of age and women of reproductive age.

2.7.1. Anthropometric indicators

Children less than 5 years of age

In children 0-59 months of age, undernutrition (including wasting, stunting, and underweight) and overnutrition were defined using WHO Child Growth Standards [26]. Children with z-scores -2.0 for weight-for-height, height-for-age, or weight-for-age were defined as wasted, stunted, or underweight, respectively. Moderate wasting, stunting, and underweight were defined as a z-score less than -2.0 but greater than or equal to -3.0 Z-scores. Z-scores less than -3.0 define severe wasting, severe stunting, or severe underweight.

Overnutrition was defined as a weight-for-height z-score greater than +2.0. Overweight was defined as a weight-for-height z-score of greater than +2.0 but less than or equal to +3.0 and obesity as a weight-for-height z-score greater than +3.0.

Questions were asked during interviews of mothers to derive all 15 of the standard infant and young child feeding indicators recommended by WHO and UNICEF. These indicators are measured in different age groups, as shown in each table presenting infant and young child feeding results. For a detailed description of each indicator, see the WHO/UNICEF recommendations [27].

School age children

As in younger children, for children aged 6-12 years, undernutrition (including acute malnutrition, stunting, and underweight) and overnutrition was calculated using WHO Child Growth Standards. Children with z-scores below -2.0 for height-for-age or weight-for-age were defined as stunted or underweight, respectively; acute malnutrition (or thinness) was defined as children having BMI-for-age z-score -2.0 or less. Overweight was defined as a BMI-for-age z-score of >+2, while obesity was defined as a BMI-for-age z-score of <+3. [28]

Non-pregnant women

Chronic energy deficiency and overnutrition in non-pregnant women were assessed by using BMI. We used the following most commonly used cut-off points for BMI to define levels of malnutrition in non-pregnant women[29],as shown below in Table 2-3.

Table 2-3. Categories of chronic energy deficiency among non-pregnant women, by value of BMI[29]

BMI	Category of malnutrition
< 16.0	Severe undernutrition
16.0 - 16.9	Moderate undernutrition
17.0 - 18.4	At risk of undernutrition
18.5 - 24.9	Normal
25.0 - 29.9	Overweight
≥ 30	Obese

Pregnant women

Because body weight in pregnancy is increased by the products of conception and extra body fluid, BMI is not a valid indicator of nutritional status. MUAC was used instead to measure the nutritional status of pregnant women. A MUAC of less than 23.0 cm was used to define a pregnant woman as undernourished [30].

2.7.2. Blood specimens - case definitions for micronutrient markers

The cut-off values for biomarkers measured in the JNMNS 2019 are presented in Table 2-4 below.

Table 2-4. Clinical cut-off points and classifications for biomarker indicators

	Adequate	Mild	Moderate	Severe
Hemoglobin [31], *				
Children 6-59 months (PSC)	≥ 110 g/L	100-109 g/L	70-99 g/L	<70 g/L
Children 6-11 years (SAC)	≥ 115g/L	110-114 g/L	80-109 g/L	<80 g/L
Children 12-12 years (SAC)	≥ 120 g/L	110-119 g/L	80-109 g/L	<80 g/L
Non-pregnant women (NPW)	≥ 120 g/L	110-119 g/L	80-109 g/L	<80 g/L
Pregnant women	≥ 110 g/L	100-109 g/L	70-99 g/L	<70 g/L
	Deficiency cut-offs			
Retinol-binding protein and retinol [32,33]				
PSC, SAC, NPW	≤0.7 µM/L**			
Serum ferritin [34]				
PSC	< 12 µg/L**			
SAC, NPW	< 15 µg/L**			
α1-acid-glycoprotein [35]				
PSC, SAC, NPW	>1 g/L			
C-reactive protein [35]				
PSC, SAC, NPW	>5 mg/L			
Serum folate[36]				
SAC, NPW	<4 ng/mL/<10 nmol/L			
25[OH]D [37]				
PSC, SAC, NPW	<12 ng/mL, deficiency; <20 ng/mL, insufficiency			
Vitamin B_{12} [38]				
SAC, NPW	<150 pmol/L (<203 pg/mL), deficiency; <220 pmol/L (298 pg/mL), insuffiency			
Serum zinc [39]				
Children 6-59 months, children 6-9.9 y	Morning, non-fasting: 65 µg/dL, afternoon, non-fasting: 57 µg/dL			
Children 10-12.9 y, female	Morning, non-fasting: 66 µg/dL, afternoon, non-fasting: 59 µg/dL			
Children 10-12.9 y, male	Morning, non-fasting: 70 µg/dL, afternoon, non-fasting: 61 µg/dL			

* Because the normal hemoglobin differs by altitude and smoking, the cutoff for defining normal hemoglobin concentrations were adjusted for these factors[31], see also Table 2-5 and Table 2-6; also, because a complete blood count was conducted, 21 other parameters were obtained (WBC, LYM, MID, GRAN, LYM%, MID%, GRAN%, RBC, MCV, HCT, PLT, MPV, MCH, MCHC, RDW%, RDW, PCT, PDW%, PDW, P-LCR, P-LCC, and clinical ranges provided by the device supplier were used.

** These indicators were adjusted for sub-clinical inflammation using appropriate algorithms [40,41]; note that for RBP, no established thresholds have been developed; however, due to a good correlation between serum retinol and RBP, the same threshold was used.

The cut-off defining normal hemoglobin concentrations was adjusted for altitude of residence:

Table 2-5. Adjustments in cut-off defining anemia, by altitude of residence [42]

Altitude (meters)	Increase in cut-off point defining anemia (g/L)
< 1000	No adjustment
1000 – 1249	+ 2
1250 – 1749	+ 5
1750 – 2249	+ 8

The cut-off defining normal hemoglobin concentrations among women was also adjusted for the number of cigarettes smoked:

Table 2-6 Adjustments in cut-off defining anemia, by smoking status (Adapted from [43])

Cigarettes smoked per day	Increase in cut-off point defining anemia (g/L)
< 10 per day	No adjustment
10 – 19 per day	+ 3
20 – 39 per day	+ 5
40 + per day	+ 7
Smoker, amount unknown	+ 3

2.7.3. Blood specimens – analytical methods

Hemoglobin

Hemoglobin status was measured as part of a full blood count using a portable analyzer from Swelab (Alpha Plus Standard, Spanga, Sweden). In addition to hemoglobin concentration, hematocrit, mean corpuscular volume (MCV), and 19 other hematologic markers were measured. Daily quality controls were conducted as per the manufacturer's instruction. The complete blood counts were conducted at Biolab Jubiha by trained laboratory technicians only.

Serum ferritin, C-reactive protein and alpha-1 acid glycoprotein

Ferritin has been recommended by the World Health Organization for population-based assessment of iron status because it has been demonstrated to reflect an individual's iron status by showing its responsiveness to iron supplementation [44]. However, because ferritin levels are elevated in the presence of inflammation, the acute phase proteins alpha-1-acid-glycoprotein (AGP) and C-reactive protein (CRP) were used to adjust ferritin values for the presence of inflammation. Ferritin values were adjusted using the correction method developed by the Biomarkers Reflecting Inflammation and Nutritional Determinants of Anemia (BRINDA) project [41].

Serum ferritin, CRP, AGP, (and RBP, see below) were analyzed using an enzyme linked immunosorbent assay (ELISA) technique at the VitMin Laboratory (Willstätt, Germany). This laboratory participates regularly in inter-laboratory quality assurance programs, such as the VITAL-EQA from the Centers of Disease Control and Prevention (CDC), Atlanta.

Retinol, Retinol binding Protein (RBP)

RBP was used to assess the vitamin A status in participating school age-children and non-pregnant women. RBP can be analyzed with small quantities of serum. It is highly correlated with serum retinol

[45], the biomarker of vitamin A status recommended by the World Health Organization. RBP values for inflammation using recommendations from the BRINDA project [46].

All samples from pre- school children were analyzed for serum retinol. To validate RBP concentrations from the samples of school-age children and non-pregnant women, a sub-sample of sera was tested for serum retinol by the Khatib Micronutrient Laboratory (Affiliate of Najdawi Laboratories in Amman, Jordan). This laboratory has recently analyzed serum retinol samples in a series of surveys and has an excellent track-record of high-quality performance with CDC's VITAL-EQA external validation program for laboratories.

Vitamin D

25[OH]D is the most commonly used marker of vitamin D status[47]It was measured using the liquid chromatography-tandem mass spectrometry (LC-MS/MS) method [48,49]. Due to concerns of methodological comparability with the 2010 national micronutrient survey, the Khatib laboratory (Affiliate of Najdawi Laboratories in Amman, Jordan) has analyzed vitamin D concentrations using this method for pre-school children and non-pregnant women. Samples from school-age children were analyzed at Biolab using the Diasorin Liaison analyzer. Both laboratories have a proven track record of successful participation in external quality control (CDC's VITAL-EQA for the Khatib laboratory; College of American Pathologists for Biolab).

Folate

Serum folate is used to assess short-term folate status and is highly responsive to increased intakes of folate naturally present in foods and folic acid added during fortification[50]. Serum folate concentrations were measured using electro-chemoluminescence with the Roche e600 SER/E170 automated analyzer at Biolab Amman. The laboratory has a long-standing record of successful external quality control (College of American Pathologists) and has recently enrolled with CDC's VITAL-EQA program.

Whole blood folate concentrations were analyzed in a 20% sub-sample by the Swiss Vitamin Institute (Epalinges, Switzerland) using a microbiological assay method using Lactobacillus caseii (ATCC 7469) as test organism following the turbidimetric reference method[51]. The Swiss Vitamin Institute participates regularly in inter-laboratory comparisons, such as the VITAL-EQA from the Centers of Disease Control (CDC), Atlanta.

Vitamin B12

Serum vitamin B12 assesses short-term B12 status and is frequently measured along with folate deficiency because both deficiencies can be a cause of anemia[31]. Measurement of vitamin B12 status in non-pregnant women can be used to assess the impact of wheat flour fortification. Serum vitamin B12 concentrations were measured using electro-chemoluminescence with the Roche e600 SER/E170 automated analyzer at Biolab Amman. The laboratory has a long-standing record of successful external quality control (College of American Pathologists) and has recently enrolled with CDC's VITAL-EQA program.

Zinc

Zinc concentrations were measured using absorption colorimetric assay with deproteinization. Biolab Amman conducted the analyses on the Roche Cobas C501 automated analyzer. The CDC VITAL-EQA program does not include serum zinc, but Biolab is successfully participating in the Randox Laboratories organized RIQAS external quality control rounds.

Hemoglobinopathies

Testing for genetic blood disorders was done on specimens from pre-school children 6-59 months of age. The diagnositic algorithm is based on the Mentzer-index formula:

- All samples underwent complete blood count (CBC) and electrophoresis (BioRad, iso-electric focusing method; Tosoh G8 analyzer)
- If electrophoresis was positive for β-thalassemia: stopped (positive)
- If electrophoresis was negative for β-thalassemia, if MCV > 76: stopped (negative)
- If electrophoresis was negative for β-thalassemia, and MCV < 76: Mentzer index formula(52) (MCV/RBC) was calculated
- If Mentzer index was <14, polymerase chain reaction (Vienna Lab Strip Assay) was done. If positive, α-thalassemia was diagnosed.

Biolab Amman participates in an inter-laboratory comparison for several tests for hemoglobinopathies.

2.7.4. Analysis of bread samples

The iron concentration of the bread was measured quantitatively using atomic absorption spectrophotometry (AAS; AACC International, Method 40-70, 1999) at the Royal Scientific Society (RSS). A National Institute of Technology reference flour (NIST # 1567b) was used to correctly set the target range of a commercially purchased wheat flour containing approximately 12 mg/kg iron. This flour was then used twice daily for internal quality control, in addition to standard solutions prepared by the laboratory. As previously mentioned, although bread samples were collected from every fourth household in all strata, no coverage estimates of bread made from fortified flour were calculated for the 2019 survey. This is because there are several types of wheat flours used to bake bread in Jordan, but Jordan's flour fortification program only mandates that Mowahad wheat flour be fortified. During the field work, it was impossible for field teams to differentiate whether a bread was made from Mowahad flour or from another type of flour. Thus, flour fortification coverage is only presented for the 2010 to 2019 comparison, with variables matched as much as possible.

Although the coverage of bread made from fortified flour was not estimated, the iron content found in bread samples was use to estimate the iron intake from bread in children 12-59 months of age and women of reproductive age.

2.8. Data management and analysis

2.8.1. Data entry

Direct electronic data entry was done using Open Data Kit (ODK[3]) during the household, child, and women interviews. Parts of the individual questionnaires were completed by the anthropmetrist and phlebotomist using a paper form. These data were entered a separate database using ODK on the same or the following day.

2.8.2. Data monitoring

Interview data uploaded from the tablets were monitored continuously. In case of systematic and sporadic errors made by one or several teams, all team leaders were immediately informed about the problem, so the problem was not repeated and/or a standardized solution could be provided to all

[3] https://opendatakit.org/

teams. For individual data errors that the teams could address, they were requested doing so immediately while still in a given enumeration area. For some variables, such data quality checks could not be done immediately (e.g. composite anthropometric indicators) and thus, during data analysis, quality checks were conducted to assess the quality of the data collected. Some of these quality checks are presented in Appendix 4.

2.8.3. Data analysis

Data analysis was done using SPSS version 26. Data analysis included calculation of proportions to derive the prevalence of dichotomous outcomes and calculation of mean and median averages for continuous outcomes. Nationwide prevalence estimates (excluding Syrian refugees) were calculated by using weighted analysis to account for the unequal probability of selection in the 3 strata. The statistical precision of all estimates was assessed using 95% confidence limits. All measures of precision, including confidence limits and chi square p values for differences, were calculated accounting for the complex cluster and stratified sampling used by the JNMNS 2019.

Descriptive statistics were calculated for households, pre-school children, school-age children, and non-pregnant women (i.e. across all settled strata), for each stratum separately, by sex (for children), and for Jordanians and non-Jordanians (for households and individuals in strata 1-3 outside the Syrian refugee camps). Results were also calculated for specific age sub-groups for non-pregnant women and children. For pregnant women, only national estimates for all ages were generated and little subgroup analysis were permitted by the small sample size.

For continuous values presented in the report, means are presented if values were normally distributed. If distribution was not normal, the geometric mean was calculating by log transforming the values.

Calculation of statistical weights prior to data analysis

Standardized sampling weights were calculated for households based on the ratio between the overall sampling fraction for the entire sample and the stratum-specific sampling fractions. These weights were applied for all analyses involving survey subjects from more than one stratum. Because target household members were selected from the same proportion of households in all strata, these household sampling weights were applied to analyses of households, pre-school children, school-age children, non-pregnant women, and pregnant women. No statistical weighting was done for non-response. Because residents of Syrian refugee camps were analyzed separately and samples within the strata were self-weighting, no sampling weights were applied to the stratum-specific analyses , including all analyses of data from Syrian refugee camps.

Estimations of iron intake from bread

The daily or monthly quantity of bread consumed in each household was calculated from the quantities purchased or money spent at an average purchase and the reported usual frequency of purchase. The number of adult male equivalents (AMEs) was calculated from the household roster using established equivalents.[53,54] The AME is the proportion of an adult male's energy requirement which is needed by an individual in each age- and sex-specific group. Age and sex were used to calculate the AME for each household member, then the AMEs for all household members were summed to determine the total AMEs in each household. The total purchase per unit time of each food commodity was then divided by the number of AMEs in each household, and the flour intake for women of reproductive age and children 12-59 months of age was calculated; these estimates were then combined with the iron content in the bread tested from each household and expressed as the % of the recommended nutrient intake (RNI).

Calculation of wealth index and socio-economic status

A wealth index was calculated using the principal component analysis method commonly employed by UNICEF MICS, the World Bank, and the World Food Programme [55,56]. Characteristics of the dwelling, water and sanitation facilities, and ownership of durable goods were included in the principal component analysis. A wealth index was calculated for each household and split into quintiles on unweighted data to permit the cross-tabulation of various nutrition indicators by household wealth.

Calculation of sun exposure index

As the quantity of vitamin D synthesized by the body is related to sun exposure, we estimated the average sun exposure that women and children were subjected to on a daily basis. The index was comprised of data from several questions and was based on an approach developed by Gannage-Yared et al.[57] Specifically, average sun exposure was estimated as the number of hours spent outside daily while accounting for the frequency of use of sun protection and sunscreen The number of hours of sun exposure was multiplied by the following factors depending on the frequency of use of sun protection:

Consistency	Multiplication factor
Never/ rarely	1.0
Sometimes	0.8
Most of the time	0.2
Always	0

The index was then multiplied by the percentage of the body exposed to sunlight (4.5 percent for the head, 1 percent for each hand, and 9 percent for each arm).

Calculation of the WHO's metabolic equivalent of task (MET):

Metabolic equivalents (MET) measures the ratio between energy expenditure during a specific activity and energy expenditure at rest, commonly called the basal metabolic rate [58]. Although each activity has a different MET, WHO recommends that analysis of data from cross-sectional surveys and physical activity surveillance systems employ a simplified measure of MET which assigns a value of 4 to moderate physical activities and a value of 8 to vigorous physical activities. To calculate the total physical activity over time, each physical activity about which data are gathered is classified as either moderate or vigorous. Then the appropriate MET, either 4 or 8, is multiplied by the number of minutes that activity is done during a defined time period, giving the MET minutes for that activity. The MET minutes for each activity are then added together to calculate a single measure of an individual's physical activity for that specified time period. WHO recommends persons achieve at least 600 MET minutes per week.

2.9. Ethical considerations

In order to ensure that the survey follows principles to protect respondents and prevent unnecessary risk to survey respondents, ethical approval for the study was obtained from the Jordan University of Science & Technology Institutional Review Board (IRB, see Appendix 9 for ethical approval).

For household interviews, oral consent was sought from the household head or in his/her absence, from another adult household member. The selected women and child caregivers were asked to provide written informed consent (see Appendix 10 for consent form) for themselves and their participating children. If any consenting survey participants were unable to read and write, the consent form was read out loud to them and a thumbprint or fingerprint was taken as evidence of consent in lieu of a signature. Alternatively, the respondent could assign a witness to sign on their behalf. The respondents were also told that they are free to withdraw from participation in the survey at any time, even after written consent had been given.

Confidentiality of information from the respondents was upheld with utmost care throughout data collection, processing and analysis. Identifying records, in both electronic and paper formats, are stored under lock and key (or password) at all times and access granted only to specifically identified survey personnel. Specific identifying information was stripped from all electronic databases used by the survey management team for data analysis.

For children younger than 6 months, no blood was collected to protect them from undue discomfort. Participants diagnosed with severe acute malnutrition or severe anemia were referred to a nearby health facility (see Appendix 11 for referral form).

3. RESULTS: JORDAN SETTLED POPULATION

3.1. Response rates for households, pre-school and school-age children, and women

Figure 3-1 provides an overview of the response rates for the different target populations included in the JNMNS for the settled population. Overall, the response rates were satisfactory, with the exception being the blood collection response rate in pre-school children. From Table 8-1 in Appendix 1, it can be seen that the problem of the low response rate existed for all three strata, although somewhat greater in the Northern and Central stratum. In order to investigate if this low response rate for blood sampling potentially inserted bias into the survey results, a comparison of selected demographic variables was conducted between pre-school children with and without a blood sample, as presented in Table 8-7 in Appendix 5: very young children, overweight children and children from the wealthiest households had more often missing blood samples.

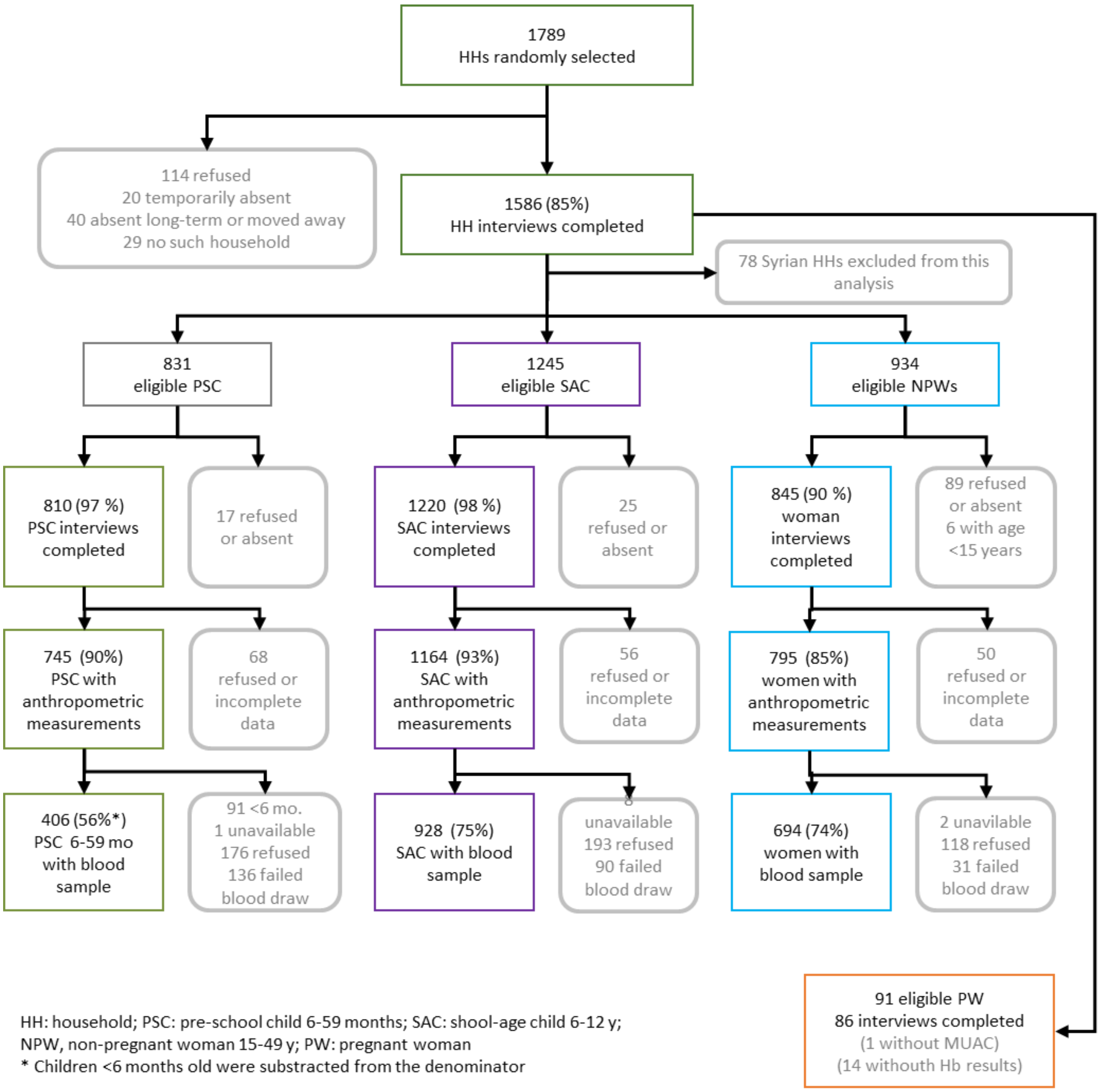

Figure 3-1. **Response rates at the household and individual level, settled population, Jordan**

3.2. Household characteristics (settled population)

3.2.1. Demographic characteristics

The characteristics of participating households from the settled population in the JNMNS 2019 are summarized in Table 3-1 below. In total 1586 households were included in the survey sample in these three strata. The urban/rural and regional distribution of the survey sample matches the distributions from census projections from the Department of Statistics [(1)].

Table 3-1. Distribution of selected residence variables for participating households, settled population, Jordan

Characteristic	Survey Sample n	% [a]	(95% CI) [b]	Jordan Population % [c]
Residence				
Urban	1306	87.3%	(77.9, 93.1)	90.3%
Rural	280	12.8%	(7.0, 22.4)	9.7%
Region				
Amman	285	41.0%	(31.6, 51.1)	42.0%
Balqa	35	5.0%	(1.6, 14.8)	5.2%
Zarqa	95	13.7%	(7.1, 24.8)	14.3%
Madaba	29	4.2%	(1.0, 15.4)	2.0%
Irbid	441	18.9%	(14.9, 23.5)	18.6%
Mafraq	98	4.2%	(1.9, 8.8)	5.8%
Jerash	65	2.8%	(1.1, 7.1)	2.5%
Ajloun	45	1.9%	(0.6, 5.8)	1.8%
Karak	214	3.6%	(2.5, 5.3)	3.3%
Tafelah	81	1.4%	(0.6, 2.9)	1.0%
Maan	76	1.3%	(0.6, 2.7)	1.5%
Aqaba	122	2.1%	(1.2, 3.6)	2.0%

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval, calculated taking into account the complex sampling design.
[c] From [(1)].

On average, households have about 4.7 members, and about two thirds of the household heads have secondary or higher education (Table 3-2). About one quarter of households have no women of reproductive age living in the households, about two thirds have no child currently aged 0-59 months, and about half have no school-age child 6-12 years old. About three quarters of the households own the dwelling in which they live.

Table 3-2. Demographic characteristics and wealth of households, settled population, Jordan

Characteristic	Number of households	Percent or mean [a]	95% CI [b]
Number of household members (mean)	1586	4.7	(4.6, 4.9)
Households with given number of non-pregnant women 15-49 years of age			
0	379	24.3%	(21.9, 26.8)
1	808	51.4%	(48.3, 54.6)
2	249	15.5%	(13.2, 18.2)
3+	146	8.7%	(6.9, 10.9)
Households with given number of children 0-59 months of age			
0	957	64.7%	(60.9, 68.3)
1	370	23.7%	(20.5, 27.3)
2	179	9.5%	(8.0, 11.2)
3+	33	2.0%	(1.2, 3.3)
Households with given number of children 6-12 years of age			
0	839	55.2%	(51.7, 58.6)
1	311	20.4%	(17.4, 23.7)
2	256	17.1%	(14.7, 19.7)
3+	133	7.4%	(6.0, 9.1)
Highest level of school attended by household head			
None	131	6.8%	(5.3, 8.7)
Elementary	455	27.9%	(23.9,32.4)
Secondary	545	33.2%	(29.9,36.6)
Higher	448	32.1%	(28.2,36.2)
Someone in household has credit card			
Yes	744	45.3%	(40.6, 50.2)
No	818	54.7%	(49.8, 59.4)
Owns dwelling			
Yes	1254	78.3%	(74.5, 81.7)
No	322	21.7%	(18.3, 25.5)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection between governorates.

[b] CI=confidence interval calculated taking into account the complex sampling design.

3.2.2. Water, sanitation and cooking fuel

As shown in Table 3-3, virtually all households use a 'clean' fuel source for cooking and have access to safe drinking water, adequate sanitation, and a handwashing place with soap and water.

Table 3-3. Indicators of household cooking fuel, water and sanitation, settled population, Jordan

Characteristic	Number of households	Percent[a]	95% confidence intervals [b]
Cooking fuel used			
Electricity	8	0.6%	(0.2, 1.4)
Natural gas	1568	99.1%	(98.3, 99.5)
Kerosene	1	0.0%	(0.0, 0.3)
No food cooked	9	0.3%	(0.2, 0.6)
Water source			
Piped into housing unit	651	40.2%	(33.7, 47.1)
Piped to yard/plot	19	0.6%	(0.2, 1.7)
Spring	16	0.8%	(0.3, 1.9)
Rainwater	104	4.8%	(3.0, 7.6)
Tanker truck	25	1.5%	(0.6, 3.6)
Bottled water	625	39.6%	(34.5, 45.1)
Water filter	145	12.3%	(9.1, 16.4)
Drink safe water[c]			
Yes	1567	99.3%	(98.3, 99.7)
No	14	0.7%	(0.3, 1.7)
Type of sanitation facility			
Flush to piped sewer system	945	67.9%	(59.5, 75.3)
Flush to pit latrine	602	29.4%	(22.4, 37.6)
Ventilated improved pit latrine	1	0.1%	(0.0, 1.0)
Flush to somewhere else	3	0.2%	(0.0, 0.9)
Pit latrine with slab	31	2.0%	(0.7, 5.5)
Pit latrine without slab /open pit	1	0.1%	(0.0, 1.0)
Share sanitation facility with another household			
Yes	25	1.4%	(0.8, 2.5)
No	1531	96.6%	(94.1, 98.1)
Don’t know	30	2.0%	(0.9, 4.5)
Adequate sanitation[d]			
Yes	1554	98.3%	(97.1, 99.0)
No	29	1.7%	(1.0, 2.9)
Water and soap at handwashing place			
Yes	1392	98.3%	(96.1, 99.3)
No	16	1.7%	(0.7, 3.9)

Note: The n’s are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection .
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Composite variable of main source of drinking water and treating water to make safe for drinking; a safe water source was considered to be: Piped into housing unit, piped to yard/plot, rainwater, tanker truck, bottled water, water filter[(59)].
[d] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush toilet to piped sewer system, flush toilet to latrine, pit latrine with slab not shared with another household[(59)].

3.2.3. Bread consumption

Komaji bread is the most commonly consumed bread type (Table 3-4).

Table 3-4. Bread and wheat flour purchasing variables of households, settled population, Jordan

Characteristic	Number of households	Percent or mean [a]	95% CI [b]
Type of bread usually purchased			
Komaji/Arabic	1149	78.8%	(74.7, 82.3)
Masrooh	280	12.0%	(9.8, 14.7)
Tabon	86	5.2%	(3.5, 7.8)
Mankosh/warda	5	0.5%	(0.2, 1.8)
Shrak	2	0.2%	(0.0, 1.0)
Home-made only (does not buy bread)	35	1.2%	(0.7, 2.1)
Does not use bread	6	0.2%	(0.1, 0.6)
Other	23	1.8%	(1.0, 3.5)

Note: The n's are un-weighted numerators for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages and means are weighted for unequal probability of selection between governorates.
[b] CI=confidence interval calculated taking into account the complex sampling design.

3.3. Pre-school children (settled population)

3.3.1. Characteristics

Table 3-5 describes the demographic characteristics of pre-school children participating in the JNMNS. A larger proportion of children reside in the Northern stratum. About half of children are male, and 85% reside in urban households.

Table 3-5. Description of sampled pre-school age children (0 - 59 months), settled population, Jordan

Characteristic	n	% [a]	(95% CI) [b]
Age Group (in months)			
0-5	91	11.7%	(9.1, 14.8)
6-11	77	9.7%	(7.3, 12.8)
12-23	156	20.4%	(17.1, 24.1)
24-35	172	22.0%	(18.5, 26.0)
36-47	150	17.1%	(14.0, 20.8)
48-59	164	19.1%	(16.3, 22.2)
Sex			
Male	399	50.1%	(44.7, 55.4)
Female	411	49.9%	(44.6, 55.3)
Residence			
Urban	647	85.0%	(73.2, 92.2)
Rural	161	15.0%	(7.8, 26.8)
Stratum			
Central	187	23.1%	(16.0, 32.2)
Northern	355	43.8%	(33.5, 54.7)
Southern	268	33.1%	(23.9, 43.7)

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.

3.3.2. Bread consumption and iron intake from bread

Children 12-59 months consumed just over 120 g bread per day, with some differences across residence, stratum and wealth quintile, although no difference reaches statistical significance (Table 3-6). Two thirds of the recommended nutrient intake for iron in children in this age group came from bread. Since total iron content of bread was measured, the iron from bread includes both intrinsic and fortification iron.

Table 3-6. Mean daily bread intake and iron intake from bread (as %RNI) for children 12-59 months of age, by various factors, settled Jordanian population[1]

Characteristic	Median daily bread intake (g); n=594 [a]	P value [b]	Median % RNI of iron for children 12-59 months; n=132 [a, c]	P value [b]
Total	122.0		67.7%	
Residence				
Urban	128.5	0.154	60.7%	0.411
Rural	95.5		72.2%	
Stratum				
Northern	128.5	0.430	64.1%	0.833
Central	118.6		71.4%	
Southern	113.2		55.9%	
Wealth Quintile				
Lowest	141.0	0.482	48.1%	0.032
Second	115.2		72.2%	
Middle	111.8		74.8%	
Fourth	126.9		87.9%	
Highest	85.9		69.2%	
Breastfed in past 24 hours				
Yes	83.8	0.721	47.2%	0.488
No	106.5		72.2%	

[1] In contrast to most other tables pertaining to the 2019 results presented in this report, this table only presents results for children 12-59 months of age.

[a] Medians and percentages weighted for unequal probability of selection.

[b] P-values are calculated using non-parametric median test; p-value <0.05 indicates that the median in at least one subgroup is statistically significantly different from the values in the other subgroups.

[c] The recommended nutrient intake iron in children is as follows (assuming 12% bioavailability): 12-35 months: 4.8 mg/d; 36-59 months: 5.3 mg/d; [(60)]; note that bread was collected only in a sub-sample of households; note that the sample size for iron intake estimates is smaller because bread samples were only collected from every fourth household.

3.3.3. Anemia, iron deficiency, and iron deficiency anemia

Nationally, just about 12% of pre-school children were anemic (Table 3-7). In this age group, no children had severe anemia, and 2.4% (95%CI: 1.1, 5.2; n=11) had moderate anemia, see table Table 3-8. This anemia prevalence constitutes a mild public health problem according to WHO[(42)].

Anemia prevalence was highest in children 6-11 months and gradually declined with age. Male children had a higher anemia prevalence than their female peers. Most other demographic variables were not significantly associated with anemia, except for wealth quintile, but there is no clear dose-response pattern: children from the poorest and second poorest households had higher prevalence than the middle groups, but children from the wealthiest households had the highest prevalence. However, there are few children with hemoglobin results in the highest wealth quintile group and thus, the precision estimate is quite poor with a wide confidence interval.

The distribution of hemoglobin values for children is shown in Figure 3-2. It is roughly symmetric with the majority of values above the cut-off point of 110 g/L. The mean hemoglobin concentration among all settled children 6-59 months old was 122.2 g/L (95%CI 121.8, 123.6 g/L).

Just over one quarter of children 6-59 months old was iron deficient, thus affecting about twice as many children than anemia. Similar to anemia, iron deficiency peaked in the youngest age group and then, diminished with increasing age. Also, although with a somewhat inconsistent pattern, iron deficiency occurs less frequently in wealthier children than poorer ones. Other demographic variables investigated here were not significantly associated with anemia.

Among anemic pre-school children in the settled population, the prevalence of iron deficiency was 47.6% (95% CI: 28.5, 67.4, n=53). Interestingly, this overlap diminishes with older age, indicating that other causes of anemia become more important.

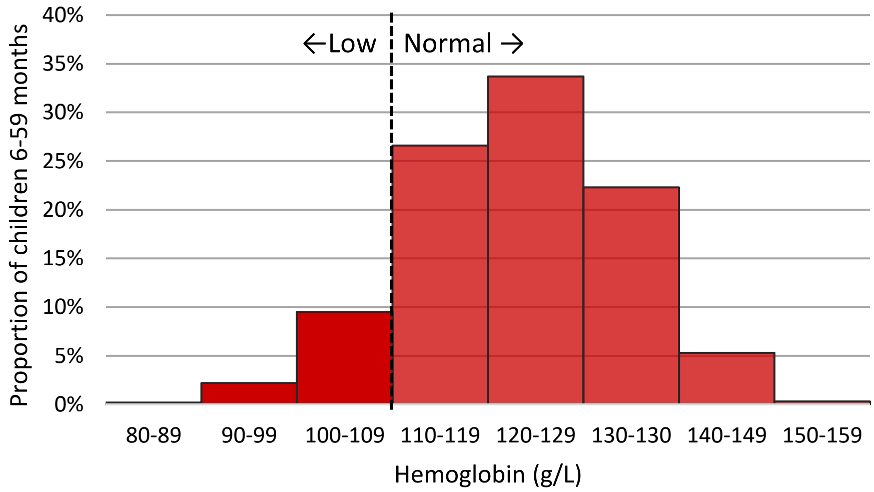

Figure 3-2. Distribution of hemoglobin (g/L) in children 6-59 months, settled population, Jordan

Table 3-7. Prevalence of anemia, iron deficiency, and iron deficiency anemia in children 6-59 months, by various demographic characteristics, settled population, Jordan

Characteristic	Anemia [b]				Iron deficiency [e]				Iron deficiency anemia [f]			
	N	% [a, b]	95% CI [c]	p-value [d]	N	% [a]	95% CI [c]	p-value [d]	N	% [a, f]	95% CI [c]	p-value [d]
TOTAL	406	11.9%	(8.0, 17.3)		395	26.0%	(21.3, 31.3)		408	5.1%	(2.8, 9.4)	
Age (in months)												
6-11	25	38.4%	(14.4, 69.8)	<0.001	26	37.5%	(18.1, 61.9)	0.000	27	17.0%	(4.9, 44.6)	0.000
12-23	77	14.8%	(7.6, 26.8)		74	33.1%	(20.1, 49.2)		76	7.2%	(2.6, 18.4)	
24-35	112	9.9%	(4.8, 19.5)		106	34.0%	(24.1, 45.6)		113	4.6%	(1.7, 12.1)	
36-47	92	9.4%	(4.0, 20.3)		93	19.2%	(11.8, 29.7)		92	3.2%	(1.3, 7.5)	
48-59	100	6.3%	(2.2, 16.5)		96	12.5%	(6.4, 23.1)		100	2.0%	(0.6, 6.6)	
Sex												
Male	203	15.8%	(9.7, 24.7)	0.028	195	29.4%	(22.0, 38.1)	0.268	201	6.7%	(2.8, 15.4)	0.317
Female	203	8.0%	(4.8, 13.1)		200	22.8%	(16.2, 31.1)		207	3.7%	(1.6, 8.3)	
Residence												
Urban	327	11.4%	(7.3, 17.4)	0.865	314	25.8%	(20.7, 31.7)	0.677	327	4.9%	(2.4, 9.8)	0.592
Rural	78	10.8%	(6.4, 17.6)		80	28.6%	(18.1, 42.1)		80	6.8%	(2.5, 17.2)	
Stratum												
Central	90	10.0%	(4.8, 19.6)	0.399	89	23.6%	(17.0, 31.8)	0.428	90	4.4%	(1.4, 12.8)	0.391
Northern	168	13.7%	(8.7, 20.9)		162	29.0%	(22.3, 36.8)		171	5.3%	(2.3, 11.5)	
Southern	148	16.9%	(11.6, 23.9)		144	30.6%	(24.6, 37.3)		147	8.8%	(5.3, 14.4)	
Wealth quintile												
Poorest	123	18.5%	(11.4, 28.7)	0.040	117	42.0%	(32.4, 52.3)	0.006	121	9.5%	(4.4, 19.0)	0.285
Second	95	12.9%	(7.1, 22.4)		91	24.0%	(15.0, 36.2)		98	4.8%	(1.9, 11.6)	
Middle	74	5.3%	(2.2, 11.8)		73	13.8%	(7.2, 25.0)		74	1.1%	(0.1, 7.4)	
Fourth	81	5.0%	(1.4, 16.5)		81	23.0%	(13.8, 35.8)		82	3.5%	(0.6, 16.9)	
Wealthiest	33	19.6%	(7.7, 41.7)		33	19.8%	(9.1, 37.9)		33	6.3%	(1.1, 28.8)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Anemia defined as hemoglobin < 110 g/L adjusted for altitude.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Iron deficiency defined as inflammation-adjusted serum ferritin < 12 μg/l.

[f] Iron deficiency anemia defined as inflammation-adjusted serum ferritin < 12.0 μg/L and hemoglobin < 110 g/L.

Table 3-8. Severity of anemia in children 6-59 months, by various demographic characteristics, settled population, Jordan

Characteristic	Mild anemia [b]			Moderate anemia [b]			Severe anemia [b]		
	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]
TOTAL	44	9.5	(6.4, 13.8)	13	2.4	(1.1, 5.2)	0	0.0	-
Age (in months)									
6-11	6	26.8	(11.3, 51.3)	3.0	11.7	(2.8, 38.1)	-	-	-
12-23	12	9.8	(4.7, 19.5)	5.0	5.1	(1.4, 17.2)	-	-	-
24-35	12	9.3	(4.4, 18.5)	1.0	0.6	(0.1, 4.7)	-	-	-
36-47	10	9.1	(3.8, 20.0)	1.0	0.4	(0.0, 2.6)	-	-	-
48-59	4	4.8	(1.3, 15.9)	3.0	1.5	(0.4, 5.3)	-	-	-
Sex									
Male	22	12.2	(7.3, 19.6)	8.0	3.7	(1.3, 9.8)	-	-	-
Female	22	6.9	(4.0, 11.5)	5.0	1.2	(0.5, 3.1)	-	-	-
Residence									
Urban	38	9.4	(6.1, 14.2)	12	2.7	(1.2, 5.9)	-	-	-
Rural	6.0	10.1	(5.6, 17.4)	1	0.6	(0.1, 4.6)	-	-	-
Stratum									
Central	7	7.8	(3.8, 15.3)	2	2.2	(0.6, 8.3)	-	-	-
Northern	20	11.9	(7.6, 18.2)	3	1.8	(0.6, 5.4)	-	-	-
Southern	17	11.5	(6.8, 18.8)	8	5.4	(2.7, 10.5)	-	-	-
Wealth quintile									
Poorest	20	12.3	(6.9, 21.0)	10	6.3	(2.7, 14.1)	-	-	-
Second	9	9.6	(4.7, 18.6)	3	3.3	(0.7, 15.4)	-	-	-
Middle	5	5.1	(2.2, 11.5)	0	0.0	-	-	-	-
Fourth	6	5.1	(1.4, 16.5)	0	0.0	-	-	-	-
Wealthiest	4	19.6	(7.7, 41.6)	0	0.0	-	-	-	-

Note: The n's are the numerators for a specific sub-group.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection among strata.
[b] Mild, moderate, and severe anemia defined as hemoglobin 100-109 g/L, 70-99 g/L, and <70 g/L, respectively.
[c] CI=confidence interval calculated taking into account the complex sampling design.

3.3.4. Vitamin A deficiency

The prevalence of vitamin A deficiency in pre-school children from the settled population in Jordan was 4-8%, depending on which of the two indicators is used, serum retinol or RBP (Table 3-9). Regardless of the indicator used, vitamin A deficiency prevalence denotes a mild public health problem on a national level according to WHO [33]. However, although the two indicators yielded a slightly different results, vitamin A deficiency appeared to be more prevalent in younger children. There were also differences by household wealth, yet there was no clear and progressive pattern emerging, although children from wealthier households were more likely to be deficient. No statistically significant differences by residence, sex, or strata were found.

Table 3-9. Prevalence of vitamin A deficiency in children 6-59 months, by various demographic characteristics, settled population, Jordan

	Based on serum retinol				Based on retinol-binding protein			
Characteristic	**N**	**% [a] with VAD [b]**	**95% CI [c]**	**p-value [d]**	**N**	**% [a] with VAD [b]**	**95% CI [c]**	**p-value [d]**
TOTAL	329	8.1%	(5.1, 12.5)		395	4.3%	(2.2, 8.4)	
Age (in months)								
6-11	17	25.1%	(6.4, 62.2)	0.000	26	9.6%	(1.5, 42.2)	0.000
12-23	55	7.9%	(2.2, 24.4)		74	1.0%	(0.1, 7.0)	
24-35	91	8.1%	(3.2, 19.2)		106	1.9%	(0.4, 8.0)	
36-47	79	7.8%	(2.9, 19.2)		93	4.3%	(1.0, 17.0)	
48-59	87	4.0%	(1.3, 11.6)		96	8.6%	(2.7, 23.8)	
Sex								
Male	167	8.1%	(4.1, 15.5)	0.986	195	4.5%	(1.7, 11.3)	0.882
Female	162	8.0%	(4.0, 15.5)		200	4.1%	(1.6, 10.0)	
Residence								
Urban	265	8.5%	(5.3, 13.5)	0.485	314	4.0%	(1.9, 8.3)	0.367
Rural	63	5.5%	(1.6, 16.9)		80	1.6%	(0.2, 10.9)	
Stratum								
Central	73	8.2%	(4.1, 15.9)	0.404	89	5.6%	(2.3, 12.8)	0.433
Northern	133	6.8%	(3.5, 12.5)		162	2.5%	(0.8, 7.3)	
Southern	123	11.4%	(6.5, 19.1)		144	2.8%	(0.9, 8.1)	
Wealth quintile								
Poorest	99	1.6%	(0.4, 5.8)	0.038	117	2.1%	(0.7, 6.3)	0.027
Second	76	6.7%	(2.1, 19.1)		91	8.5%	(2.8, 23.1)	
Middle	59	13.2%	(5.4, 28.5)		73	2.5%	(0.8, 7.8)	
Fourth	67	6.6%	(2.2, 18.0)		81	0.3%	(0.0, 2.2)	
Wealthiest	28	21.2%	(8.8, 43.0)		33	12.7%	(3.0, 40.4)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] VAD = Vitamin A deficiency was defined either as serum retinol ≤0.7 µmol/L or as RBP adjusted for inflammation ≤0.7 µmol/L[61].

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

The distribution of RBP and serum retinol values for children from the settled population is shown in Figure 3-3. The majority of values for both indicators are above the cut-off of 0.7 µmol/L. Note that

RBP was not inflammation-adjusted for the histogram and thus, more cases are below the threshold than shown in Table 3-9 above.

Mean serum retinol concentration in this group was 1.13 µmol/L (95%CI: 1.08, 1.16), and the mean inflammation-adjusted retinol binding protein concentration was 1.13 µmol/L (95%CI: 1.09, 1.16).

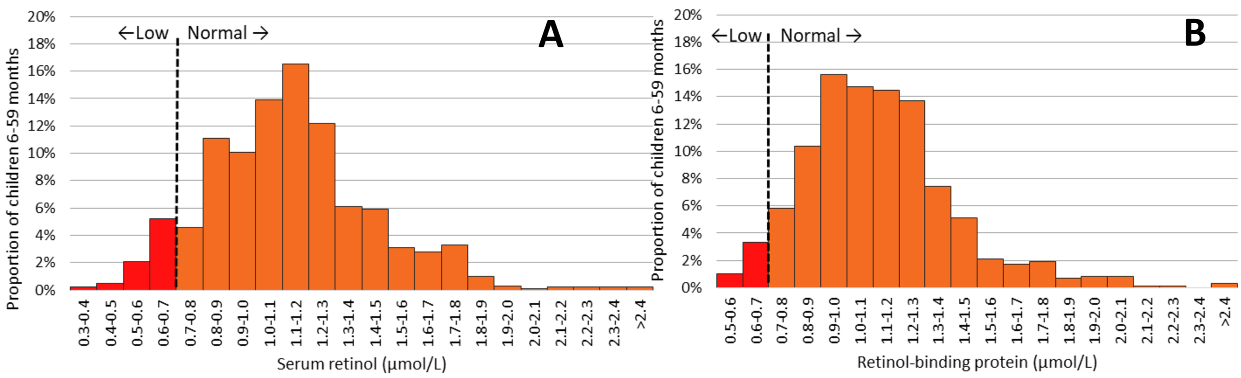

Figure 3-3. Distribution of serum retinol (A) and inflammation-adjusted retinol-binding protein (B) in children 6-59 months, settled population, Jordan

A comparison of retinol versus retinol-binding concentrations is shown in Figure 8-1 of Appendix 2.

3.3.5. Vitamin D deficiency and insufficiency

Almost one third of children 6-59 months old living in the settled population was vitamin D deficient, and another third was vitamin D insufficient, totaling up to almost two thirds of children with inadequate vitamin D status (Table 3-10). With the exception of children 6-11 months, which had a high prevalence of inadequate vitamin D status, there was a significant pattern showing increasing prevalence with age. There was also a difference between sexes, with the proportion of girls affected by vitamin D deficiency higher than among boys. Children in the Southern stratum were less often vitamin D deficient than those from Central or Northern strata. Other demographic factors were not clearly associated with vitamin D status.

The geometric mean of vitamin D concentration was 16.8 ng/mL (95%CI: 15.7, 17.9).

Figure 3-4 shows the geographic distribution of vitamin D deficiency among pre-school children in the settled population , and it can be seen that children in the Northern and Central strata are more often affected than their peers in the South. One exception is Karak, where the prevalence is below 10%.

Table 3-10. Prevalence of vitamin D deficiency and insufficiency in children 6-59 months of age, by various demographic characteristics, settled population, Jordan

		Deficient [a]		Insufficient [a]			Deficient or insufficient		
Characteristic	**N**	**% [b]**	**95% CI [c]**	**% [b]**	**95% CI [c]**	**p-value [d]**	**% [b]**	**95% CI [c]**	**p-value [d]**
TOTAL	340	27.7%	(22.3, 33.9)	33.0%	(26.4, 40.4)		60.7%	(54.9, 66.2)	
Age (in months)									
6-11	18	31.6%	(10.5, 64.4)	13.4%	(2.2, 51.9)	0.000	45.0%	(18.6, 74.5)	0.000
12-23	57	16.6%	(7.2, 33.8)	8.2%	(4.0, 16.0)		24.8%	(13.3, 41.5)	
24-35	95	20.9%	(11.6, 34.7)	34.3%	(23.9, 46.4)		55.1%	(42.3, 67.3)	
36-47	80	30.5%	(19.2, 44.7)	41.1%	(27.0, 56.9)		71.6%	(58.1, 82.1)	
48-59	90	40.3%	(26.5, 55.9)	46.6%	(32.4, 61.4)		86.9%	(79.1, 92.1)	
Sex									

Characteristic	N	Deficient [a] % [b]	Deficient [a] 95% CI [c]	Insufficient [a] % [b]	Insufficient [a] 95% CI [c]	p-value [d]	Deficient or insufficient % [b]	Deficient or insufficient 95% CI [c]	p-value [d]
Male	174	18.7%	(12.6, 26.9)	35.2%	(26.1, 45.5)	0.036	53.9%	(45.3, 62.3)	0.025
Female	166	37.1%	(27.6, 47.7)	30.7%	(20.2, 43.8)		67.8%	(59.4, 75.2)	
Residence									
Urban	276	28.5%	(22.6, 35.1)	31.4%	(24.3, 39.6)	0.080	59.9%	(53.4, 66.0)	0.422
Rural	63	17.7%	(8.8, 32.7)	46.2%	(36.6, 56.1)		64.0%	(56.0, 71.3)	
Stratum									
Central	75	33.3%	(24.7, 43.2)	28.0%	(18.3, 40.3)	0.013	61.3%	(53.0, 69.0)	0.404
Northern	138	22.5%	(16.6, 29.7)	39.1%	(30.9, 48.0)		61.6%	(51.7, 70.6)	
Southern	127	12.6%	(7.5, 20.5)	41.7%	(33.2, 50.8)		54.3%	(45.1, 63.2)	
Wealth quintile									
Poorest	102	18.7%	(11.3, 29.2)	38.5%	(27.5, 50.7)	0.353	57.1%	(47.5, 66.3)	0.234
Second	79	28.4%	(17.3, 42.9)	36.6%	(25.2, 49.6)		65.0%	(50.9, 76.8)	
Middle	60	33.5%	(18.3, 53.2)	41.3%	(25.4, 59.2)		74.8%	(61.5, 84.6)	
Fourth	70	33.3%	(18.6, 52.2)	20.3%	(11.0, 34.4)		53.6%	(37.7, 68.8)	
Wealthiest	29	25.3%	(9.2, 53.1)	27.6%	(11.1, 53.8)		52.9%	(32.1, 72.8)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Deficient <12 ng/mL; Insufficient 12.1-19.9 ng/mL.
[b] Percentages weighted for unequal probability of selection.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

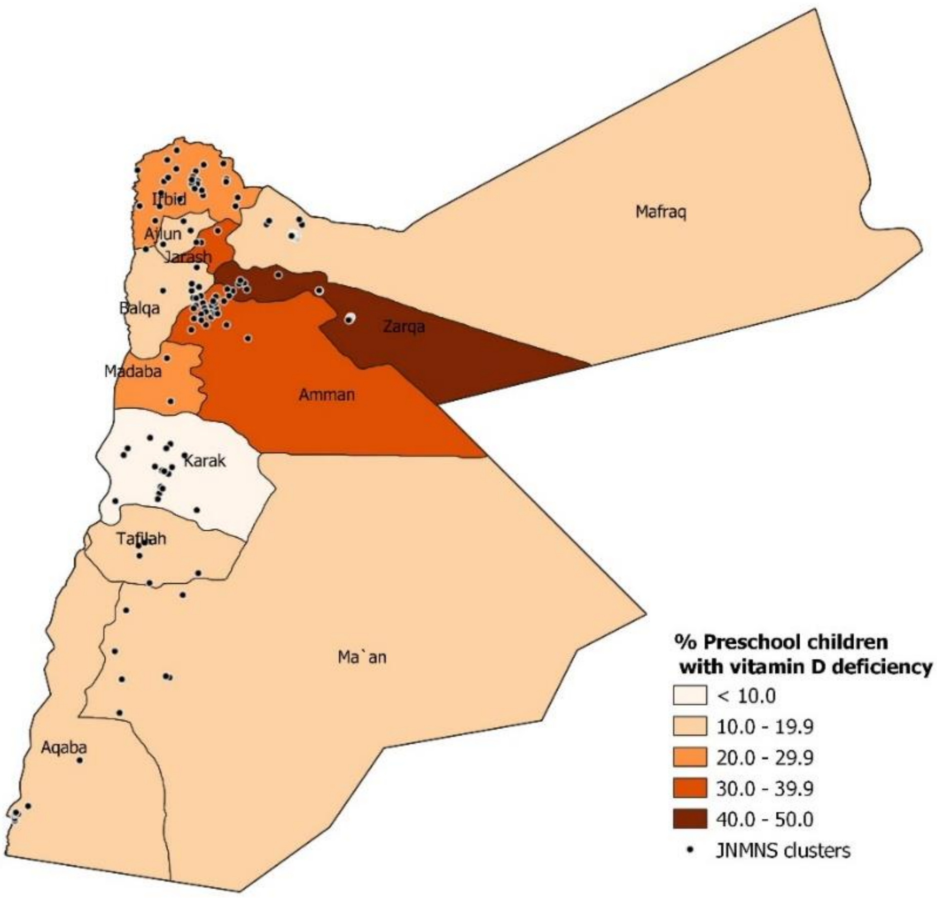

Figure 3-4. Prevalence of vitamin D deficiency (< 12 ng/mL) by governorate in pre-school children, settled population, Jordan

3.3.6. Zinc deficiency

Zinc deficiency in pre-school children affected slightly more than 1 out of 10 children (Table 3-11). Significant differences were found by age, with oldest children having a significantly lower prevalence. No statistically significant differences in zinc deficiency were found between male and female children or between children living in the different residences, strata, or households with different wealth.

The mean serum zinc concentration in this group was 72.2 µg/dL (95%CI: 69.7, 74.7).

Table 3-11. Prevalence of zinc deficiency in children 6-59 months, by various demographic characteristics, settled population, Jordan

Characteristic	N	% [a, b]	95% CI [c]	p-value [d]
TOTAL	293	11.5%	(6.6, 19.4)	
Age (in months)				
6-11	15	12.3%	(3.4, 35.6)	0.000
12-23	51	14.3%	(5.6, 32.1)	
24-35	79	13.2%	(6.1, 26.3)	
36-47	72	12.7%	(5.9, 25.1)	
48-59	76	6.1%	(2.9, 12.7)	
Sex				
Male	150	12.8%	(7.5, 21.0)	0.574
Female	143	10.2%	(4.3, 22.4)	
Residence				
Urban	233	11.7%	(6.3, 20.8)	0.884
Rural	59	10.8%	(4.0, 26.1)	
Stratum				
Central	63	7.9%	(2.2, 24.7)	0.299
Northern	111	15.3%	(9.0, 24.8)	
Southern	119	19.3%	(12.1, 29.4)	
Wealth quintile				
Poorest	87	13.2%	(6.0, 26.4)	0.369
Second	68	7.9%	(3.6, 16.3)	
Middle	50	9.2%	(2.7, 27.1)	
Fourth	63	18.3%	(5.7, 45.3)	
Wealthiest	25	3.4%	(1.1, 9.4)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Zinc deficiency, defined as follows: morning non-fasting: <65 µg/dL, afternoon non-fasting: <57 µg/dL

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.3.7. Sickle cell, α- and β-thalassemia

Of the 408 children from the settled population with complete blood count, 0.2% (95% CI: 0.0, 0.9) had sickle cell mutations, 4.5% (95% CI: 2.3, 8.6) were carriers of at least one α-thalassemia gene, while 4.1% (95% CI: 2.1, 7.8) carried at least a β-thalassemia gene. Due to the low number with affected children, no further sub-group analyses have been conducted.

3.3.8. Birthweight, recent morbidity and current inflammation

Table 3-12 below shows various health indicators for the children less than 5 years of age included in the settled population. About half of the caretakers reported birthweight from an official document and the other half reported the birth weight from recall. There may be a recall bias in remembered birth weights, but nonetheless, just about 15% of children had low birthweight. Recent illnesses as reported by the caregiver were relatively common, in particular one quarter of children had fever in the two weeks preceding the survey. A bit over 1 in 10 of children were reported to have had diarrhea or lower respiratory infection in the two weeks preceding the survey.

Table 3-12. Health indicators in children less than 5 years of age, settled population, Jordan

Characteristic	Number of children	% [a], mean	95% CI [b]
Birthweight reported from official document			
Yes	417	50.9%	(44.5, 57.2)
No	372	49.1%	(42.8, 55.5)
Birthweight in kilograms (mean)	785	3.1	(3.0, 3.1)
Birthweight			
<2500 grams	115	15.0%	(11.3, 19.5)
2500+ grams	674	85.0%	(80.5, 88.7)
Had diarrhea in past 2 weeks			
Yes	99	13.8%	(10.5, 17.9)
No	711	86.2%	(82.1, 89.5)
Had fever in past 2 weeks			
Yes	231	26.1%	(21.6, 31.2)
No	579	73.9%	(68.8, 78.4)
Had lower acute respiratory infection in past 2 weeks			
Yes	111	13.8%	(10.4, 18.2)
No	684	86.2%	(81.8, 89.6)
Inflammation stage			
None (Neither CRP nor AGP elevated)	265	65.9%	(59.0, 72.1)
Incubation (CPR elevated, AGP normal)	6	2.0%	(0.8, 5.0)
Early convalescence (both CPR and AGP elevated)	43	10.5%	(7.7, 14.1)
Late convalescence (CRP normal, AGP elevated)	81	21.7%	(16.0, 28.7)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.

3.3.9. Stunting

Overall, the prevalence of stunting of 8.5% (Table 3-13 in pre-school children in the settled population is relatively low according to recently released updated thresholds defining categories for stunting into public health relevance[24]. That said, there are significant differences by stratum with less children affected in the Southern stratum. No other demographic sub-group analysis identified statistically significant differences. Although not statistically significant, children of mothers with short stature were twice as likely to be stunted and four times as likely to be severely stunted as children whose mothers had normal stature.

The distribution of height-for-age z-scores is slightly shifted to the left, as shown in Figure 3-5. The mean height-for-age z-score was -0.33 (95% CI: -0.42, -0.24), with a standard deviation of 1.26.

Table 3-13. Prevalence of stunting in children 0-59 months, by various demographic characteristics, settled population, Jordan

		Severely stunted [b]		Moderately stunted [b]			Total stunted [c]		
Characteristic	N	% [a]	95% CI	%	95% CI	p-value [d]	%	95% CI	p-value [d]
TOTAL	750	3.2%	(1.8, 5.8)	4.2%	(2.7, 6.5)		7.4%	(5.1, 10.7)	
Age (in months)									
0-11	155	6.6%	(2.7, 15.0)	3.1%	(1.1, 8.6)	0.491	9.7%	(5.1, 17.7)	0.581
12-23	147	1.7%	(0.6, 4.6)	2.8%	(0.8, 9.1)		4.4%	(1.9, 10.0)	
24-35	157	3.1%	(0.8, 11.5)	6.0%	(2.7, 12.6)		9.1%	(4.8, 16.8)	
36-47	138	2.1%	(0.4, 11.2)	6.1%	(2.6, 14.0)		8.2%	(3.0, 20.5)	
48-59	53	2.3%	(0.5, 10.7)	3.2%	(1.0, 9.6)		5.5%	(2.2, 13.2)	
Sex									
Male	362	3.0%	(1.4, 6.4)	4.0%	(2.1, 7.5)	0.911	7.0%	(4.5, 10.8)	0.699
Female	388	3.5%	(1.6, 7.5)	4.4%	(2.6, 7.3)		7.9%	(4.7, 13.1)	
Residence									
Urban	601	3.7%	(2.0, 6.7)	4.1%	(2.5, 6.8)	0.281	7.8%	(5.2, 11.6)	0.493
Rural	147	0.9%	(0.2, 4.5)	5.0%	(2.1, 11.2)		5.9%	(2.8, 11.9)	
Stratum									
Central	172	4.7%	(2.3, 9.2)	4.1%	(2.0, 8.0)	0.042	8.7%	(5.2, 14.2)	0.142
Northern	337	1.5%	(0.6, 3.4)	4.7%	(2.8, 8.0)		6.2%	(3.9, 9.8)	
Southern	241	0.8%	(0.2, 3.2)	2.9%	(1.5, 5.5)		3.7%	(1.8, 7.4)	
Wealth quintile									
Poorest	213	5.7%	(2.6, 11.9)	6.6%	(4.0, 10.9)	0.081	12.3%	(7.9, 18.7)	0.103
Second	168	1.0%	(0.2, 4.0)	2.2%	(0.6, 7.8)		3.2%	(1.2, 8.1)	
Middle	165	0.6%	(0.1, 2.8)	5.9%	(2.5, 13.7)		6.5%	(2.9, 14.1)	
Fourth	126	6.4%	(1.8, 20.2)	3.3%	(0.9, 11.0)		9.7%	(4.0, 21.7)	
Wealthiest	78	2.5%	(0.4, 16.1)	0.8%	(0.1, 5.5)		3.3%	(0.7, 14.7)	
Mother's stature									
Short (≤ 150 cm)	24	16.6%	(4.6, 44.9)	0.0%	--	0.112	16.6%	(4.6, 44.9)	0.310
Normal (> 150 cm)	321	4.5%	(1.9, 10.2)	3.8%	(1.8, 7.8)		8.3%	(4.7, 14.3)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Severe stunting is defined as having a height-for-age z-score below -3 standard deviations from the WHO Child Growth Standards population median; moderate stunting is defined as having a height-for-age z-score equal to or above -3 standard deviations and less than -2 SD from the WHO Child Growth Standards population median.

[c] Total stunting includes both severely and moderately stunted children.

[d] P value <0.05 indicates that at least one subgroup is significantly different from the others. Chi-square results are based on total stunting.

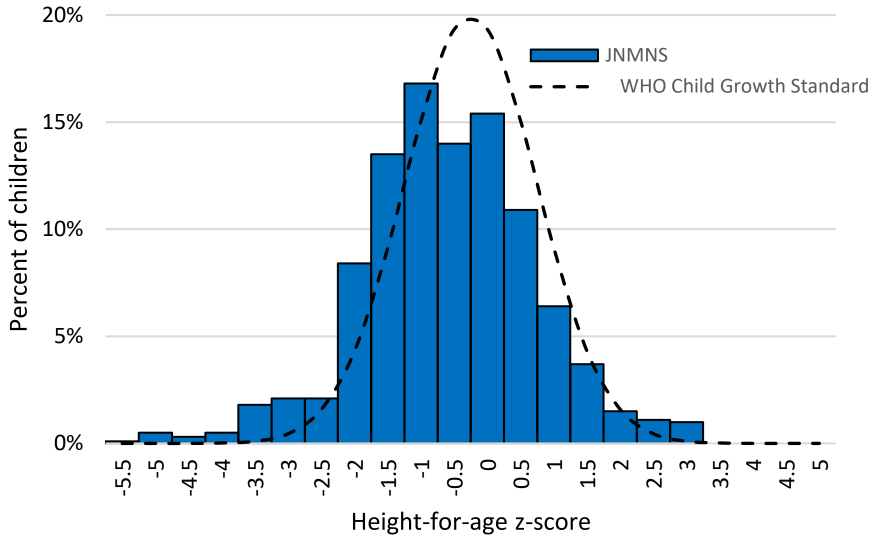

Figure 3-5. **Distribution of height-for-age z-scores in children less than 5 years of age, settled population, Jordan**

3.3.10. Wasting and underweight

The prevalence of wasting in pre-school children in the settled population was only 0.6% (95% CI: 0.2, 2.0). The small number of wasted children precludes any meaningful sub-group analysis. Figure 3-6 shows the distribution of weight-for-height z-scores; there is little difference in the Z score distribution between the JNMNS sample and €the WHO child growth standard.

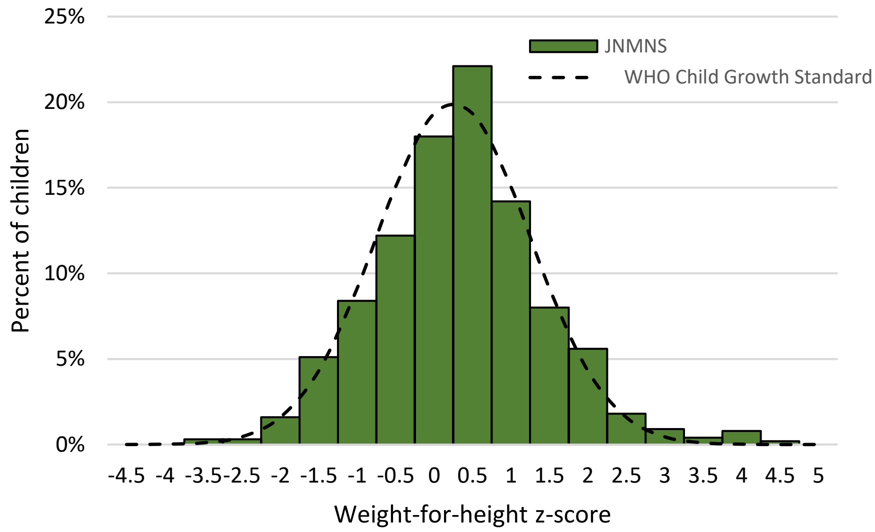

Figure 3-6. **Distribution of weight-for-height z-scores in children 6-59 months, settled population, Jordan**

Similar to wasting, the prevalence of underweight in this population group was very low with 2.7% (95% CI: 1.6, 4.7) children affected. Only 0.6% of children were diagnosed with severe underweight. No sub-group analyses were conducted due to the low numbers of affected children.

3.3.11. Overweight and obesity

Overall, close to one out of ten pre-school children from the settled population was overweight or obese (see Table 3-14); the majority of these children were overweight and only 2% were obese. Male children were more likely than female children, and younger children to be more likely to be overweight than older children, albeit without statistical significance.

Table 3-14. Prevalence of overweight and obesity in children 0-59 months, by various demographic characteristics, settled population, Jordan

Characteristic	N	Obesity [b]		Overweight [b]			Total overweight or obesity [b]		
		% [a]	95% CI	%	95% CI	p-value [c]	%	95% CI	p-value [c]
TOTAL	747	2.2%	(1.2, 4.0)	7.0%	(4.9, 9.7)		9.2%	(6.9, 12.1)	
Age (in months)									
0-11	153	2.0%	(0.4, 9.4)	10.6%	(5.9, 18.1)	0.630	12.6%	(7.5, 20.4)	0.328
12-23	147	3.3%	(1.1, 9.0)	7.1%	(3.6, 13.4)		10.4%	(6.0, 17.4)	
24-35	156	2.9%	(0.9, 9.2)	7.6%	(3.8, 14.8)		10.5%	(5.7, 18.6)	
36-47	138	1.7%	(0.6, 5.2)	5.0%	(1.7, 14.0)		6.7%	(2.9, 15.1)	
48-59	153	1.1%	(0.3, 4.3)	3.8%	(1.3, 10.6)		4.8%	(2.0, 11.4)	
Sex									
Male	363	2.3%	(1.1, 4.8)	9.4%	(6.5, 13.5)	0.072	11.7%	(8.6, 15.7)	0.023
Female	384	2.1%	(0.8, 5.4)	4.5%	(2.6, 7.7)		6.7%	(4.2, 10.5)	
Residence									
Urban	596	2.5%	(1.4, 4.6)	7.5%	(5.2, 10.6)	0.286	10.0%	(7.5, 13.2)	0.204
Rural	149	0.7%	(0.1, 4.6)	4.5%	(1.5, 12.5)		5.2%	(1.8, 13.7)	
Stratum									
Central	171	1.8%	(0.6, 5.2)	5.8%	(3.2, 10.6)	0.397	7.6%	(4.6, 12.3)	0.266
Northern	333	3.3%	(1.8, 5.9)	8.7%	(6.0, 12.5)		12.0%	(8.7, 16.3)	
Southern	243	1.2%	(0.4, 3.9)	7.4%	(4.2, 12.6)		8.6%	(5.1, 14.1)	
Wealth quintile									
Poorest	213	1.3%	(0.4, 4.5)	3.5%	(1.4, 8.3)	0.477	4.8%	(2.3, 9.9)	0.310
Second	165	3.1%	(1.0, 9.5)	6.2%	(2.9, 12.8)		9.3%	(4.8, 17.0)	
Middle	164	0.9%	(0.2, 3.6)	9.3%	(5.2, 16.2)		10.2%	(5.8, 17.2)	
Fourth	128	3.3%	(0.9, 11.0)	7.4%	(3.3, 15.5)		10.7%	(5.6, 19.4)	
Wealthiest	77	3.7%	(0.8, 15.3)	10.5%	(4.4, 22.8)		14.2%	(6.7, 27.5)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Overweight is defined as having a weight-for-height z-score greater than +2 but less than or equal to +3 standard deviations from the WHO Child Growth Standards population median; obesity is defined as having a weight-for-height z-score greater than +3 standard deviations from the WHO Child Growth Standards population median.

[c] P value <0.05 indicates that at least one subgroup is significantly different from the others.

3.3.12. Infant and young child feeding indicators and supplements

Figure 3-7 provides a summary of the various infant and young child feeding indicators as per WHO/UNICEF recommendations[(27)]. Ever breastfeeding was common (indicator #9), but early initiation of breastfeeding (indicator #1) was practiced by the caretakers of less than two thirds of children. The prevalence of exclusive breastfeeding (indicator #2) is very poor in children less than 6 months of age. Further, continued breastfeeding at 1 year and continued breastfeeding at 2 years (indicators # 3 and 10) are not very common. The median duration of breastfeeding among children less than 24 months is 14 months, indicating a relatively short breastfeeding period (data not shown).

Indicators of complementary feeding, including introduction of solid foods, minimum dietary diversity, minimum meal frequency, and minimum dietary acceptability (indicators #4-7) are reasonable but not optimal. Almost two thirds of children had eaten iron-rich foods or taken iron supplements in the 24 hours prior to data collection (indicator #8). Age-appropriate and predominant breastfeeding (indicators # 11 and

12) are relatively poor, and almost two thirds of children had received food from a bottle in the prior 24 hours (indicator #13).

The most commonly consumed liquid in children less than 6 months of age was water, closely followed by infant formula and other non-human milk (Table 3-15). Almost one-half of children 6-23 months of age had eaten sugary foods and/or drank sugary beverages in the past 24 hours. About one third of the 6-23 months old children ate fried/salty snacks.

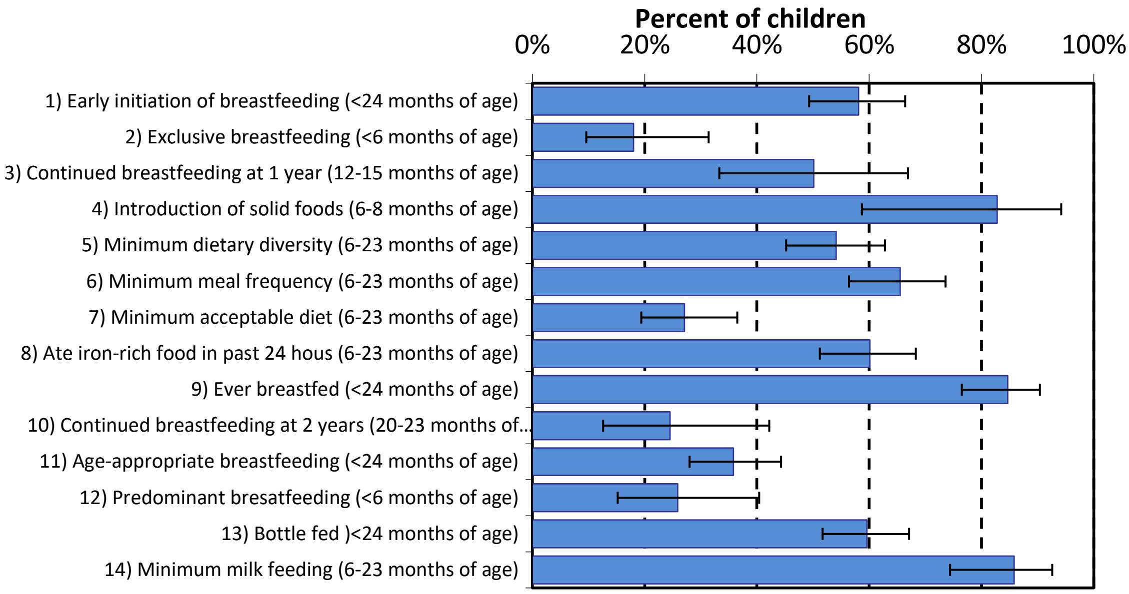

Figure 3-7. Prevalence of standard WHO/UNICEF infant and young child feeding indicators in children of various ages, settled population, Jordan

Table 3-15. Additional dietary indicators in children less than 24 months of age, settled population, Jordan

Characteristic	N	% [a]	95% CI [b]
Liquids other than breastmilk consumed in past 24 hours (<6 months of age)			
Plain water	42	49.7%	(35.5, 63.9)
Infant formula	37	42.0%	(27.2, 58.3)
Tinned, powdered, or other non-human milk	35	41.4%	(28.9, 55.1)
Juice or juice drinks	6	3.8%	(1.7, 8.3)
Shourba or clear broth	7	4.1%	(1.9, 8.6)
Yogurt	10	7.8%	(3.3, 17.3)
Thin porridge	4	4.0%	(1.0, 15.4)
Other liquids	9	4.6%	(2.3, 9.3)
Ate sugary foods in past 24 hours (6-23 months of age)			
Yes	118	46.9%	(37.2, 56.9)
No	115	53.1%	(43.1, 62.8)
Consumed sugary drinks in past 24 hours (6-23 months of age)[c]			
Yes	103	38.8%	(31.3, 46.9)
No	130	61.2%	(53.1, 68.7)
Ate salty/fried foods in past 24 hours (6-23 months of age)[d]			
Yes	90	37.5%	(29.7, 46.0)
No	143	62.5%	(54.0, 70.3)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] The question was about 'Sugar-sweetened beverages (soft drinks/fizzy drinks, chocolate drinks, malt drinks, yoghurt drinks, sweet tea or coffee with sugar, sweetened fruit juices and "juice drinks")'.
[d] The question was about 'Salty or fried snacks: Crisps and chips, fried dough or other fried snacks (e.g. Samposic)'.

Although almost one quarter of children consumed vitamin A supplements, supplement consumption in general and treatment with an anthelmintic drug in the preceding six months was low in this age group (Figure 3-8).

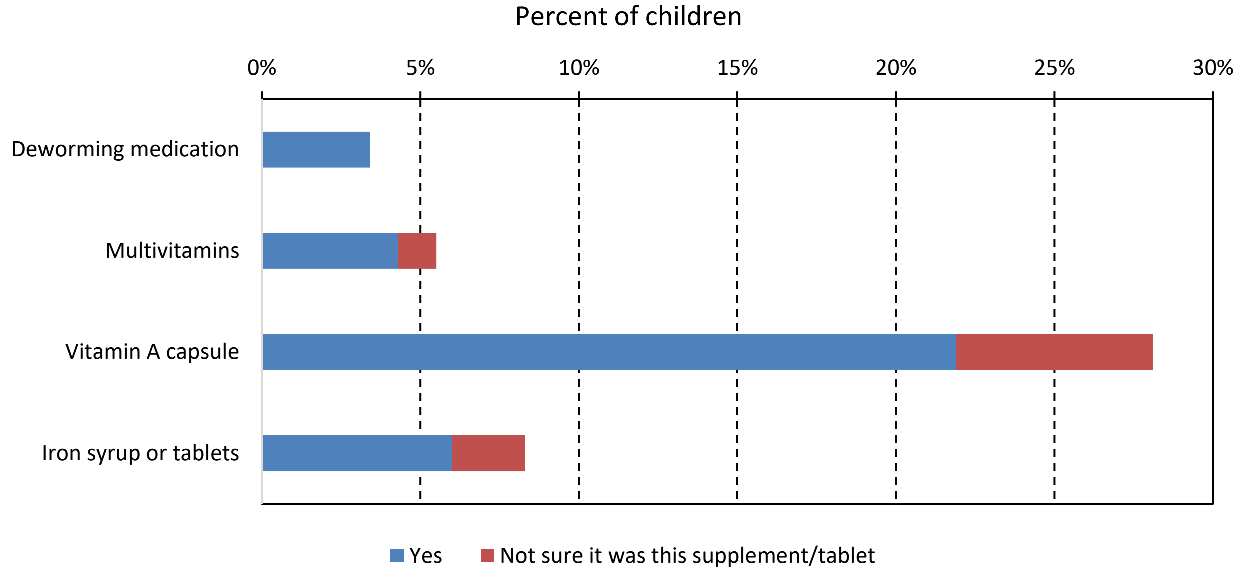

Figure 3-8. Proportion of children less than 5 years of age who took various supplements in past 6 months, settled population, Jordan.

3.3.13. Sun exposure

When pre-school children are outside, most do not have their heads protected from the sun and in about half of the children, the arms are never or only sometimes protected. Also, sunscreen usage is very uncommon. On the other hand, over three quarters of the children spend less than two hours outside per day. Subsequently, only about a quarter of children has a sun index of ≥20, while almost one fifth have an index of zero.

Table 3-16. Sun exposure in children less than 5 years of age, settled population, Jordan

Characteristic	n	Mean or % [a]	95% CI
Child's head usually protected from sun when outside			
Never/rarely	611	70.0%	(63.9, 75.4)
Sometimes	109	15.5%	(11.2, 21.1)
Most of the time	31	5.8%	(3.5, 9.4)
All the time	59	8.7%	(6.5, 11.6)
How usually child's head protected from sun [b]			
Scarf/headcloth	44	20.6%	(12.1, 33.0)
Hat	148	76.3%	(64.1, 85.4)
Umbrella	1	0.1%	(0.0, 0.8)
Blanket	6	2.9%	(1.0, 8.5)
Child's arms usually protected from sun when outside			
Never/rarely	229	32.5%	(26.6, 38.9)
Sometimes	201	24.6%	(19.6, 30.5)
Most of the time	209	23.2%	(18.8, 28.2)
All the time	171	19.7%	(14.4, 26.4)
How much time per day typically child spend under the sun			
None	87	13.3%	(10.0, 17.3)
1-29 minutes	161	20.5%	(16.6, 25.1)
30-59 minutes	175	20.7%	(16.6, 25.5)
1-2 hours	166	22.7%	(18.2, 28.0)

Characteristic	n	Mean or % [a]	95% CI
More than 2 but less than 3 hours	139	15.8%	(13.0, 19.1)
More than 3 hours	79	7.0%	(4.7, 10.3)
Child usually has sunscreen			
Never/rarely	794	98.2%	(95.9, 99.2)
Sometimes	10	1.1%	(0.3, 3.4)
Most of the time	3	0.5%	(0.1, 2.1)
All the time	3	0.3%	(0.1, 0.9)
Sun index[c]			
20+	218	25.9%	(21.2, 31.2)
10-19	201	23.3%	(19.7, 27.5)
0.01-9.9	282	34.5%	(30.2, 39.1)
0	106	16.3%	(12.9, 20.3)

Note: The n's are un-weighted numerators for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Of those respondents that reported protecting the child from sun.
[c] See chapter 2.8.3 for a description of the index.

3.3.14. Physical activity and sleep

below shows various indicators of physical activity and sleep patterns in pre-school children. Overall, children watch 2 hours of television or video per day on average, and play video or computer games for almost one hour. About half of the children watch television never or rarely while eating, and about one-quarter have a television in their bedrooms. Children average more than 10 hours of sleep per day. Children walk in their neighborhoods and play outdoors for more than 30 minutes on almost 5 days per week. Few preschool children participate in organized physical activities. Mothers of most children report their children of average physical activity. More than half of the children are cared for at home, and most others are cared for by friends or family members.

Table 3-17. Physical activity and sleep patterns in children less than 5 years of age, settled population, Jordan

Characteristic	n	Mean or % [a]	95% CI [b]
Hours of television or video watching per day (mean)	484	1.98	(1.74, 2.22)
Hours of video or computer games per day (mean)	481	0.94	(0.80, 1.08)
Watch television while eating			
No or rarely	246	50.1%	(43.8, 56.4)
1 meal per day	142	27.2%	(22.4, 32.6)
2 meals per day	45	10.1%	(6.8, 14.8)
3 or more meals per day	35	9.2%	(5.4, 15.3)
Television or computer in room where child sleeps			
Yes	131	25.9%	(20.5, 32.2)
No	355	74.1%	(67.8, 79.5)
Hours sleep per 24-hour period (mean)	486	10.0	(9.6, 10.4)
Days in past 7 days walked in neighborhood (mean)	486	4.5	(4.0, 5.1)
Days in past 7 days played outdoors 30+ minutes (mean)	486	4.9	(4.5, 5.3)
Organized physical activity in typical week			
Yes	10	2.3%	(1.0, 5.1)
No	476	97.7%	(94.9, 99.0)
Mother ranks child's activities relative to other children			
A lot less active	4	1.3%	(0.4, 4.0)
Less active	23	4.0%	(2.4, 6.7)
Same	305	62.2%	(55.6, 68.3)
More active	135	28.2%	(22.9, 34.1)
A lot more active	19	4.4%	(2.3, 8.3)
Type of child care facility typically attends			
None, stays at home	287	59.2%	(49.6, 68.1)
Informal (family, friends)	149	31.6%	(23.0, 41.7)
Day care <8 hours	13	2.8%	(1.4, 5.6)
Preschool	37	6.4%	(3.8, 10.7)

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling design.

3.3.15. Risk factors for anemia and iron deficiency and vitamin D status

Table 3-19 and Table 3-20 below show the association between various risk factors and anemia or iron deficiency in children 6-59 months of age iron deficiency in children 6-59 months of age in the settled population. Table 3-20 shows the association between various risk factors and sub-optimal vitamin D status.

Children who had received deworming tablets had a substantially lower prevalence of anemia but not iron deficiency. No statistically significant associations were found between anemia prevalence and intake of mineral and vitamin supplements or fortified foods. Because there are few children with anemia, iron deficiency, or iron deficiency anemia, these analyses have poor precision.

Anemia prevalence was about 2.5 and 4 times higher in children with iron deficiency or vitamin A deficiency, respectively, compared to those without (Table 3-19). Figure 3-9 illustrates the overlap between anemia and iron deficiency in children 6-59 months of age, showing that about one-third of the anemic children had concurrent iron deficiency. The survey did not find any association between anemia and inflammation, fever, or lower respiratory infection. Surprisingly, children with recent diarrhea were less likely to be anemic compared to those children without recent diarrhea.

Only 3 children had sickle cell trait and thus, this was not included in this bivariate analysis of risk factors for anemia and iron deficiency. Despite the small number of cases of α-thalassemia and β-thalassemia, both had a highly significant association with anemia: children with any form of thalassemia were much more likely to be anemic. This association was not seen for iron deficiency. No significant associations were found between iron deficiency and any illness, inflammation or other micronutrient deficiencies.

Table 3-18. Anemia and iron deficiency in pre-school age children 6-59 months of age, by vitamin and mineral supplement and deworming, settled population, Jordan

	Anemia			Iron deficiency		
Characteristic	**N**	**% [a]**	**P value [b]**	**N**	**% [a]**	**P value [b]**
Consumed iron-fortified foods yesterday						
No	380	12.2%	0.733	368	25.9%	0.878
Yes	24	9.5%		25	27.9%	
Consumed iron tablets or syrup in past six months						
No	374	11.2%	0.897	364	24.0%	0.085
Yes	24	12.0%		23	41.7%	
Consumed multivitamins in past six months						
No	385	11.9%	0.289	375	25.2%	0.295
Yes	16	5.2%		15	41.2%	
Received deworming medication in past six months [c]						
No	391	12.3%	0.018	380	26.0%	0.993
Yes	15	1.6%		15	26.2%	

Note: The n's are un-weighted denominators in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.
[c] Includes only children 12-59 months of age.

Table 3-19. Correlation between various factors and anemia and iron deficiency in children 6-59 months of age, settled population, Jordan

Characteristic	n	% anemic [a]	P value [b]	n	% iron deficient [a]	P value [b]
Child had diarrhea						
Yes	44	4.7%	0.028	43	22.6%	0.660
No	362	12.9%		352	26.5%	
Child had fever						
Yes	123	9.3%	0.306	120	22.1%	0.374
No	283	12.9%		275	27.6%	
Child had lower respiratory infection						
Yes	61	7.6%	0.212	60	20.0%	0.390
No	338	12.5%		328	26.2%	
Child has inflammation						
Yes	129	12.3%	0.677	130	23.6%	0.495
No	258	10.9%		265	27.3%	
Child iron deficient						
Yes	110	20.5%	0.013			
No	277	8.1%				
Child vitamin A deficient						
Yes	12	41.5%	0.009	13	19.8%	0.672
No	375	10.0%		382	26.3%	
Child vitamin D insufficient or deficient						
Yes	197	11.3%	0.812	200	25.9%	0.481
No	138	10.4%		139	31.6%	
Child zinc deficient						
Yes	45	13.0%	0.763	45	29.1%	0.903
No	247	11.2%		248	28.2%	
Child has α-thalassemia trait						
Yes	17	38.2%	0.007	17	23.9%	0.931
No	370	8.8%		353	25.2%	
Child has β-thalassemia trait						
Yes	15	50.7%	0.000	14	48.3%	0.156
No	372	8.8%		353	25.2%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

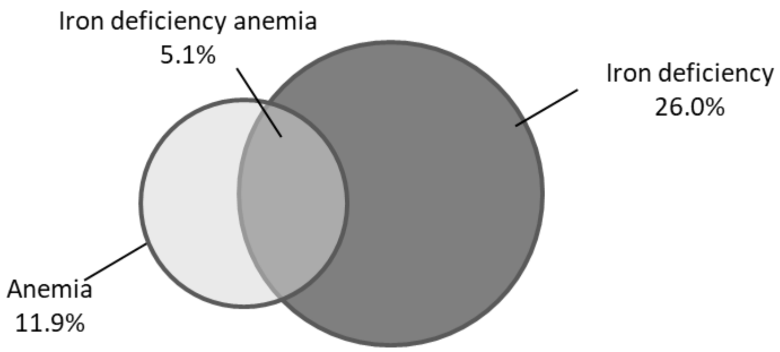

Figure 3-9. Venn diagram showing overlap between anemia and iron deficiency in children 6-59 months, settled population, Jordan

Table 3-20 presents associations between sub-optimal vitamin D status and various factors, none of which are significantly associated, except for vitamin A which seems to be protective of sub-optimal vitamin D status.

Table 3-20. Correlation between various factors and sub-optimal vitamin D status in children 6-59 months of age, settled population, Jordan

Characteristic	n	% VDD or insufficiency [a]	P value [b]
Child had diarrhea			
Yes	35	62.5%	0.837
No	305	60.4%	
Child had fever			
Yes	105	57.5%	0.491
No	235	62.0%	
Child had lower respiratory infection			
Yes	49	57.9%	0.678
No	286	61.6%	
Child has inflammation			
Yes	110	58.8%	0.709
No	229	61.9%	
Child iron deficient			
Yes	105	56.1%	0.481
No	234	62.7%	
Child vitamin A deficient			
Yes	10	93.1%	0.003
No	329	59.3%	
Child zinc deficient			
Yes	45	66.9%	0.395
No	246	59.8%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

3.3.16. Correlation between micronutrient deficiencies and growth indices

Correlations between various micronutrient deficiencies and growth indices are presented in Table 3-21. The low prevalence of wasting and underweight precluded analyses for those two growth indices. The survey did not yield any significant associations between stunting and the investigated micronutrient deficiencies or anemia. Vitamin D deficiency or insufficiency was associated with a lower prevalence of overweight and obesity, compared to normal vitamin D status. No statistically significant associations were found between overweight or obesity and any of the other investigated micronutrient deficiencies or anemia.

Table 3-21. Correlation between various micronutrient deficiencies and growth indices status in children 6-59 months of age, settled population, Jordan

Characteristic	N	% Stunted [a]	P value [b]	% Overweight or obese [a]	P value [b]
Child anemic					
Yes	56	7.5%	0.943	9.7%	0.389
No	341	7.9%		5.7%	
Child iron deficient					
Yes	111	11.2%	0.295	6.4%	0.964
No	276	6.7%		6.2%	
Child vitamin A deficient					
Yes	12	0.0%	0.415	4.7%	0.759
No	375	8.2%		6.3%	
Child vitamin D insufficient or deficient					
Yes	199	6.0%	0.511	3.6%	0.020
No	136	8.5%		10.6%	
Child zinc deficient					
Yes	44	7.3%	0.966	10.6%	0.305
No	244	7.1%		6.1%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

3.3.17. Correlation between physical activity and growth indices

The correlation between physical activities and growth indices in pre-school children is presented in Table 3-22. The small number of children with underweight or wasting precluded the inclusion of those growth indices in these analyses. Neither stunting nor overweight or obesity were associated with how active the mother considered the child compared to others nor with the type of childcare. Time spent in front of screens was not associated with overweight or obesity, but children spending less time in front of screens were substantially more likely to be stunted.

Table 3-22. Correlation between physical activities and growth indices among children less than 5 years old, settled Jordanian population

Characteristic	N	% [a] Stunted	P value	% [a] Overweight or obese	P value [b]
Time watching TV or playing video games					
≤ 2 hours	189	13.8%	0.001	7.6%	0.928
> 2 hours	255	2.7%		9.3%	
How active does mother consider the child compared to others					
More/lot more	143	8.5%	0.695	9.1%	0.707
Same	282	7.9%		6.7%	
Less/lot less	23	0.0%		7.3%	
Type of childcare					
Day care/pre-school	45	16.1%	0.123	7.0%	0.929
Informal/home	403	6.8%		7.6%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

3.3.18. Correlation between sun exposure and vitamin D deficiency

As shown in Table 3-23, the vitamin D status of pre-school children of the settled population in Jordan is not associated with the sun exposure index.

Table 3-23. Association between sun exposure and vitamin D deficiency in children 6-59 months of age, settled population, Jordan

	N	%[a] VDD	%[a] VD insufficient	P value [b]	%[a] VDD or insufficient	P value [b]
Sun exposure index						
<10	123	31.2%	28.9%	0.544	60.1%	0.992
10-19	106	30.2%	30.4%		60.6%	
>20	109	20.3%	40.9%		61.2%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

3.4. School-age children (settled population)

3.4.1. Characteristics

The demographic characteristics of the school-age children are shown in Table 3-24. Overall, there is a good representation of all age groups, although there is a slightly smaller proportion of older children (note that the age range for younger children includes 2 year intervals, whereas for the older children, it is only 1 year). Slightly more male children than female children were included in the survey sample. Similar to the household demographics, almost 9 of 10 children reside in urban dwellings, and there are proportionally more children in the Northern stratum. Virtually all children visited school at the time of the survey.

Table 3-24. Description of sampled school-age children 6-12 years, settled population, Jordan

Characteristic	n	% [b]	(95% CI) [c]
Age Group (in years)[a]			
6-7	360	29.3%	(26.1, 32.7)
8-9	357	28.8%	(25.4, 32.4)
10-11	358	30.2%	(27.2, 33.3)
12	144	11.7%	(9.6, 14.3)
Sex			
Male	640	52.8%	(48.9, 56.7)
Female	579	47.2%	(43.3, 51.1)
Residence			
Urban	991	89.5%	(81.1, 94.4)
Rural	224	10.5%	(5.6, 18.9)
Stratum			
Central	315	25.8%	(18.5, 34.8)
Northern	488	40.0%	(30.4, 50.5)
Southern	416	34.1%	(25.2, 44.4)
Currently attends school			
Yes	1202	98.8%	(97.5, 99.4)
No	17	1.2%	(0.6, 2.5)
Has ever attended school			
Yes	1204	98.8%	(97.6, 99.4)
No	15	1.2%	(0.6, 2.4)

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] The age groups are simplified above, they are: 6.0-7.9 y, 8.0-9.9 y, 10.0-11.9 y, and 12.0-12.9 y.
[b] Percentages weighted for unequal probability of selection.
[c] CI=confidence interval, calculated taking into account the complex sampling design.

3.4.2. Anemia, iron deficiency, and iron deficiency anemia

Overall, just 6% of school-aged children in the settled population were anemic, which is at the lower end of the prevalence range indicated to constitute a mild public health problem according to WHO[42] (see Table 3-25); no children in this group had severe anemia, and the prevalence of moderate anemia was less than 2% (Table 3-26). Among anemic school-age children in the settled population, the prevalence of iron deficiency was 30.6% (95% CI: 14.1, 54.1, n=66), but iron deficiency did not meaningfully contribute to the anemia prevalence, as shown by the fact that iron deficiency anemia occurred in only about 2% of children.

The prevalence of anemia was statistically significantly associated only with urban versus rural residence. The absence of sex-differences in this age group may be due to the fact that most girls in this group were likely still pre-menarche [62] and thus, a differential pattern may only be expected in older adolescents.

The low prevalence of anemia in these children is corroborated by the hemoglobin histogram, as shown in Figure 3-10. No children in this age group were severely anemic and 1.9% (95% CI: 1.0, 3.5; n=24) of children were moderately anemic. Because two different hemoglobin thresholds are used in this age group, depending on the age, no threshold line could be inserted.

The mean hemoglobin concentration among all settled school-age children was 130.6 g/L (95%CI 129.3, 131.8g/L).

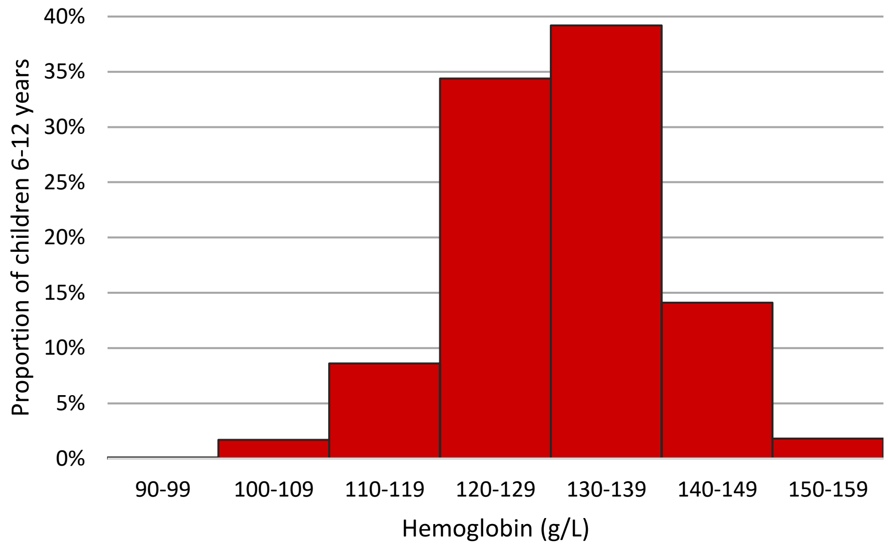

Figure 3-10. Distribution of hemoglobin (g/L) in school-age children 6-12 years, settled Jordanian population

Table 3-25. Prevalence of anemia, iron deficiency, and iron deficiency anemia in school-age children 6-12 years, by various demographic characteristics, settled population, Jordan

Characteristic	Anemia [b]				Iron deficiency [e]				Iron deficiency anemia [f]			
	n	% [a]	95% CI [c]	p-value [d]	n	% [a]	95% CI [c]	p-value [d]	n	% [a]	95% CI [c]	p-value [d]
TOTAL	928	6.0%	(3.6, 9.9)		924	30.6%	(25.3, 36.5)		931	1.8%	(0.9, 3.9)	
Age (in years)												
6-7	264	6.6%	(3.1, 13.4)	0.573	264	30.8%	(21.2, 42.4)	0.596	266	0.9%	(0.4, 2.3)	0.038
8-9	274	4.1%	(1.8, 9.1)		272	28.9%	(20.9, 38.4)		274	1.3%	(0.3, 5.6)	
10-11	275	6.6%	(3.3, 12.7)		274	34.4%	(25.9, 44.1)		276	3.6%	(1.5, 8.3)	
12	115	8.3%	(3.3, 19.4)		114	24.9%	(16.1, 36.5)		115	0.6%	(0.1, 3.0)	
Sex												
Male	479	7.2%	(3.8, 13.3)	0.236	476	27.0%	(20.7, 34.5)	0.133	481	2.3%	(0.8, 6.6)	0.464
Female	449	4.9%	(2.9, 8.2)		448	34.2%	(27.1, 42.2)		450	1.4%	(0.5, 3.5)	
Residence												
Urban	759	6.7%	(4.0, 10.9)	0.003	755	29.9%	(24.1, 36.4)	0.346	761	2.0%	(0.9, 4.3)	0.235
Rural	166	1.2%	(0.4, 3.8)		166	36.0%	(25.5, 48.0)		167	0.8%	(0.2, 2.9)	
Stratum												
Central	242	5.8%	(2.8, 11.5)	0.234	239	32.2%	(25.2, 40.1)	0.300	243	1.6%	(0.5, 5.1)	0.444
Northern	352	5.7%	(3.2, 10.0)		353	27.2%	(21.1, 34.3)		355	2.0%	(0.9, 4.3)	
Southern	334	9.9%	(6.2, 15.4)		332	25.0%	(20.5, 30.1)		333	3.3%	(1.7, 6.4)	
Wealth quintile												
Poorest	289	9.7%	(3.8, 22.6)	0.091	288	32.0%	(22.5, 43.3)	0.937	290	3.6%	(1.5, 8.6)	0.135
Second	200	2.7%	(0.9, 7.5)		200	33.2%	(23.9, 44.0)		201	0.8%	(0.3, 2.4)	
Middle	188	1.1%	(0.3, 3.8)		185	28.3%	(20.2, 38.1)		187	0.1%	(0.0, 0.7)	
Fourth	154	7.7%	(3.7, 15.4)		154	28.4%	(18.7, 40.7)		154	1.9%	(0.4, 9.2)	
Wealthiest	97	10.1%	(3.3, 27.2)		97	30.1%	(18.9, 44.3)		99	2.7%	(0.5, 13.0)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Anemia defined as hemoglobin < 115 g/L (children 5-11 y) and <120 g/L (children 12+ y), adjusted for altitude.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.
[e] Iron deficiency defined as inflammation-adjusted serum ferritin < 12 µg/l.
[f] Iron deficiency anemia defined the combination of iron deficiency and anemia.

Table 3-26. Severity of anemia in school-age children 6-12 years, by various demographic characteristics, settled population, Jordan

Characteristic	Mild anemia [b]			Moderate anemia [b]			Severe anemia [b]		
	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]
TOTAL	43	4.2	(2.4, 7.0)	24	1.9	(1.0, 3.5)	0	-	-
Age (in years)									
6-7	16	4.1	(1.9, 8.7)	10	2.5	(0.9, 6.4)	-	-	-
8-9	8	2.5	(0.8, 7.4)	7	1.5	(0.4, 5.5)	-	-	-
10-11	14	5.1	(2.2, 11.4)	5	1.5	(0.4, 5.6)	-	-	-
12	5	5.9	(2.0, 16.2)	2	2.4	(0.4, 14.2)	-	-	-
Sex									
Male	20	4.6	(2.4, 8.5)	13	2.6	(1.2, 5.7)	-	-	-
Female	23	3.8	(2.0, 6.9)	11	1.1	(0.4, 3.3)	-	-	-
Residence									
Urban	41	4.6	(2.7, 7.8)	20	2.0	(1.1, 3.8)	-	-	-
Rural	2	0.4	(0.1, 1.8)	4	0.8	(0.2, 3.0)	-	-	-
Stratum									
Central	10	4.1	(2.0, 8.4)	4	1.7	(0.7, 4.1)	-	-	-
Northern	13	3.7	(2.0, 6.8)	7	3.0	(0.7, 5.7)	-	-	-
Southern	20	6.0	(3.1, 11.3)	13	2.9	(2.3, 6.5)	-	-	-
Wealth quintile									
Poorest	18	7.1	(2.7, 17.5)	11	2.5	(1.0, 6.3)	-	-	-
Second	11	2.6	(0.9, 7.5)	1	0.1	(0.0, 0.7)	-	-	-
Middle	4	0.8	(0.2, 3.7)	1	0.3	(0.0, 2.2)	-	-	-
Fourth	4	5.1	(1.9, 13.1)	6	2.6	(0.7, 9.0)	-	-	-
Wealthiest	6	5.1	(1.2, 18.9)	5	5.0	(1.7, 13.7)	-	-	-

Note: The n's are the numerators for a specific sub-group.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection among strata.
[b] Mild, moderate, and severe anemia defined as hemoglobin 110-114 g/L, 80-109 g/L, and <80 g/L, respectively.
[c] CI=confidence interval calculated taking into account the complex sampling design.

3.4.3. Vitamin A deficiency

Just over 7% of school-aged children in the settled population of Jordan are vitamin A deficient (see Table 3-27), constituting only a mild public health problem as per the WHO [33]. There is an age-difference, with younger children being more affected by vitamin A deficiency, in particular those children 6.0-7.9 years.

No other demographic variables assessed showed statistically significant differences for vitamin A deficiency.

Table 3-27. Prevalence of vitamin A deficiency in school-age children 6-12 years, by various demographic characteristics, settled population, Jordan

Characteristic	n	% [a, b]	95% CI [c]	Chi-Square p-value [d]
TOTAL	924	7.2%	(4.8, 10.8)	
Age (in years)				
6-7	264	12.9%	(7.2, 22.0)	0.027
8-9	272	7.7%	(4.3, 13.4)	
10-11	274	3.7%	(1.5, 8.8)	
12	114	2.8%	(0.5, 13.2)	
Sex				
Male	476	7.5%	(4.2, 13.3)	0.808
Female	448	6.9%	(4.2, 11.1)	
Residence				
Urban	755	7.5%	(4.8, 11.5)	0.485
Rural	166	5.3%	(2.1, 12.6)	
Stratum				
Central	239	7.5%	(4.4, 12.7)	0.435
Northern	353	7.1%	(4.7, 10.5)	
Southern	332	4.5%	(2.1, 9.6)	
Wealth quintile				
Poorest	288	7.4%	(4.2, 12.6)	0.761
Second	200	8.2%	(4.7, 13.9)	
Middle	185	7.6%	(3.5, 15.5)	
Fourth	154	4.4%	(1.7, 11.1)	
Wealthiest	97	8.6%	(3.1, 21.7)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] VAD = Vitamin A deficiency was defined as RBP adjusted for inflammation ≤0.7 µmol/L[61].

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

When using the sub-sample of 63 children for whom serum retinol concentrations were measured, a prevalence of 4.1% resulted. Because of the small number of children with serum retinol results, this prevalence is not statistically significantly different from the prevalence calculated from RBP values.

Appendix 2 shows the scatterplot comparing serum retinol versus retinol-binding protein concentrations.

Figure 3-11 shows the distribution of retinol-binding protein values, indicating that vitamin A deficiency is not very common. The mean retinol-binding concentration in this group was 1.08 µmol/L (95%CI: 1.05, 1.12).

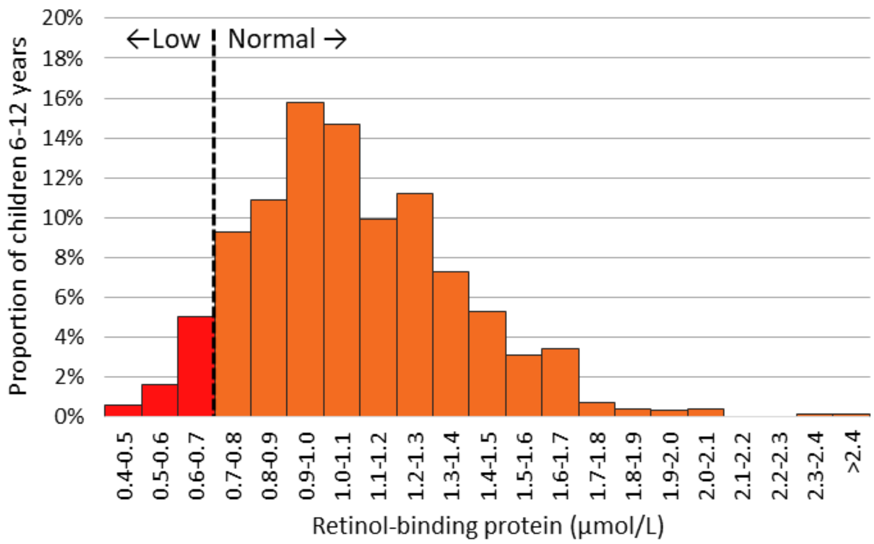

Figure 3-11. Distribution of inflammation-adjusted retinol-binding protein in school-age children 6-12 years, settled population, Jordan

3.4.4. Vitamin D deficiency and insufficiency

Inadequate vitamin D status affected the vast majority of school-age children (Table 3-28), with almost half of them being vitamin D deficient and 40% being vitamin D insufficient. Girls had poorer vitamin D status than boys, with an overall higher prevalence of deficiency or insufficiency and, among those with low vitamin D, a larger proportion of girls had deficiency. In addition, older children had more vitamin D deficiency. Further, children living in the Central stratum had more vitamin D deficiency than those in the North and South.

Because in settled school-age children, vitamin D concentrations are normally distributed, no log-transformation was required. The mean vitamin D concentration was 13.2 ng/mL (95%CI: 12.5, 13.9).

Figure 3-12 gives the geographic distribution of vitamin D deficiency among school-age children in the settled population. Similar to the pre-school children, highest prevalence rates are observed in the Northern half of the country.

Table 3-28. Prevalence of vitamin D deficiency and insufficiency in school-age children 6-12 years, by various demographic characteristics, settled population, Jordan

		Deficient [a]		Insufficient [a]			Deficient or insufficient		
Characteristic	**N**	**% [b]**	**95% CI [c]**	**% [b]**	**95% CI [c]**	**p-value [d]**	**% [b]**	**95% CI [c]**	**p-value [d]**
TOTAL	906	44.2%	(37.9, 50.7)	43.3%	(37.2, 49.7)		87.6%	(83.8, 90.5)	
Age (in years)									
6-7	255	38.6%	(27.7, 50.8)	42.2%	(31.9, 53.1)	0.004	80.8%	(71.8, 87.4)	0.024
8-9	268	37.3%	(30.0, 45.2)	52.2%	(44.6, 59.8)		89.5%	(84.5, 93.0)	
10-11	269	54.3%	(45.0, 63.4)	34.9%	(26.2, 44.8)		89.2%	(84.3, 92.7)	
12	114	51.3%	(38.9, 63.6)	42.3%	(30.7, 54.9)		93.6%	(83.0, 97.8)	
Sex									
Male	464	23.4%	(17.5, 30.5)	57.3%	(49.8, 64.6)	0.000	80.7%	(74.6, 85.6)	0.000
Female	442	66.3%	(59.1, 72.7)	28.4%	(22.3, 35.4)		94.7%	(91.6, 96.7)	
Residence									
Urban	737	44.7%	(37.7, 51.8)	43.3%	(36.5, 50.3)	0.596	88.0%	(83.8, 91.2)	0.371
Rural	166	40.5%	(30.3, 51.6)	43.8%	(35.8, 52.0)		84.2%	(75.1, 90.4)	
Stratum									
Central	236	50.4%	(41.7, 59.1)	41.5%	(33.2, 50.4)	0.000	91.9%	(86.7, 95.2)	0.000
Northern	346	33.8%	(28.7, 39.4)	44.8%	(40.0, 49.7)		78.6%	(73.8, 82.7)	
Southern	324	21.6%	(15.8, 28.8)	51.5%	(45.9, 57.1)		73.1%	(67.2, 78.4)	
Wealth quintile									
Poorest	283	37.0%	(28.2, 46.8)	44.0%	(36.3, 52.0)	0.010	81.0%	(73.3, 86.9)	0.054
Second	192	55.3%	(44.0, 66.1)	34.2%	(24.9, 45.0)		89.6%	(80.7, 94.6)	
Middle	184	35.4%	(27.0, 44.8)	59.1%	(49.9, 67.7)		94.5%	(91.4, 96.5)	
Fourth	150	45.1%	(30.3, 60.9)	41.3%	(27.2, 57.0)		86.5%	(73.8, 93.6)	
Wealthiest	97	54.7%	(40.3, 68.4)	33.3%	(20.0, 50.0)		88.1%	(80.3, 93.0)	

Note: The n's are un-weighted numerators for each subgroup; subgroups that do not sum to the total have missing data.
[a] Deficient <12 ng/mL; Insufficient 12.1-19.9 ng/mL.
[b] Percentages weighted for unequal probability of selection.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others

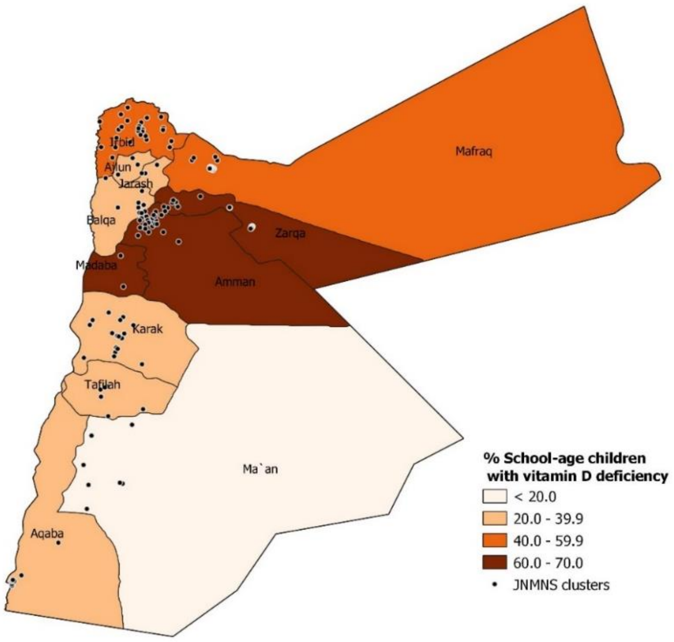

Figure 3-12. Prevalence of vitamin D deficiency (<12 ng/mL) by governorate in school-age children, settled population, Jordan

3.4.5. Zinc deficiency

Less than 4% of school-age children are zinc deficient (see Table 3-29). A greater proportion of children residing in the Southern stratum are zinc deficient compared to their peers in the North and Center strata.

The mean serum zinc concentration was 77.8 µg/dL (95% CI: 76.3, 79.3).

Table 3-29. Prevalence of zinc deficiency in school-age children 6-12 years, by various demographic characteristics, settled population, Jordan

Characteristic	N	% [a, b]	95% CI [c]	p-value [d]
TOTAL	882	3.6%	(2.5, 5.2)	
Age (in years)				
6-7	246	4.3%	(2.1, 8.6)	0.507
8-9	259	4.3%	(2.4, 7.9)	
10-11	264	2.1%	(1.1, 3.9)	
12	113	4.4%	(1.5, 12.4)	
Sex				
Male	449	3.7%	(2.2, 6.2)	0.919
Female	433	3.6%	(2.1, 5.9)	
Residence				
Urban	716	3.5%	(2.3, 5.3)	0.463
Rural	163	5.1%	(2.0, 12.5)	
Stratum				
Central	229	1.3%	(0.5, 3.7)	0.000
Northern	339	7.1%	(4.3, 11.4)	
Southern	314	16.2%	(11.4, 22.6)	
Wealth quintile				
Poorest	274	6.2%	(3.6, 10.5)	0.155
Second	189	4.0%	(1.7, 9.2)	
Middle	180	2.6%	(1.3, 5.4)	
Fourth	145	3.1%	(1.0, 9.0)	
Wealthiest	94	1.1%	(0.4, 3.1)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Zinc deficiency, defined as follows: children 6-9.9 years: morning non-fasting: <65 µg/dL, afternoon non-fasting: <57 µg/dL; girls 10-12.9 years: morning non-fasting: <66 µg/dL, afternoon non-fasting: <59 µg/dL; boys 10-12.9 years: morning non-fasting: <70 µg/dL, afternoon non-fasting: <61 µg/dL;

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.4.6. Folate and vitamin B12 deficiency

The prevalence of folate deficiency is only 0.6% (95%CI: 0.2, 1.8) in this age group and thus, no further sub-group analyses could be meaningfully conducted.

Vitamin B12 deficiency, although more common than folate deficiency, remains at low levels, with 7% of school-age children affected in the settled population; however the prevalence of marginal B12 status is much more common. Both vitamin B12 deficiency and marginal B12 status are much less common in the Southern stratum then in the central or northern strata , and there is a progressive rise in the prevalence of marginal B12 status with age (Table 3-30).

Serum folate concentration was normally distributed, with a mean of 12.2 ng/mL (95%CI: 11.6, 12.8). Because of a skewed distribution, vitamin B12 results were log-transformed. The geometric mean is 366.6 pg/mL (95%CI: 351.5, 382.3).

Table 3-30. Prevalence of vitamin B12 deficiency in school-age children 6-12 years, by various demographic characteristics, settled population, Jordan

Characteristic		B12 deficiency [b]		Marginal B12 status [b]			B12 deficiency or marginal status		
	N	% [a]	95% CI [c]	% [a]	95% CI [c]	p-value [d]	% [a]	95% CI [c]	p-value [d]
TOTAL	906	6.9%	(4.9, 9.6)	22.7%	(18.5, 27.5)		29.6%	(24.8, 34.9)	
Age (in years)									
6-7	255	2.4%	(0.8, 6.8)	14.5%	(9.3, 22.0)	0.002	16.9%	(11.4, 24.4)	0.000
8-9	268	8.8%	(4.7, 15.8)	19.2%	(13.3, 27.0)		28.0%	(20.8, 36.5)	
10-11	269	7.9%	(4.8, 12.8)	27.2%	(20.3, 35.5)		35.2%	(27.5, 43.7)	
12	114	9.2%	(4.3, 18.4)	36.2%	(23.8, 50.9)		45.4%	(32.5, 58.9)	
Sex									
Male	464	7.5%	(4.6, 11.9)	22.6%	(16.6, 29.9)	0.889	30.1%	(23.5, 37.6)	0.840
Female	442	6.3%	(3.8, 10.1)	22.8%	(17.5, 29.2)		29.1%	(22.8, 36.3)	
Residence									
Urban	737	7.0%	(4.9, 9.9)	23.3%	(18.7, 28.7)	0.758	30.3%	(25.1, 36.1)	0.474
Rural	166	6.5%	(2.0, 19.3)	19.6%	(13.7, 27.3)		26.2%	(17.8, 36.8)	
Stratum									
Central	236	6.4%	(4.0, 10.0)	24.2%	(18.6, 30.7)	0.000	30.5%	(24.2, 37.7)	0.000
Northern	346	10.7%	(7.1, 15.8)	22.3%	(18.0, 27.1)		32.9%	(27.4, 39.1)	
Southern	324	0.3%	(0.0, 2.1)	9.3%	(5.8, 14.4)		9.6%	(6.1, 14.7)	
Wealth quintile									
Poorest	283	7.2%	(3.6, 13.8)	23.3%	(15.5, 33.5)	0.955	30.5%	(20.3, 43.0)	0.965
Second	192	7.3%	(3.0, 16.3)	24.1%	(15.9, 34.7)		31.3%	(22.2, 42.2)	
Middle	184	9.0%	(3.9, 19.1)	19.6%	(11.9, 30.6)		28.5%	(19.9, 39.1)	
Fourth	150	6.7%	(3.1, 14.1)	23.6%	(14.5, 36.1)		30.3%	(19.5, 43.9)	
Wealthiest	97	3.1%	(0.9, 10.4)	22.8%	(14.8, 33.4)		25.8%	(15.8, 39.3)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Vitamin B12 deficiency defined as plasma B12 <150 pmol/L (<203 pg/mL); marginal status as 150-220 pmol/L (203-297 pg/mL).
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.4.7. Recent morbidity and current inflammation

Although less common than in pre-school children, recent fever was still reported for almost a fifth of school-age children, while lower respiratory infection was reported for about 10% (Table 3-31). Further, about one quarter of children had one or both of the evaluated inflammatory marker (AGP, CRP) elevated, indicating some form of systemic inflammation.

Table 3-31. Health indicators in school-age children 6-12 years, settled population, Jordan

Characteristic	Number of children	% [a]	95% CI [b]
Had diarrhea in past 2 weeks			
Yes	35	3.8%	(2.5, 5.7)
No	1183	96.2%	(94.3, 97.4)
Had fever in past 2 weeks			
Yes	204	18.0%	(14.6, 22.0)
No	1012	81.5%	(77.6, 84.8)
Had lower acute respiratory infection in past 2 weeks			
Yes	100	9.7%	(7.0, 13.5)
No	1105	90.3%	(86.5, 93.0)
Inflammation stage			
None (Neither CRP nor AGP elevated)	714	74.4%	(68.9, 79.3)
Incubation (CPR elevated, AGP normal)	3	0.6%	(0.2, 2.3)
Early convalescence (both CPR and AGP elevated)	52	6.1%	(4.3, 8.6)
Late convalescence (CRP normal, AGP elevated)	155	18.9%	(14.6, 23.9)

Note: The n's are un-weighted numerators for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection

[b] CI=confidence interval calculated taking into account the complex sampling design.

3.4.8. Stunting

The prevalence of stunting in this age group is less than 4% of school-age children affected (Table 3-32). Severe and moderate stunting are present in 1.6% (95% CI: 0.7, 3.5) and 1.8% (95% CI: 0.9, 3.3), respectively and thus, no further sub-group analyses are presented for moderate and severe stunting.

The prevalence of stunting is higher in girls than in boys. Further, there is a trend towards a higher stunting prevalence in poorer children. The mean height-for-age z-score in this group is -0.30 with a standard deviation of 1.04. Figure 3-13 shows that the distribution of the height-for-age z-scores closely matches the WHO Child Growth Standard.

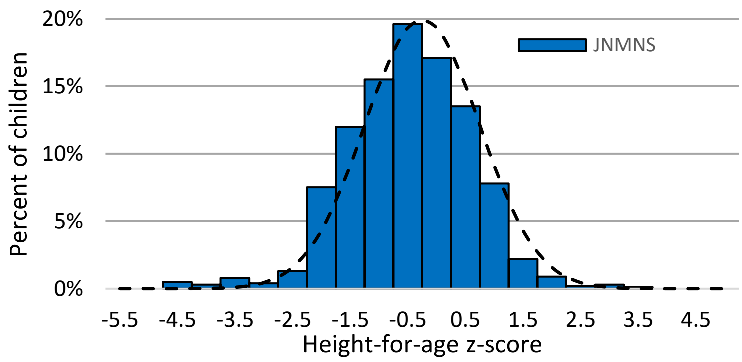

Figure 3-13. Distribution of height-for-age z-scores in school-aged children 6-12 years, settled population, Jordan

Table 3-32. Prevalence of stunting in school-age children 6-12 years, by various demographic characteristics, settled population, Jordan

Characteristic	N	% [a,b]	95% CI [c]	p-value [d]
TOTAL	1164	3.4%	(1.7, 6.4)	
Age (in years)				
6-7	348	1.4%	(0.4, 4.4)	0.130
8-9	338	4.9%	(1.7, 13.6)	
10-11	341	4.5%	(2.2, 8.8)	
12	137	1.5%	(0.7, 3.6)	
Sex				
Male	602	2.1%	(1.0, 4.0)	0.003
Female	562	4.7%	(2.3, 9.4)	
Residence				
Urban	946	3.1%	(1.4, 6.6)	0.264
Rural	214	5.8%	(2.5, 12.8)	
Stratum				
Central	295	3.4%	(1.4, 8.1)	0.374
Northern	468	2.8%	(1.5, 5.2)	
Southern	401	5.0%	(3.2, 7.7)	
Wealth quintile				
Poorest	333	7.7%	(3.3, 16.9)	0.010
Second	238	3.2%	(1.3, 7.7)	
Middle	246	2.2%	(0.7, 6.5)	
Fourth	196	0.5%	(0.1, 1.7)	
Wealthiest	151	2.0%	(0.4, 8.7)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Stunting is defined as having a height-for-age z-score below -2 standard deviations from the WHO Child Growth Standards population median.

[b] Percentages weighted for unequal probability of selection.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is significantly different from the others.

3.4.9. Thinness, overweight and obesity

Thinness was highly uncommon, with only just over 1% of school-age children affected (1.4%; 95% CI: 0.8, 2.6). The low number of affected children precludes any meaningful sub-group analysis.

Overall, more than one quarter of school-age children 6-12 years old are overweight or obese; with 12% obese and 16% overweight. Obesity is much more common among 12-year-olds than among the younger age groups. No other demographic characteristics showed a statistically significant association with either overweight or obesity (Table 3-33).

Figure 3-14 shows that there is some geographic variation in overweight among school-age children in Jordan, with Amman, Zarqa, Madaba, and Tafilah having higher prevalence rates.

Table 3-33. Prevalence of overweight and obesity in school-age children 6-12 years, by various demographic characteristics, settled population, Jordan

Characteristic	N	Obesity [b] % [a]	Obesity [b] 95% CI	Overweight [b] %	Overweight [b] 95% CI	p-value [c]	Obesity or overweight %	Obesity or overweight 95% CI	p-value [c]
TOTAL	1163	11.8%	(9.1, 15.1)	16.0%	(12.8, 19.8)		27.8%	(23.3, 32.7)	
Age (in years)									
6-7	348	8.9%	(5.0, 15.4)	13.0%	(8.9, 18.6)	0.020	21.9%	(15.8, 29.4)	0.035
8-9	337	11.1%	(6.4, 18.5)	18.4%	(12.8, 25.7)		29.4%	(22.3, 37.8)	
10-11	341	9.8%	(6.3, 15.1)	17.5%	(12.6, 23.8)		27.4%	(21.3, 34.3)	
12	137	25.3%	(15.4, 38.6)	13.8%	(7.8, 23.1)		39.1%	(29.5, 49.6)	
Sex									
Male	601	12.3%	(8.8, 17.1)	14.8%	(11.2, 19.1)	0.710	27.1%	(21.8, 33.2)	0.741
Female	562	11.1%	(7.5, 16.3)	17.3%	(12.6, 23.3)		28.4%	(22.3, 35.6)	
Residence									
Urban	945	11.5%	(8.7, 15.0)	16.7%	(13.2, 20.9)	0.239	28.2%	(23.2, 33.7)	0.534
Rural	214	15.1%	(7.6, 27.8)	9.5%	(5.6, 15.8)		24.6%	(16.4, 35.2)	
Stratum									
Central	295	13.2%	(9.5, 18.1)	16.6%	(12.3, 22.0)	0.203	29.8%	(23.7, 36.8)	0.170
Northern	468	8.1%	(5.5, 11.9)	13.9%	(10.8, 17.7)		22.0%	(17.3, 27.5)	
Southern	400	9.5%	(7.1, 12.5)	17.0%	(12.9, 22.1)		26.5%	(21.1, 32.7)	
Wealth quintile									
Poorest	333	8.0%	(4.2, 14.7)	13.2%	(7.9, 21.1)	0.441	21.2%	(14.2, 30.4)	0.527
Second	238	10.4%	(5.2, 19.7)	18.8%	(12.4, 27.3)		29.2%	(19.9, 40.6)	
Middle	245	13.5%	(7.8, 22.3)	14.8%	(10.3, 20.9)		28.4%	(20.8, 37.3)	
Fourth	196	17.3%	(10.3, 27.8)	13.3%	(7.8, 21.8)		30.6%	(20.8, 42.6)	
Wealthiest	151	10.6%	(5.7, 18.7)	21.0%	(13.0, 32.1)		31.6%	(21.8, 43.2)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Overweight is defined as having a BMI-for-age z-score greater than +2 but less than or equal to +3 standard deviations from the WHO Child Growth Standards population median; obesity is defined as having a BMI-for-age z-score greater than +3 standard deviations from the WHO Child Growth Standards population median.

[c] P value <0.05 indicates that one at least subgroup is significantly different from the others.

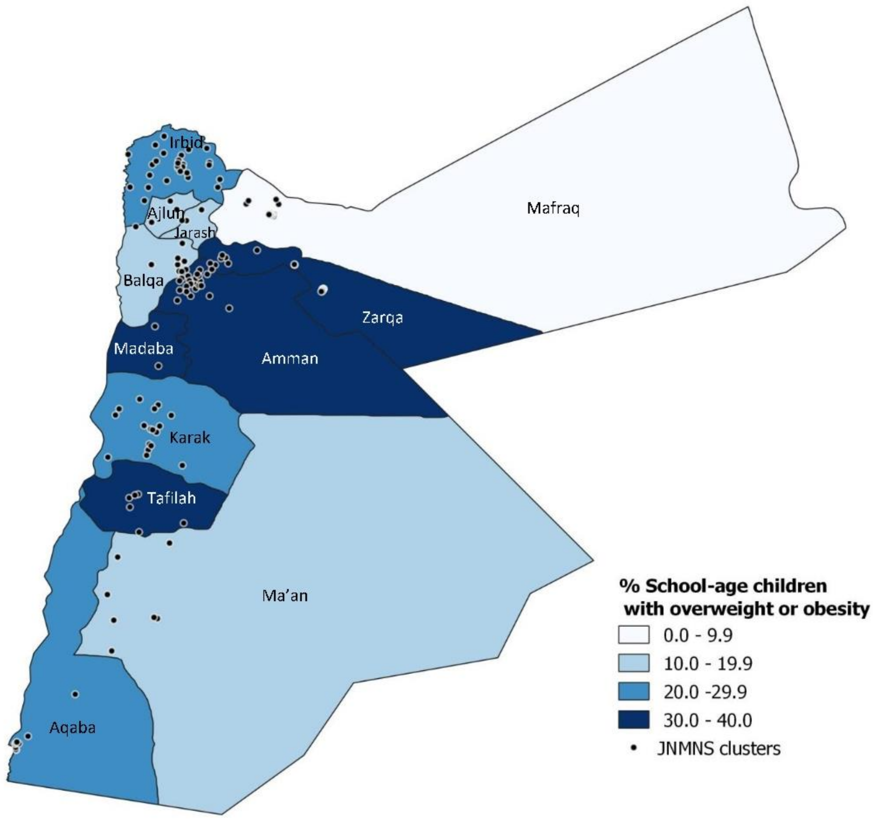

Figure 3-14. **Prevalence of overweight (BMI z-score > +2) by governorate among school-age children, settled population, Jordan**

3.4.10. Underweight (only children 6-10 years)

Underweight can only be assessed up to 10 years of age, since no reference z-scores exist for older children. Overall, the prevalence of underweight was low with 2.9% (95% CI: 1.5, 5.9), and only 0.4% of children had severe underweight. No further sub-group analysis could be meaningfully conducted.

3.4.11. Dietary habits, dietary diversity and supplement consumption

Almost 9 out of 10 children were ever breastfed, which is a slightly higher estimate than for the pre-school children (Table 3-34).

Well over one half of children meet the threshold for a diverse diet, and less than half of children drank tea and/or coffee in a manner which would inhibit the absorption of ingested iron.

Less than half of children eat breakfast before going to school, and just over half take a meal from home to school. Almost 9 out of 10 get some money to buy snacks outside the home; from that money most of the children buy chips, chocolate, juice and/or biscuits. One fifth of the children get a free snack at school, which consists predominantly of biscuits or date bars.

Only a very small proportion of children consumed dietary supplements: iron (1.9%), vitamin D (1.3%), vitamin A (0.3%), multivitamins (3.9%).

Table 3-34. Child dietary habits and current dietary diversity, school-age children 6-12 years, settled population, Jordan

Characteristic	n	Mean or %[a]	95% CI[b]
Child was ever breastfed			
Yes	1088	86.9%	(83.3, 89.8)
No	131	13.1%	(10.2, 16.7)
Number of food groups consumed (mean)	1219	4.89	(4.58, 5.20)
Meets minimum dietary diversity (≥ 5 food groups)[c]			
Yes	709	56.1%	(48.7, 63.2)
No	510	43.9%	(36.8, 51.3)
Iron-inhibiting coffee/tea drinking behavior [d]			
Yes	540	43.3%	(37.7, 49.2)
No	679	56.7%	(50.8, 62.3)
Child typically has breakfast before going to school			
Yes	513	45.2%	(39.8, 50.8)
No	704	54.8%	(49.2, 60.2)
Of these 513 children, what the child typically has for breakfast			
Tea	280	52.0%	(43.7, 60.2)
Milk	271	48.8%	(40.8, 56.9)
Juice	53	11.9%	(7.2, 19.0)
Bread/ Sandwich	438	88.4%	(82.8, 92.3)
Labneh/ Yoghurt/ Cheese	387	76.8%	(69.7, 82.7)
Fruit	110	25.3%	(18.3, 33.8)
Vegetable	104	20.7%	(15.1, 27.8)
Eggs	179	39.7%	(31.7, 48.2)
Cereals	41	8.1%	(4.9, 13.3)
Child typically takes a meal from home to school			
Yes	502	51.1%	(43.8, 58.3)
No	717	48.9%	(41.7, 56.2)
Of these 502 children, what the child typically takes to school			
Milk	30	7.0%	(4.5, 10.8)
Juice	136	30.1%	(24.3, 36.6)
Bread/ Sandwich	490	98.4%	(96.4, 99.3)
Labneh/ Yoghurt/ Cheese	405	83.8%	(77.1, 88.8)
Fruit	121	26.8%	(19.5, 35.7)
Vegetable	82	17.7%	(13.6, 22.8)
Potato chips/ crisps	22	8.8%	(4.7, 16.0)
Child typically receives free snack at school			
Yes	381	20.9%	(15.6, 27.6)
No	838	79.1%	(72.4, 84.4)
Of these 381 children, what snack the child typically receives			
Biscuit/datebar	313	81.2%	(65.5, 90.8)
Pastry with fruit and vegetable	67	18.7%	(9.1, 34.4)
Child typically receives money to buy snack			
Yes	1124	89.2%	(84.5, 92.6)
No	95	10.8%	(7.4, 15.5)
Of these 1124 children, what the child typically buys from this money			
Sandwich/ school meal	485	43.8%	(38.4, 49.5)
Juice	831	70.5%	(63.9, 76.4)

Characteristic	n	Mean or %[a]	95% CI[b]
Soda	112	12.4%	(8.5, 17.7)
Biscuits	847	68.6%	(62.2, 74.3)
Crackers	458	39.5%	(31.9, 47.6)
Chips	935	85.0%	(81.1, 88.2)
Chocolate	745	71.2%	(65.5, 76.3)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Based on reference [63].
[d] The combination of drinking coffee/tea once or several times per day and drinking it during or just after a meal.

3.4.12. Sun exposure

Table 3-35 shows indicators of sun exposure in school-age children in the settled Jordanian population. Three quarters did not usually protect their heads from the sun when outdoors. Almost two thirds of children spend one hour or more per day outdoors. About a third of children had a high head exposure sun index, while only 1 out of 10 an index of 0.

Table 3-35. Sun exposure in school-age children 6-12 years, settled Jordanian population

Characteristic	n	% [a]	95% CI [b]
Child's head usually protected from sun when outside			
Never/rarely	953	72.5%	(66.7, 77.7)
Sometimes	138	13.5%	(9.4, 19.0)
Most of the time	32	5.4%	(3.4, 8.4)
All the time	96	8.6%	(6.1, 12.1)
How usually protect child's head from sun			
Scarf/headcloth	121	40.3%	(30.4, 51.1)
Hat	145	59.7%	(48.9, 69.6)
How much time per day typically child spend under the sun			
None	16	2.6%	(1.3, 5.3)
1-29 minutes	120	13.8%	(10.2, 18.4)
30-59 minutes	212	21.5%	(16.8, 27.2)
1-2 hours	338	29.2%	(24.8, 34.2)
More than 2 but less than 3 hours	294	19.8%	(16.1, 24.0)
3 hours or more	234	13.0%	(10.1, 16.6)
Child usually has sunscreen			
Never/rarely	1196	98.3%	(96.6, 99.2)
Sometimes	10	0.6%	(0.2, 1.7)
Most of the time	7	0.8%	(0.2, 2.8)
All the time	6	0.2%	(0.1, 0.6)
Head exposure sun index[c]			
10-19	493	30.2%	(25.7, 35.2)
0.01-9.9	606	58.6%	(52.6, 64.3)
0	115	11.2%	(8.0, 15.6)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] School-age children were only asked about sun exposure to the head, the sun index for this age group is based only on this exposure, unlike other groups for where sun exposure includes exposure to the head, arms, and hands (women only).

3.4.14. Physical activity

School-age children generally like physical activities and outdoor playing, and the majority of caregivers considers their child to be equally or more active than his or her peers, with almost two thirds of children being physically active for more than one hour per day (Table 3-36).

Table 3-36. Physical activity patterns in school-age children 6-12 years, settled population, Jordan

Characteristic	n	Mean or % [a]	95% CI [b]
Child likes physical activity and outdoor playing			
Does not like	69	7.5%	(5.4, 10.2)
Likes	698	63.4%	(57.1, 69.4)
Likes a lot	448	29.1%	(23.6, 35.3)
Caregiver ranks child's activities relative to other children			
Less active	77	8.5%	(6.1, 11.6)
Same	686	56.5%	(50.7, 62.1)
More active	452	35.1%	(30.6, 39.8)
Time child typically spends physically active per day			
< 30 minutes	78	10.1%	(6.8, 14.8)
30-60 minutes	258	23.0%	(19.5, 26.9)
> 60 minutes	834	63.2%	(57.6, 68.4)
Don't know	49	3.7%	(1.9, 7.3)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.

3.4.15. Risk factors for anemia and iron deficiency

Table 3-37 and Table 3-38 below show the association between various risk factors and anemia or iron deficiency in school-age children in Jordan. No significant association between anemia or iron deficiency and iron supplements or multivitamin supplements was found. The low consumption of supplements resulted in very small numbers for this analysis.

Table 3-37. Anemia, and iron deficiency in school-age children 6-12 years, by vitamin and mineral supplement indicators, settled population, Jordan

		Anemia		Iron deficiency	
Characteristic	N	% [a]	P value [b]	% [a]	P value [b]
Consumed iron tablets or syrup in past six months					
No	910	6.1%	0.069	30.5%	0.842
Yes	18	1.1%		33.3%	
Consumed multivitamins in past six months					
No	899	6.0%	0.807	30.6%	0.880
Yes	28	7.7%		32.8%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[d] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.
[c] Analyses for this variable only include 25% of the households, as bread samples were only collected in a sub-sample.

The anemia prevalence was about 3 times higher in children with vitamin A deficiency compared to those without. Iron deficiency was not significantly associated with anemia, which is a rather surprising finding, but consistent with the low prevalence of iron deficiency anemia. No other factors were significantly associated with anemia or iron deficiency.

Figure 3-15 illustrates the overlap between anemia and iron deficiency in these children, showing that very few anemic children had concurrent iron deficiency.

Table 3-38. Correlation between various factors and anemia and iron deficiency in school-age children 6-12 years, settled population, Jordan

Characteristic	n	% anemic [a]	P value [b]	% iron deficient [a]	P value [b]
Child had diarrhea					
Yes	31	16.5%	0.071	33.2%	0.799
No	896	5.6%		30.5%	
Child had fever					
Yes	165	7.4%	0.582	25.2%	0.210
No	760	5.8%		32.1%	
Child had lower respiratory infection					
Yes	72	3.4%	0.499	31.6%	0.898
No	843	6.4%		30.6%	
Child has inflammation					
Yes	209	6.4%	0.844	35.8%	0.213
No	711	6.0%		28.8%	
Child iron deficient					
Yes	256	6.1%	0.984		
No	664	6.1%			
Child vitamin A deficient					
Yes	58	13.7%	0.044	22.5%	0.266
No	862	5.5%		31.2%	
Child vitamin D insufficient or deficient					
Yes	751	6.2%	0.933	31.0%	0.494
No	151	6.4%		26.4%	
Child vitamin B12 deficient or marginal					
Yes	217	9.6%	0.122	28.2%	0.438
No	685	4.7%		31.6%	
Child zinc deficient					
Yes	78	4.8%	0.723	17.0%	0.160
No	802	5.9%		31.1%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[d] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

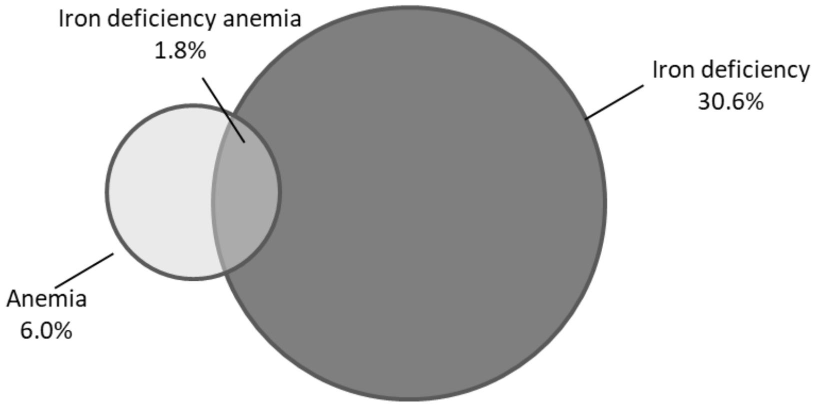

Figure 3-15. Venn diagram showing overlap between anemia and iron deficiency in school-age children 6-12 years, settled population, Jordan

3.4.16. Correlation between physical activity and growth indices

Overweight and/or obesity are oftentimes linked to lack of physical activity, and Table 3-39 shows associations between overweight/obesity and reported physical activity in school-age children. In this survey, none of the physical activity indicators were statistically significantly associated with overweight or obesity.

Table 3-39. Correlation between physical activities and growth indices among school-age children 6-12 years, settled population, Jordan

Characteristic	N	% [a] Obese	% [a] Overweight	P value[b]	% [a] Overweight or obese	P value[b]
Child likes physical activity and outdoor playing						
Does not like	66	15.3%	24.0%	0.596	39.4%	0.219
Likes	666	11.5%	15.8%		27.4%	
Likes a lot	427	10.7%	14.5%		25.2%	
Caregiver ranks child's activities relative to other children						
Less active	73	19.7%	9.9%	0.400	29.6%	0.870
Same	654	11.6%	16.6%		28.1%	
More active	432	10.3%	16.4%		26.7%	
Time child typically spends physically active per day						
< 30 minutes	73	10.2%	15.8%	0.189	26.0%	0.155
30-60 minutes	245	15.4%	21.2%		36.5%	
> 60 minutes	796	10.0%	14.9%		24.9%	
Don't know	49	23.4%	3.8%		27.2%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[d] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

3.4.17. Correlation between sun exposure and vitamin D deficiency

Head sun exposure in school-age children residing in Jordan is significantly associated with vitamin D deficiency and insufficiency: children with a higher index were less likely to be vitamin D deficient, but more likely to be vitamin D insufficient. Overall, children with a higher head sun exposure index are less likely to have sub-optimal vitamin D status.

Table 3-40. Association between sun exposure and vitamin D deficiency in school-age children 6-12 years, settled population, Jordan

Characteristic	N	% [a] VDD	% [a] VD insufficient	P value	% [a] VDD or insufficient	P value[b]
Head sun exposure index						
0	83	86.1%	13.9%	0.000	100.0%	0.018
0.01 – 9.9	438	52.3%	39.0%		91.2%	
10-19	381	42.3%	42.2%		84.4%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

3.5. Non-pregnant women (settled population)

3.5.1. Characteristics

Characteristics of non-pregnant women randomly selected for the survey are presented in Table 3-41. There are slightly more women aged 15-19 years than in other age groups, and consistent with the household sample selected, almost 9 out of 10 women are residing in urban settlements, with slightly more women from the Northern stratum. Over three quarters have secondary or higher education. Almost 60% of women are currently married, with the majority of the remainder being unmarried. Of married women, over 90% have ever been pregnant. Of those having given birth to a child, one fifth were breastfeeding at the time of the survey.

Almost two thirds of women with a blood sample have no elevated inflammatory markers, and less than 10% are in the acute phase, while almost one fifth are in the early convalescence phase.

Table 3-41. Description of non-pregnant women 15 - 49 years, settled population, Jordan

Characteristic	Number of women	% [a]	95% CI [b]
Age (in years)			
15-19	187	21.0%	(17.1, 25.4)
20-24	140	15.4%	(12.2, 19.3)
25-29	101	12.6%	(9.7, 16.3)
30-34	109	14.1%	(10.7, 18.4)
35-39	118	14.6%	(11.6, 18.3)
40-44	103	10.8%	(8.2, 14.2)
45-49	87	11.4%	(8.8, 14.6)
Residence			
Urban	694	88.8%	(77.3, 94.8)
Rural	151	11.2%	(5.2, 22.7)
Stratum			
Central	222	26.3%	(19.0, 35.2)
Northern	349	41.3%	(31.8, 51.6)
Southern	274	32.4%	(23.9, 42.3)
Wealth Quintile			
Poorest	197	16.2%	(11.8, 22.0)
Second	181	22.0%	(16.6, 28.5)
Middle	172	21.6%	(15.6, 29.1)
Fourth	184	22.6%	(17.7, 28.3)
Wealthiest	111	17.6%	(11.9, 25.2)
Woman's education			
Elementary	187	22.6%	(17.6, 28.5)
Secondary	361	48.0%	(42.2, 53.9)
Higher	261	29.4%	(24.8, 34.4)
Marital Status			
Never married	346	37.4%	(32.9, 42.1)
Currently married	470	57.5%	(51.8, 62.9)
Widowed	12	1.6%	(0.7, 3.6)
Divorced or separated	17	3.5%	(1.8, 6.5)

Characteristic	Number of women	% [a]	95% CI [b]
Number of times been pregnant [c]			
0	27	6.2%	(3.7, 10.3)
1-2	98	21.9%	(17.4, 27.2)
3-4	146	32.5%	(26.5, 39.1)
5-6	114	20.9%	(16.7, 25.8)
7+	83	18.5%	(14.3, 23.6)
Number of times given birth [d]			
0	3	1.4%	(0.4, 5.0)
1-2	107	24.9%	(19.9, 30.8)
3-4	176	42.2%	(36.4, 48.2)
5-6	106	22.4%	(17.5, 28.1)
7+	49	9.1%	(6.0, 13.6)
Currently breastfeeding a child [e]			
Yes	77	19.1%	(14.3, 24.9)
No	361	80.9%	(75.1, 85.7)

[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Among currently married women.
[d] Among currently married women who reported a prior pregnancy.
[e] Among currently married women who reported a prior birth.
[f] Only available for these women with a successful blood draw.

3.5.2. Bread consumption and iron intake from bread

The results of bread consumption and iron intake from bread for women of reproductive age in the settled Jordanian population are shown in Table 3-42. Overall, about 20% of the RNI for iron comes from consumption of bread. Women in poorer households have a significantly higher iron intake than their wealthier peers.

Table 3-42. Mean daily bread intake, and iron intake from bread, as well as estimated %RNI for non-pregnant women, by various factors, settled Jordanian population

Characteristic	Median daily bread intake (g); N=782 [a]	P value [b]	Median % RNI of iron for non-pregnant woman; N=413 [a, c]	P value [b]
Total	255.0		19.8%	
Residence				
Urban	274.6	0.484	19.9%	0.281
Rural	236.1		18.6%	
Stratum				
Northern	295.7	0.100	19.8%	0.215
Central	231.0		18.0%	
Southern	228.7		21.8%	
Wealth Quintile				
Lowest	255.0	0.061	23.0%	0.006
Second	252.9		21.7%	
Middle	322.8		18.7%	
Fourth	244.7		17.6%	
Highest	219.1		11.7%	

Characteristic	Median daily bread intake (g); N=782 [a]	P value [b]	Median % RNI of iron for non-pregnant woman; N=413 [a, c]	P value [b]
Currently breastfeeding				
Yes	239.1	0.711	13.9%	0.614
No	263.7		21.3%	

[a] Medians and percentages weighted for unequal probability of selection.
[b] P-values are calculated using non-parametric median test; p-value <0.05 indicates that the median in at least one subgroup is statistically significantly different from the values in the other subgroups.
[c] The recommended nutrient intake iron in women is as follows (assuming 12% bioavailability): 15-17 years: 25.8 mg/d; 18-50 years: 24.5 mg/d[60]; note that bread was collected only in a sub-sample of households.

3.5.3. Anemia, iron deficiency, and iron deficiency anemia

Table 3-43 shows the prevalence of anemia, iron deficiency and iron deficiency anemia for non-pregnant women in the settled Jordanian population. A little less than one quarter of these women were anemic and two thirds were iron deficient. Almost all anemia can be ascribed to iron deficiency. Anemia and iron deficiency anemia were more common in the Southern stratum and iron deficiency was more common in rural women. There is a suggestion, albeit without statistical significance, that the prevalence of iron deficiency is higher in the poorest household wealth quintile than in the other quintiles.

The prevalence of severe anemia was only 1% (Table 3-44). This is corroborated by the hemoglobin histogram, as shown in Figure 3-16.

Nonetheless, overall, the anemia situation in these non-pregnant women is classified of 'moderate' public health importance as per WHO criteria [42]. Among anemic non-pregnant women in the settled population, the prevalence of iron deficiency was 91.7% (95% CI: 79.8, 96.8, n=195).

The mean hemoglobin concentration among all settled non-pregnant women was 126.7g/L (95%CI 124.8, 128.6 g/L).

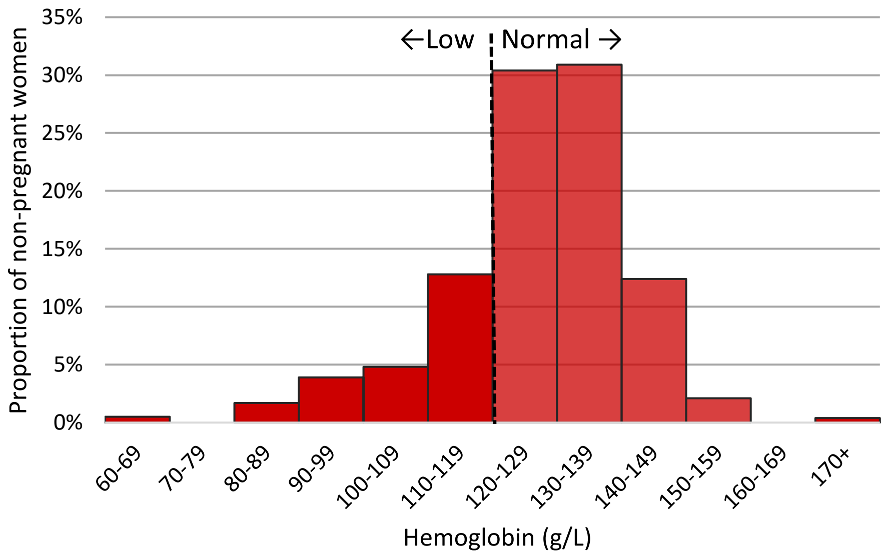

Figure 3-16. Distribution of hemoglobin values in non-pregnant women 15-49 years of age, settled population, Jordan

Table 3-43. Prevalence of anemia, iron deficiency, and iron deficiency anemia in non-pregnant women 15-49 years of age, by various demographic characteristics, settled population, Jordan

	Anemia [b]				Iron deficiency [e]				Iron deficiency anemia [f]			
Characteristic	n	% [a]	95% CI [c]	p-value [d]	n	% [a]	95% CI [c]	p-value [d]	n	% [a]	95% CI [c]	p-value [d]
TOTAL	694	23.9%	(19.6, 28.8)		690	65.6%	(58.9, 71.7)		694	21.5%	(17.4, 26.2)	
Age (in years)												
15-19	152	22.4%	(13.4, 35.1)	0.402	151	65.4%	(53.7, 75.4)	0.984	152	22.1%	(13.1, 34.8)	0.272
20-24	114	19.9%	(11.1, 33.0)		114	70.0%	(51.1, 83.9)		114	18.7%	(10.2, 31.9)	
25-29	80	15.2%	(7.1, 29.7)		81	66.0%	(47.1, 80.9)		81	14.3%	(6.4, 28.8)	
30-34	90	18.7%	(7.2, 40.6)		90	61.0%	(44.3, 75.4)		90	11.4%	(5.8, 21.2)	
35-39	95	24.4%	(12.7, 41.7)		92	65.1%	(47.2, 79.6)		95	23.9%	(12.3, 41.4)	
40-44	88	32.2%	(20.0, 47.4)		87	66.4%	(50.9, 79.0)		87	28.8%	(16.8, 44.9)	
45-49	75	36.9%	(21.4, 55.6)		75	64.9%	(51.0, 76.6)		75	32.5%	(18.2, 51.0)	
Residence												
Urban	564	23.4%	(19.0, 28.5)	0.614	561	63.9%	(56.8, 70.4)	0.013	564	20.9%	(16.7, 25.8)	0.471
Rural	130	27.7%	(14.1, 47.2)		129	79.5%	(69.1, 87.1)		130	26.7%	(13.6, 45.8)	
Stratum												
Central	180	22.8%	(17.6, 28.9)	0.021	179	65.9%	(57.4, 73.6)	0.937	180	20.6%	(15.6, 26.5)	0.011
Northern	279	24.4%	(18.5, 31.3)		277	64.3%	(57.3, 70.6)		279	21.5%	(16.2, 27.9)	
Southern	235	37.0%	(27.4, 47.8)		234	65.8%	(57.7, 73.1)		235	34.0%	(25.6, 43.7)	
Wealth quintile												
Poorest	180	32.4%	(22.0, 44.8)	0.552	177	82.4%	(71.5, 89.7)	0.088	180	30.8%	(20.5, 43.5)	0.459
Second	149	21.8%	(12.1, 36.0)		148	63.1%	(50.0, 74.6)		148	17.8%	(8.9, 32.3)	
Middle	142	25.8%	(15.9, 39.1)		142	56.8%	(43.9, 68.8)		143	23.5%	(14.6, 35.5)	
Fourth	140	20.6%	(11.6, 34.0)		140	62.3%	(46.0, 76.1)		140	18.2%	(9.6, 32.0)	
Wealthiest	83	18.6%	(10.1, 31.7)		83	66.8%	(51.1, 79.5)		83	17.4%	(9.1, 30.5)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Anemia defined as hemoglobin < 120 g/L adjusted for altitude and smoking.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.
[e] Iron deficiency defined as serum ferritin < 15 µg/l after adjustment for inflammation.
[f] Iron deficiency anemia defined as serum ferritin < 15 µg/L and hemoglobin < 120 g/L.

Table 3-44. Severity of anemia in non-pregnant women 15-49 years of age, by various demographic characteristics, settled population, Jordan

Characteristic	Mild anemia [b]			Moderate anemia [b]			Severe anemia [b]		
	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]
TOTAL	107	12.8	(9.6, 16.9)	83	10.5	(7.3, 14.8)	6	0.6	(0.1, 2.6)
Age (in years)									
15-19	18	11.0	(5.6, 20.7)	17	11.3	(5.5, 21.7)	1	0.1	(0.0, 0.9)
20-24	18	14.3	(7.1, 26.8)	11	5.2	(1.6, 15.2)	1	0.4	(0.1, 2.9)
25-29	10	6.6	(2.2, 18.3)	4	5.0	(1.1, 20.1)	1	3.7	(0.5, 21.4)
30-34	15	13.8	(3.7, 39.6)	6	4.8	(1.2, 16.9)	1	0.2	(0.0, 1.4)
35-39	12	11.1	(4.7, 23.7)	11	13.3	(5.8, 27.8)	0	0.0	-
40-44	17	15.4	(7.2, 30.1)	18	16.3	(7.5, 32.0)	2	0.4	(0.1, 1.8)
45-49	17	18.4	(8.4, 35.5)	16	18.5	(8.5, 35.6)	0	0.0	-
Residence									
Urban	87	13.0	(9.6, 17.4)	67	9.8	(6.5, 14.6)	5	0.6	(0.1, 3.0)
Rural	20	11.2	(4.2, 26.6)	16	15.9	(8.9, 26.6)	1	0.6	(0.1, 4.3)
Stratum									
Central	22	12.3	(8.4, 17.7)	18	10.1	(6.2, 15.8)	1	0.6	(0.1, 4.1)
Northern	35	12.2	(8.3, 17.8)	32	11.2	(7.6, 16.3)	1	0.3	(0.0, 2.4)
Southern	50	21.3	(14.3, 30.5)	33	14.0	(9.5, 20.2)	4	1.7	(0.7, 4.3)
Wealth quintile									
Poorest	34	17.7	(9.6, 30.3)	27	14.6	(6.3, 30.5)	0	0.0	-
Second	24	13.1	(6.5, 24.6)	16	8.6	(4.0, 17.3)	1	0.1	(0.0, 0.8)
Middle	17	15.0	(7.3, 28.6)	21	10.9	(4.8, 22.9)	0	0.0	-
Fourth	17	8.8	(4.2, 17.4)	13	11.3	(4.8, 24.4)	3	0.5	(0.1, 1.8)
Wealthiest	15	9.1	(3.9, 19.7)	6	6.6	(2.1, 19.0)	2	2.9	(0.4, 17.5)

Note: The n's are the numerators for a specific sub-group.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among strata.

[b] Mild, moderate, and severe anemia defined as hemoglobin 110-119 g/L, 80-109 g/L, and <80 g/L, respectively.

[c] CI=confidence interval calculated taking into account the complex sampling design.

3.5.4. Vitamin A deficiency

Nationally, only 3.0% (95%CI: 1.6, 5.6) of non-pregnant women had vitamin A deficiency, and only one individual would be considered severely vitamin A deficient. As such, no sub-group analyses for vitamin A deficiency could be conducted. Figure 3-17 shows the distribution of RBP values.

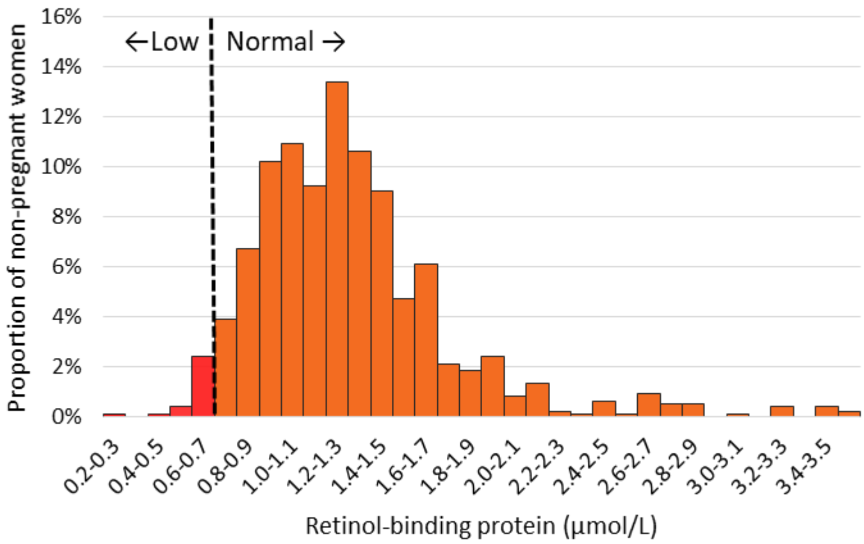

Figure 3-17. Distribution of inflammation-adjusted RBP values in non-pregnant women 15-49 years of age, settled population, Jordan

The mean retinol-binding concentration among settled non-pregnant women was 1.31 µmol/L (95% CI: 1.26, 1.37). A comparative scatterplot of serum retinol and retinol-binding protein is shown in Appendix 2.

3.5.6. Folate and vitamin B12 deficiency

Serum folate deficiency occurred in 11% of women in the settled population. Its prevalence was considerably higher in the Southern stratum. No other demographic differences were found (Table 3-45). The geometric mean folate is 7.3 ng/mL (95%CI: 6.8, 7.8).

Table 3-45. Prevalence of folate deficiency in non-pregnant women 15-49 years of age, by various demographic characteristics, settled population, Jordan

Characteristic	n	%[a, b]	95% CI[c]	p-value [d]
TOTAL	669	10.6%	(7.5, 14.8)	
Age (in years)				
15-19	147	7.3%	(3.4, 14.8)	0.362
20-24	111	8.3%	(3.0, 20.6)	
25-29	79	13.5%	(5.0, 31.5)	
30-34	88	11.9%	(5.3, 24.7)	
35-39	90	14.1%	(5.8, 30.2)	
40-44	83	3.7%	(1.7, 7.6)	
45-49	71	18.0%	(8.6, 34.0)	
Residence				
Urban	543	11.0%	(7.8, 15.5)	0.534
Rural	126	7.2%	(1.8, 25.1)	
Stratum				
Central	173	10.4%	(6.6, 15.9)	0.000
Northern	272	7.7%	(4.6, 12.6)	
Southern	224	22.3%	(16.5, 29.5)	
Wealth quintile				
Poorest	174	14.7%	(8.8, 23.5)	0.415
Second	144	11.5%	(5.9, 21.4)	
Middle	137	12.0%	(6.0, 22.4)	
Fourth	135	4.7%	(1.9, 11.4)	
Wealthiest	79	10.6%	(7.5, 14.8)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Folate deficiency defined as serum folate <10 nmol/L
[b] Percentages weighted for unequal probability of selection.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

About one fifth of non-pregnant women 15-49 years old had vitamin B12 deficiency, and another third had marginal vitamin B12 status (Table 3-45). In contrast to folate deficiency, the prevalence of vitamin B12 deficiency was smaller in the Southern stratum than in the Northern and Central strata. Although there is a suggestion of a trend towards lower prevalence of vitamin B12 deficiency in wealthier households, there is no statistical difference in vitamin B12 status among women in different wealth quintiles. About one third of non-pregnant women have a marginal vitamin B12 status, and over half of women have a sub-optimal vitamin B12 status

Because of a skewed distribution, a geometric mean was calculated for vitamin B12 results; it is 296.3 pg/mL (95%CI: 281.5, 311.9).

Table 3-46. Prevalence of vitamin B12 deficiency in non-pregnant women 15-49 years of age, by various demographic characteristics, settled population, Jordan.

		B12 deficiency		Marginal B12 status			B12 deficiency or marginal status		
Characteristic	N	% [a, b]	95% CI [c]	% [a, b]	95% CI [c]	p-value [d]	% [a, b]	95% CI [c]	p-value [d]
TOTAL	669	19.0%	(14.9, 23.8)	34.1%	(28.7, 40.0)		53.1%	(47.2, 48.9)	
Age (in years)									
15-19	147	21.6%	(14.0, 31.7)	37.6%	(27.2, 49.3)	0.827	59.2%	(45.8, 71.4)	0.872
20-24	111	13.9%	(7.2, 25.2)	32.9%	(21.4, 47.0)		46.8%	(35.3, 58.7)	
25-29	79	25.5%	(13.5, 43.0)	22.2%	(11.5, 38.7)		47.8%	(29.3, 66.8)	
30-34	88	19.5%	(11.1, 32.0)	35.2%	(24.7, 47.4)		54.7%	(38.9, 69.7)	
35-39	90	12.2%	(5.2, 26.2)	37.2%	(23.7, 53.0)		49.4%	(33.2, 65.8)	
40-44	83	22.6%	(12.1, 38.2)	32.2%	(20.1, 47.3)		54.8%	(36.1, 72.3)	
45-49	71	18.8%	(8.7, 35.9)	37.8%	(23.0, 55.4)		56.7%	(38.8, 73.0)	
Residence									
Urban	543	19.1%	(14.7, 24.4)	35.3%	(29.7, 41.4)	0.350	54.4%	(48.7, 59.9)	0.328
Rural	126	18.1%	(10.5, 29.3)	24.8%	(13.0, 42.0)		42.8%	(23.2, 65.1)	
Stratum									
Central	173	17.9%	(13.0, 24.1)	33.5%	(26.7, 41.1)	0.000	51.4%	(44.1, 58.8)	0.000
Northern	272	27.2%	(21.6, 33.7)	39.0%	(33.7, 44.6)		66.2%	(59.0, 72.7)	
Southern	224	7.1%	(4.1, 12.0)	26.8%	(21.2, 33.3)		33.9%	(26.9, 41.7)	
Wealth quintile									
Poorest	174	25.9%	(15.4, 40.1)	37.4%	(24.6, 52.3)	0.613	63.3%	(49.2, 75.4)	0.492
Second	144	20.0%	(13.4, 28.6)	30.1%	(20.9, 41.1)		50.0%	(37.6, 62.5)	
Middle	137	20.2%	(12.0, 31.8)	33.8%	(22.2, 47.7)		54.0%	(41.7, 65.8)	
Fourth	135	17.3%	(9.6, 29.3)	33.9%	(26.0, 42.9)		51.3%	(39.7, 62.7)	
Wealthiest	79	9.5%	(3.7, 22.4)	36.7%	(23.5, 52.2)		46.1%	(31.4, 61.6)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Vitamin B12 deficiency defined as plasma B12 <150 pmol/L (<203 pg/mL); marginal status as 150-220 pmol/L (203-297 pg/mL).
[b] Percentages weighted for unequal probability of selection.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.5.7. Vitamin D deficiency and insufficiency

Table 3-47 shows that 6 out of 10 women were vitamin D deficient and an additional 18% have vitamin D insufficiency. Women in the Southern stratum were more often affected by sub-optimal vitamin D status, but no other demographic factors showed statistically significant differences. The geometric mean vitamin D concentration is 10.6 ng/mL (95%CI: 9.6, 11.6).

Figure 3-18 shows the geographic distribution of vitamin D deficiency among non-pregnant women in Jordan. In contrast to pre-school and school-age children, there is more homogenous distribution of the prevalence. Aqaba governorate in the South has the highest prevalence.

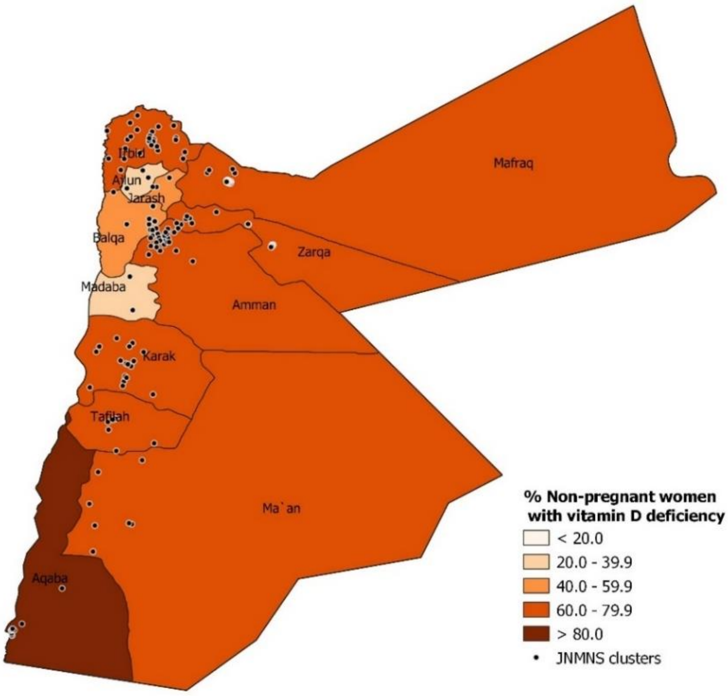

Figure 3-18. Prevalence of vitamin D deficiency (<12 ng/mL) by governorate among non-pregnant women, settled population, Jordan

Table 3-47. Prevalence of vitamin D deficiency and insufficiency in non-pregnant women 15-49 years of age, by various demographic characteristics, settled population, Jordan

		Deficient		Insufficient			Deficient or insufficient		
Characteristic	N	% [a]	95% CI [b]	% [a]	95% CI [b]	p-value[c]	% [a]	95% CI [b]	p-value [c]
TOTAL	675	63.5%	(56.2, 70.2)	17.8%	(12.9, 24.1)		81.3%	(75.8, 85.8)	
Age (in years)									
15-19	147	67.8%	(56.7, 77.1)	22.0%	(13.5, 33.6)	0.598	89.7%	(80.7, 94.8)	0.292
20-24	112	67.6%	(52.6, 79.7)	20.4%	(10.5, 36.0)		88.0%	(77.2, 94.1)	
25-29	79	53.1%	(36.2, 69.3)	19.6%	(9.9, 35.1)		72.7%	(55.2, 85.2)	
30-34	87	63.7%	(47.9, 77.0)	14.7%	(7.4, 27.0)		78.4%	(58.8, 90.2)	
35-39	91	62.4%	(47.2, 75.4)	15.5%	(7.3, 30.0)		77.9%	(62.8, 88.0)	
40-44	87	64.9%	(46.8, 79.6)	10.8%	(3.8, 27.0)		75.8%	(58.0, 87.6)	
45-49	72	60.5%	(42.0, 76.4)	18.5%	(9.0, 34.3)		79.0%	(62.5, 89.4)	
Residence									
Urban	547	64.0%	(55.9, 71.5)	16.7%	(11.5, 23.7)	0.077	80.8%	(74.6, 85.7)	0.233
Rural	128	59.1%	(52.1, 65.8)	26.4%	(19.5, 34.7)		85.5%	(79.2, 90.1)	
Stratum									
Central	175	62.9%	(53.6, 71.3)	17.7%	(11.7, 26.0)	0.093	80.6%	(73.4, 86.2)	0.010
Northern	273	63.4%	(56.6, 69.7)	18.3%	(13.7, 24.1)		81.7%	(77.3, 85.4)	
Southern	227	72.2%	(65.4, 78.2)	18.1%	(13.0, 24.6)		90.3%	(85.7, 93.6)	
Wealth quintile									
Poorest	174	74.8%	(62.0, 84.4)	13.3%	(6.6, 25.1)	0.388	88.1%	(78.3, 93.8)	0.197
Second	147	56.2%	(44.1, 67.7)	21.4%	(11.0, 37.5)		77.7%	(64.1, 87.1)	
Middle	139	67.9%	(55.2, 78.4)	16.0%	(7.8, 30.0)		83.9%	(71.4, 91.5)	
Fourth	135	61.6%	(51.5, 70.9)	22.1%	(14.1, 33.0)		83.7%	(74.1, 90.2)	
Wealthiest	80	56.6%	(38.5, 73.1)	14.7%	(5.5, 33.7)		71.3%	(57.0, 82.2)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection; <12 ng/mL, deficiency; 12.1-19.9 ng/mL, insufficiency.

[b] CI=confidence interval calculated taking into account the complex sampling design.

[c] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

3.5.8. Undernutrition, overweight, and obesity

Figure 3-19 shows the various categories of under- and over-nutrition in non-pregnant women. Because undernutrition is relatively rare, no further sub-group analyses were conducted of the categories of severity of undernutrition. On the other hand, over-nutrition was very common. Figure 3-20 provides a histogram of the BMI distribution in this population segment.

Table 3-48 shows the analysis of undernutrition, overweight, obesity, and overweight/obesity by various demographic factors. Although rare, undernutrition is most common among women less than 25 years of age and does not occur in women 40 years of age and older.

Overall, one third of women are overweight and one third obese. Although the prevalence of overweight is relatively constant, the prevalence of obesity rises with age. No significant differences in overweight or obesity prevalence was found for any of the other demographic factors.

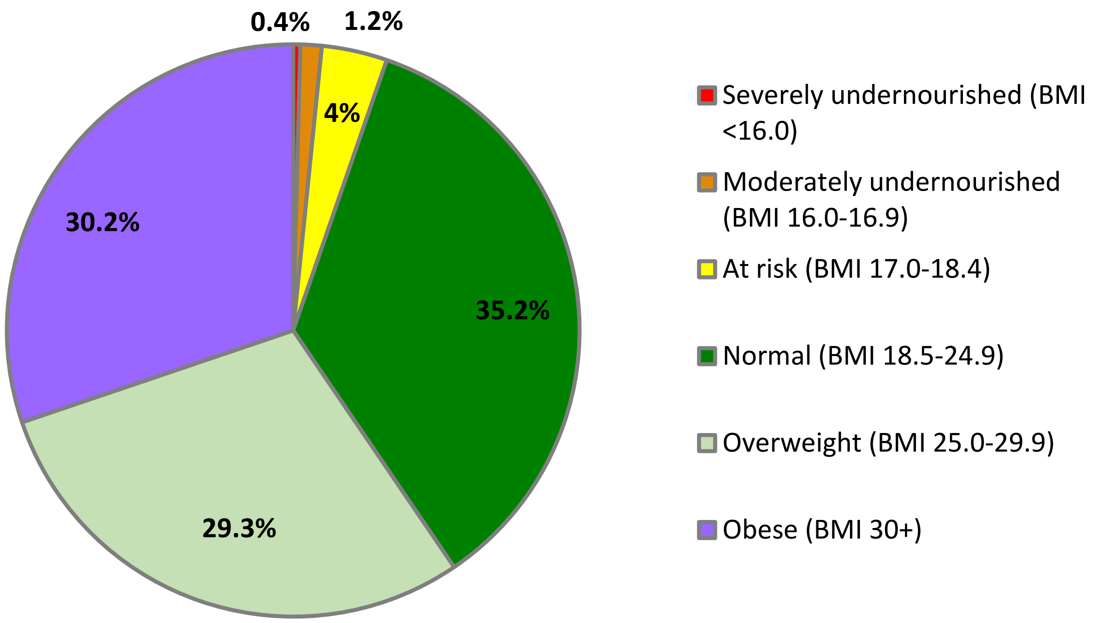

Figure 3-19. Underweight and overweight based on BMI in non-pregnant women 15-49 years of age, settled population, Jordan

Figure 3-21 shows the geographic distribution of overweight/obesity among non-pregnant women in Jordan. While there are differences, no pattern emerges, but Ajloun has the highest prevalence.

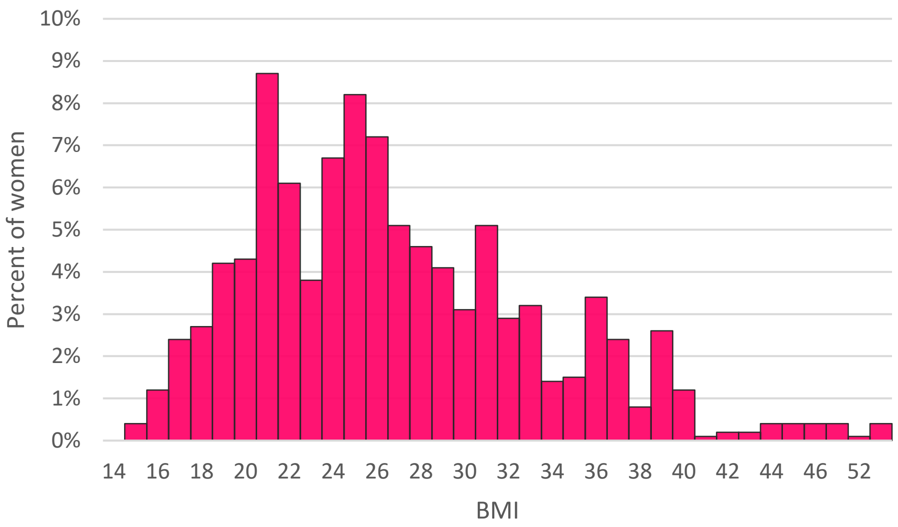

Figure 3-20. Distribution of BMI values in non-pregnant women 15-49 years of age, settled population, Jordan

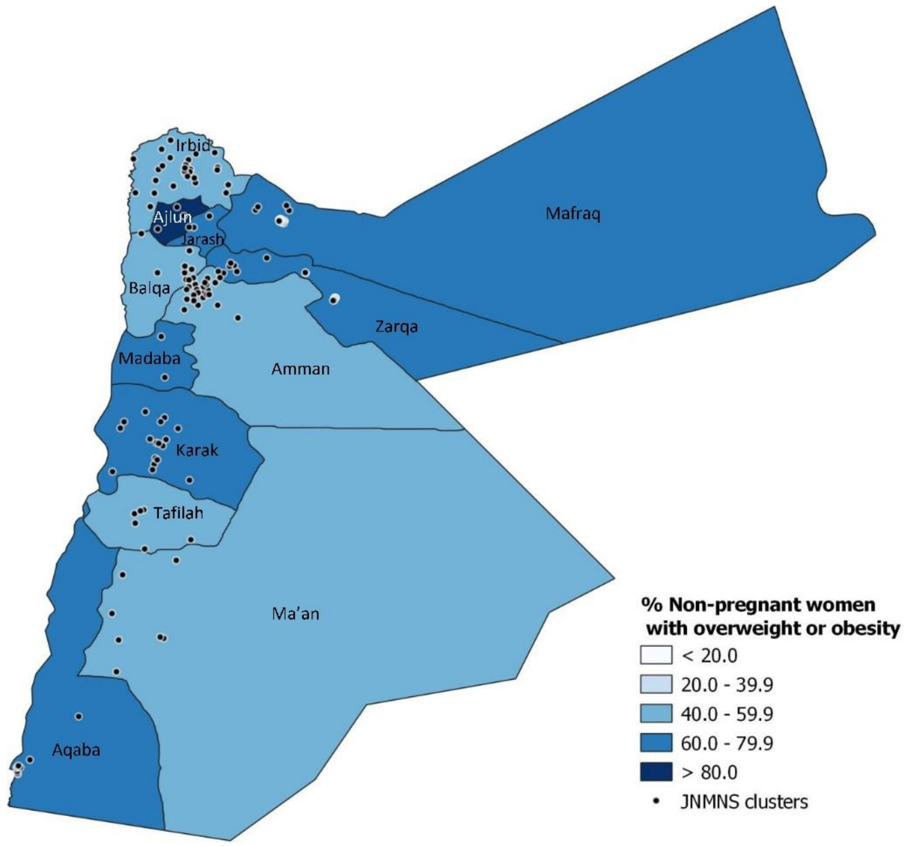

Figure 3-21. Prevalence of overweight/obesity (BMI 25+) by governorate among non-pregnant women, settled population, Jordan

Table 3-48. Prevalence of low and high BMI in non-pregnant women 15-49 years of age, by various demographic characteristics, settled population, Jordan

		Low BMI (<18.5) [b]			Overweight [b]		Obese [b]			Overweight or obese (BMI 25+)		
Characteristic	**N**	**% [a]**	**95% CI [c]**	**P value [c]**	**% [a]**	**95% CI [c]**	**% [a]**	**95% CI [c]**	**P value [c]**	**% [a]**	**95% CI [c]**	**P value [c]**
TOTAL	795	5.3%	(3.3, 8.4)		29.3%	(24.7, 34.4)	30.2%	(26.0, 34.8)		59.6%	(54.6, 64.4)	
Age (in years)												
15-19	174	9.4%	(3.9, 21.0)	0.042	24.5%	(16.6, 34.6)	4.7%	(1.6, 12.9)	0.000	29.3%	(20.9, 39.3)	0.000
20-24	134	11.2%	(4.2, 26.6)		19.0%	(10.9, 31.0)	20.8%	(11.8, 33.9)		39.8%	(28.3, 52.5)	
25-29	95	6.3%	(1.8, 19.9)		28.5%	(17.0, 43.6)	21.4%	(12.0, 35.3)		49.9%	(36.5, 63.2)	
30-34	104	0.1%	(0.0, 1.1)		34.9%	(21.7, 50.9)	30.5%	(20.7, 42.3)		65.4%	(47.8, 79.6)	
35-39	108	5.0%	(1.2, 17.8)		38.3%	(25.8, 52.4)	39.9%	(28.6, 52.3)		78.1%	(64.2, 87.7)	
40-44	98	0.0%	--		31.7%	(16.8, 51.5)	56.4%	(38.5, 72.8)		88.1%	(73.2, 95.2)	
45-49	82	0.5%	(0.1, 3.3)		32.9%	(20.5, 48.4)	61.3%	(46.0, 74.7)		94.2%	(82.9, 98.2)	
Residence												
Urban	654	5.6%	(3.4, 9.2)	0.102	29.4%	(24.4, 34.9)	30.4%	(25.8, 35.4)	0.889	59.8%	(54.7, 64.7)	0.826
Rural	141	2.4%	(0.9, 6.2)		29.0%	(18.5, 42.4)	28.7%	(21.2, 37.6)		57.7%	(39.2, 74.3)	
Stratum												
Central	216	5.6%	(3.1, 9.8)	0.560	29.6%	(23.9, 36.1)	30.1%	(25.0, 35.8)	0.947	59.7%	(53.5, 65.7)	0.724
Northern	328	4.0%	(2.4, 6.4)		28.0%	(22.6, 34.3)	30.2%	(24.4, 36.6)		58.2%	(51.7, 64.5)	
Southern	251	5.6%	(3.5, 8.9)		29.5%	(23.5, 36.2)	32.3%	(25.6, 39.8)		61.8%	(54.8, 68.3)	
Wealth quintile												
Poorest	185	6.2%	(2.2, 16.0)	0.794	29.6%	(20.2, 41.1)	34.2%	(24.8, 45.0)	0.436	63.8%	(52.5, 73.7)	0.315
Second	172	5.6%	(1.6, 17.8)		23.6%	(15.8, 33.8)	31.2%	(21.1, 43.5)		54.8%	(40.6, 68.3)	
Middle	162	2.7%	(0.8, 8.9)		31.1%	(19.7, 45.3)	37.2%	(27.7, 47.8)		68.3%	(57.9, 77.1)	
Fourth	173	7.1%	(3.0, 15.7)		29.1%	(21.4, 38.2)	24.2%	(16.1, 34.8)		53.3%	(43.3, 63.1)	
Wealthiest	103	4.8%	(1.6, 13.5)		34.7%	(24.3, 46.7)	24.6%	(16.2, 35.5)		59.3%	(47.1, 70.5)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Severe undernutrition defined as BMI <16.0; moderate undernutrition defined as BMI 16.0-16.9; at risk of undernutrition defined as BMI 17.0-18.5; normal BMI defined as BMI 18.5 – 24.9; overweight defined as BMI 25.0-29.9; obese defined as BMI $\geq$30.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that one subgroup is significantly different from the other.

3.5.9. Dietary diversity and supplement consumption or injection

Non-pregnant women consumed, on average, almost 5 food groups in the 24 hours prior to the interview. Over half of them met the criterion for minimum dietary diversity (Table 3-49).

Consumption of oral vitamin and mineral supplements was rather low in this group. Almost one fifth of women had ever been given a vitamin B12 injection, and of these women, about one third had received it in the 3 months preceding the survey.

Table 3-49. Measures of dietary diversity and consumption of vitamin supplements in non-pregnant women 15 - 49 years, settled population, Jordan

Characteristic	N	Mean or %[a]	95% CI[b]
Number of MDD-W[c] food groups consumed (mean)	845	4.89	(4.55, 5.22)
Meets minimum dietary diversity (5+ food groups)			
Yes	484	54.0%	(46.8, 61.1)
No	361	46.0%	(38.9, 53.2)
Consumed iron tablets or syrup in past three months			
Yes	117	15.1%	(11.7, 19.2)
No	726	84.9%	(80.8, 88.3)
Consumed folic acid tablets or syrup in past three months			
Yes	42	3.7%	(2.3, 5.9)
No	800	96.3%	(94.1, 97.7)
Consumed vitamin A tablets in past six months			
Yes	11	1.4%	(0.6, 3.3)
No	830	98.6%	(96.7, 99.4)
Consumed vitamin D tablets or syrup in past six months			
Yes	86	11.8%	(9.2, 15.1)
No	756	88.2%	(84.9, 90.8)
Consumed multivitamin tablets in past six months			
Yes	63	6.8%	(4.5, 10.1)
No	778	93.2%	(89.9, 95.5)
Ever had a vitamin B12 injection			
Yes	147	19.5%	(15.3, 24.5)
No	694	79.4%	(74.1, 83.9)
Of those who had B12 injection, when was it given			
< 1 month ago	9	3.2%	(1.1, 9.4)
1-3 months	32	26.5%	(17.0, 38.9)
4-11 months	15	12.5%	(6.2, 23.7)
12+ months	85	56.5%	(44.6, 67.7)

Note: The n’s are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.

[a] Means and percentages weighted for unequal probability of selection.

[b] CI=confidence interval calculated taking into account the complex sampling design.

[c] MDD-W = Minimum dietary diversity for women as recommended in FAO and FHI 360[(64)].

3.5.10. Physical activity and sleep

Non-pregnant women in the settled population spend on average more than 3.5 hours in front of a screen (TV, video or computer), but more than half of them report not watching TV while eating, with only one quarter having a TV in the bedroom (Table 3-50).

A quarter of women in this group meet the WHO recommended physical activity levels, but almost 60% of women have a metabolic equivalent time score of 0, indicating a sedentary lifestyle.

Table 3-50. Physical activity and sleep patterns in non-pregnant women 15-49 years of age, settled population, Jordan

Characteristic	n	% or mean[a]	95% CI[b]
Hours of television or video watching per day (mean)	841	1.68	(1.47, 1.89)
Hours of video or computer games per day (mean)	839	2.04	(1.76, 2.31)
Watch television while eating			
No or rarely	506	55.1%	(48.4, 61.6)
1 meal per day	184	24.0%	(20.6, 27.9)
2 meals per day	56	7.4%	(5.1, 10.6)
3 or more meals per day	70	9.8%	(6.1, 15.4)
Television or computer in bedroom			
Yes	211	22.6%	(18.0, 27.9)
No	634	77.4%	(72.1, 82.0)
Categories of MET's (minutes per week) [c]			
0	509	57.5%	(51.0, 63.9)
0.01-600	133	17.5%	(13.8, 21.9)
600+	179	25.0%	(19.9, 30.9)
Among women with non-0 METs, mean METs per week[c]	312	2269.8	(1461.6, 3078.0)
Meeting WHO recommendations on physical activity for health[c]			
Yes	179	25.0%	(19.9, 30.9)
No	642	75.0%	(69.1, 80.1)
Undertakes any vigorous physical activity			
Yes	62	12.6%	(8.3, 18.6)
No	773	87.4%	(81.4, 91.7)
Sedentary activities on average per day (mean), hours	748	3.46	(3.05, 3.88)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Means and percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] MET=Metabolic Equivalent of Task, as per [58].

3.5.11. Sun exposure

Close to 9 out of 10 women cover their head and arms all the time when going outside, but three quarters do not cover their hands (Table 3-51). This explains that, despite most women covering their head and arms, there are still many women with a sun exposure index above minimal exposure. Nonetheless, because the sun exposure index was calculated in the same way for preschool children and non-pregnant women, we can see that sun exposure is substantially lower in non-pregnant women then preschool children.

Table 3-51. Sun exposure in non-pregnant women 15-49 years of age, settled population, Jordan

Characteristic	n	%[a]	95% CI
Usually protect head from sun when outside			
Never/rarely	38	7.7%	(4.4, 13.1)
Sometimes	9	1.6%	(0.7, 3.8)
Most of the time	16	2.5%	(1.2, 5.2)
All the time	782	88.2%	(82.3, 92.4)
How usually protect head from sun			
Scarf/headcloth	807	100.0%	--
Usually cover arms when outside			
Never/rarely	19	5.0%	(2.3, 10.6)
Sometimes	10	1.7%	(0.7, 3.8)
Most of the time	34	5.8%	(3.5, 9.6)
All the time	782	87.5%	(81.3, 91.8)
Usually cover hands when outside			
Never/rarely	599	62.5%	(54.4, 70.0)
Sometimes	42	7.6%	(4.4, 12.9)
Most of the time	30	6.2%	(2.8, 13.4)
All the time	174	23.6%	(17.0, 31.8)
How much time per day spend under the sun			
None	60	10.0%	(7.0, 13.9)
1-29 minutes	201	27.7%	(23.5, 32.4)
30-59 minutes	206	26.8%	(22.2, 31.9)
1-<2 hours	209	24.8%	(19.4, 31.0)
More than 2 hours	167	10.8%	(7.9, 14.6)
Usually use sunscreen			
Never / rarely	690	79.3%	(74.3, 83.5)
Sometimes	45	8.6%	(6.0, 12.2)
Most of the time	34	3.5%	(2.0, 6.1)
All the time	76	8.6%	(6.2, 11.8)
Sun exposure index			
2.0+	188	18.3%	(13.6, 24.3)
0.5-1.99	240	28.5%	(23.9, 33.5)
0.01-0.49	145	18.0%	(13.1, 24.1)
0	270	35.3%	(28.2, 43.0)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.

[a] Means and percentages weighted for unequal probability of selection.

[b] CI=confidence interval calculated taking into account the complex sampling design.

3.5.12. Risk factors for anemia and iron deficiency

Most anemia in non-pregnant women can be ascribed to iron deficiency. This is further illustrated in the Venn diagram shown in Figure 3-22 as well as in Table 3-52, where the results of the bivariate analysis for certain risk factors are shown: iron deficient women are more than 5 times more likely to be anemic than their iron replete peers. Of the other factors investigated, only inflammation was a significant risk factor for anemia. Inadequate sanitation was a risk factor for iron deficiency. However, the number of households without inadequate sanitation is very small, so inadequate sanitation may not be a major determinant of iron deficiency in the population. Supplement consumption was not associated with anemia or iron deficiency.

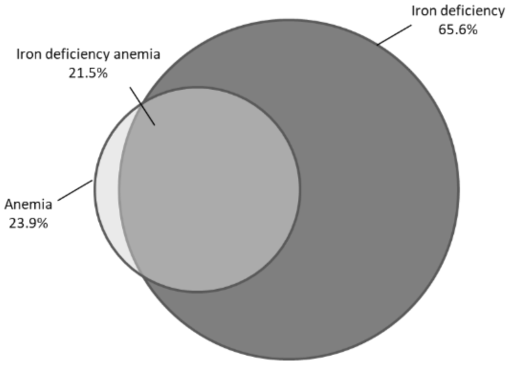

Figure 3-22. Venn diagram showing overlap between anemia and iron deficiency in non-pregnant women, settled population, Jordan

Table 3-52. Correlation between various factors and anemia and iron deficiency in non-pregnant women 15-49 years of age, settled population, Jordan

Characteristic	n	% [a] anemic	p value [b]	% [a] ID	p value [b]
Woman's household has adequate sanitation					
Yes	682	23.7%	0.210	18.9%	0.000
No	9	0.0%		66.3%	
Woman is overweight or obese					
Yes	411	27.7%	0.105	64.2%	0.405
No	272	18.0%		68.3%	
Woman has inflammation					
Yes	242	30.2%	0.040	62.3%	0.357
No	447	19.8%		67.6%	
Woman is iron deficient					
Yes	450	33.0%	0.000		
No	239	5.8%			
Woman is vitamin A deficient					
Yes	16	23.3%	0.979	55.1%	0.539
No	673	23.7%		65.9%	
Woman is vitamin D deficient or insufficient					
Yes	568	25.8%	0.209	66.8%	0.505
No	106	17.3%		61.9%	
Woman is folate deficient					
Yes	120	29.8%	0.228	60.1%	0.339
No	549	23.2%		67.5%	
Woman is vitamin B12 deficient					
Yes	121	24.1%	0.992	73.5%	0.150
No	548	24.1%		64.8%	
Consumed iron tablets or syrup in past three months					
Yes	98	24.4%	0.928	65.8%	0.978
No	595	23.7%		65.5%	
Consumed multivitamins in past six months					
Yes	49	19.5%	0.593	60.2%	0.510
No	642	24.2%		66.1%	

Note: The n's are un-weighted numbers (denominator) in each subgroup; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] P-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the others.

3.5.13. Risk factors for overweight and obesity

An analysis for risk factors for overweight and obesity is shown below in Table 3-53. None of the factors investigated were significantly associated with overweight or obesity in non-pregnant women of the settled population.

Table 3-53. Correlation between various factors and overweight and obesity in non-pregnant women 15-49 years of age, settled population, Jordan

Characteristic	N	% [a] overweight or obese	p value [b]
Average hours per day watching video or playing computer games			
>2 hours	483	57.1%	0.124
≤ 2 hours	304	64.3%	
Ever watch television while eating			
Yes	292	59.9%	0.698
No	476	57.8%	
Average hours per day sitting			
>4 hours	193	53.5%	0.084
≤ 4 hours	512	63.8%	
Meeting WHO recommendations on physical activity for health [c]			
Yes	175	61.9%	0.608
No	599	58.5%	

Note: The n's are un-weighted numbers (denominator) in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Percentages weighted for unequal probability of selection.
[b] P-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.
[c] As per [58].

3.5.14. Correlation between sun exposure and vitamin D deficiency

Sun exposure in non-pregnant women in the settled population is not significantly associated with vitamin D deficiency or insufficiency (Table 3-54).

Table 3-54. Association between sun exposure and vitamin D deficiency in non-pregnant women 15-49 years of age, settled population, Jordan

Characteristic	N	% [a] VDD	% [a] VD insufficient	p value [b]	% [a] VDD or insufficient	p value [b]
Sun exposure index						
>2.0	145	74.3%	17.7%	0.170	92.0%	0.061
0.5-1.99	112	67.3%	15.5%		17.2%	
0.01-0.49	223	53.4%	15.8%		30.8%	
0	673	58.6%	21.1%		20.3%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.
[c] Analyses for this variable only include 25% of the households, as bread samples were only collected in a sub-sample.

3.6. Pregnant women (settled population)

3.6.1. Characteristics

Pregnant women enrolled in the survey sample were largely 20-39 years of age (Table 3-55). As with other target groups, the majority of pregnant women reside in urban dwellings. The Northern stratum has more pregnant women than the other strata. The educational level pregnant women was roughly similar to that of non-pregnant women. Fewer women are in their first trimester than in the second and third, and most had been pregnant and given birth before.

Table 3-55. Description of pregnant women, settled population, Jordan

Characteristic	n	% [a]	95% CI[b]
Age (in years)			
15-19	8	3.4%	(1.6, 7.0)
20-29	37	56.3%	(34.7, 75.8)
30-39	37	38.7%	(19.8, 61.7)
40+	4	1.7%	(0.6, 4.8)
Residence			
Urban	71	90.4%	(76.4, 96.5)
Rural	15	9.6%	(3.5, 23.6)
Stratum			
Central	17	19.8%	(10.9, 33.3)
Northern	40	46.5%	(32.2, 61.5)
Southern	29	33.7%	(21.8, 48.2)
Wealth Quintile			
Poorest	22	15.8%	(7.7, 29.5)
Second	24	26.5%	(14.6, 43.1)
Middle	16	25.1%	(13.7, 41.4)
Fourth	16	21.6%	(11.3, 37.4)
Wealthiest	8	11.0%	(3.6, 29.3)
Woman's education			
Elementary	18	18.7%	(10.4, 31.1)
Secondary	36	52.3%	(38.1, 66.1)
Higher	32	29.1%	(16.8, 45.4)
Trimester of pregnancy			
1	20	21.7%	(11.6, 36.9)
2	31	31.2%	(18.9, 46.9)
3	35	47.1%	(31.2, 63.6)
Number of times given birth			
0	14	17.4%	(7.1, 36.6)
1-2	33	40.5%	(24.0, 59.5)
3-4	23	31.8%	(16.9, 51.6)
5-6	10	8.4%	(3.4, 19.4)
7+	5	1.9%	(0.7, 5.0)

Note: The n's are un-weighted numerators for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval calculated taking into account the complex sampling design.

3.6.2. Anemia

Anemia was prevalent in less than 20% of pregnant women, which is lower than the prevalence among non-pregnant women (Table 3-56). Due to the relatively small sample size, large confidence intervals accompany the point estimates and as such, not many demographic factors appear as significant modifiers. However, pregnant women in the Southern stratum are much more likely to be anemic than women in the other strata. Women in the third trimester are much likely to be anemic than those in the earlier pregnancy stages.

Table 3-56. Prevalence of anemia in pregnant women, by various demographic characteristics, settled population, Jordan

Characteristic	N	% anemia [a, b]	95% CI [c]	p-value [d]
TOTAL	72	19.1%	(8.5, 37.5)	
Age (in years)				
15-19	7	34.4%	(8.9, 73.9)	0.316
20-29	31	24.7%	(8.2, 54.4)	
30-39	30	10.1%	(3.3, 26.9)	
40+	4	28.1%	(5.2, 73.4)	
Residence				
Urban	59	20.4%	(8.7, 40.7)	0.235
Rural	13	8.1%	(1.9, 29.0)	
Stratum				
Central	15	13.3%	(3.0, 43.1)	0.014
Northern	34	26.5%	(14.2, 44.0)	
Southern	23	56.5%	(37.0, 74.2)	
Trimester of pregnancy				
1	16	7.6%	(1.7, 28.6)	0.010
2	24	6.6%	(2.2, 18.2)	
3	32	32.0%	(12.7, 60.2)	

Note: The n's are un-weighted numbers (denominator) in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Anemia defined as hemoglobin < 110 g/L adjusted for altitude.
[b] Percentages weighted for unequal probability of selection.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

The distribution of hemoglobin concentrations in pregnant women is seen in Figure 3-23. The mean hemoglobin concentration among all settled pregnant women was 117.1 g/L (95% CI: 114.2, 120.1). The majority of anemic cases are classified as mildly anemic, with no cases of severe anemia (Table 3-57).

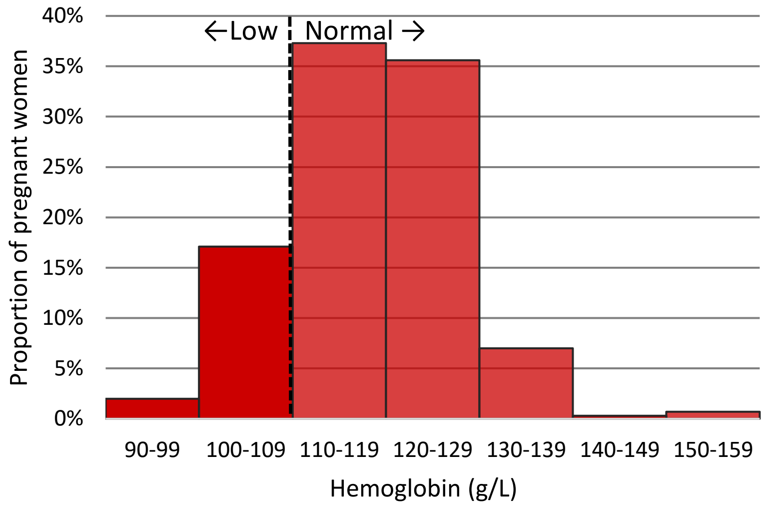

Figure 3-23. Distribution of hemoglobin (g/L) in pregnant women, settled population, Jordan

Table 3-57. Severity of anemia in pregnant women, by various demographic characteristics, settled population, Jordan

Characteristic	Mild anemia [b]			Moderate anemia [b]			Severe anemia [b]		
	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]
TOTAL	18	17.1	(7.0, 36.1)	6	2.0	(0.8, 4.9)	-	-	-
Age (in years)									
15-19	3	34.4	(8.8, 74.1)	0	0.0	--	-	-	-
20-29	7	22.4	(6.8, 53.3)	3	2.3	(0.6, 8.4)	-	-	-
30-39	6	8.1	(2.3, 24.7)	3	2.0	(0.5, 7.1)	-	-	-
40+	2	28.1	(5.2, 73.4)	0	0.0	--	-	-	-
Residence									
Urban	18	19.0	(7.7, 39.8)	3	1.4	(0.4, 4.9)	-	-	-
Rural	0	0.0	-	3	8.1	(1.9, 29.0)	-	-	-
Stratum									
Central	2	13.3	(2.8, 44.7)	0	0.0	--	-	-	-
Northern	8	23.5	(11.6, 42.0)	1	2.9	(0.4, 19.2)	-	-	-
Southern	8	34.8	(19.0, 54.9)	5	21.7	(10.5, 39.6)	-	-	-
Trimester of pregnancy									
1	1	3.8	(0.4, 26.1)	1	3.8	(0.5, 24.6)	-	-	-
2	4	5.8	(1.8, 17.5)	1	0.8	(0.1, 6.2)	-	-	-
3	13	29.7	(11.1, 58.9)	4	2.2	(0.9, 5.7)	-	-	-

Note: The n's are the numerators for a specific sub-group.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection among strata.
[b] Mild, moderate, and severe anemia defined as hemoglobin 100-109 g/L, 70-99 g/L, and <70 g/L, respectively.
[c] CI=confidence interval calculated taking into account the complex sampling design.

3.6.4. Underweight

No pregnant women were underweight as measured by MUAC. As such, no further analyses were undertaken.

3.6.5. Dietary diversity and consumption of vitamins and supplements

Over two thirds of pregnant women consumed a diet that meets minimum diversity, and 6 out of 10 pregnant women have consumed iron and folic acid supplements in the three months preceding the survey (Table 3-58). About a quarter have consumed vitamin D or multivitamin supplements in the past six months. A small proportion of pregnant women had ever had a vitamin B12 injection, but no woman received it within 3 months preceding the survey.

Table 3-58. Dietary diversity and supplement consumption in pregnant women, settled population, Jordan

Characteristic	N	Mean or %[a]	95% CI [b]
Number of MDD-W [c] food groups consumed (mean)	86	5.45	(4.87, 6.03)
Meets minimum dietary diversity (MDD-W, 5+ food groups)			
Yes	60	69.6%	(48.7, 84.7)
No	26	30.4%	(15.3, 51.3)
Consumed iron tablets or syrup in past three months			
Yes	58	56.9%	(39.6, 72.6)
No	27	43.1%	(27.4, 60.4)
Consumed folic acid tablets or syrup in past three months			
Yes	57	60.9%	(45.2, 74.6)
No	29	39.1%	(25.4, 54.8)
Consumed vitamin A tablets in past six months			
Yes	4	5.2%	(1.0, 22.0)
No	81	94.8%	(78.0, 99.0)
Consumed vitamin D tablets or syrup in past six months			
Yes	21	25.7%	(11.6, 47.8)
No	64	74.3%	(52.2, 88.4)
Consumed multivitamin tablets in past six months			
Yes	25	29.2%	(14.4, 50.5)
No	60	70.8%	(49.5, 85.6)
Ever had a vitamin B12 injection			
Yes	11	15.2%	(6.4, 32.0)
No	74	84.8%	(86.0, 93.6)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.

[a] Means and percentages weighted for unequal probability of selection.

[b] CI=confidence interval calculated taking into account the complex sampling design.

[c] MDD-W = Minimum dietary diversity for women as recommended in FAO and FHI 360[64].

4. RESULTS: SYRIAN REFUGEES RESIDING IN CAMPS

4.1. Response rates for households, PSC, SAC, and women

Figure 4-1 provides an overview of the response rates for the different population segments residing in Syrian refugee camps. Overall, the response rates were satisfactory in this stratum. From Table 8-2 in Appendix 1 provides a camp-specific breakdown by camp and shows similar response rates.

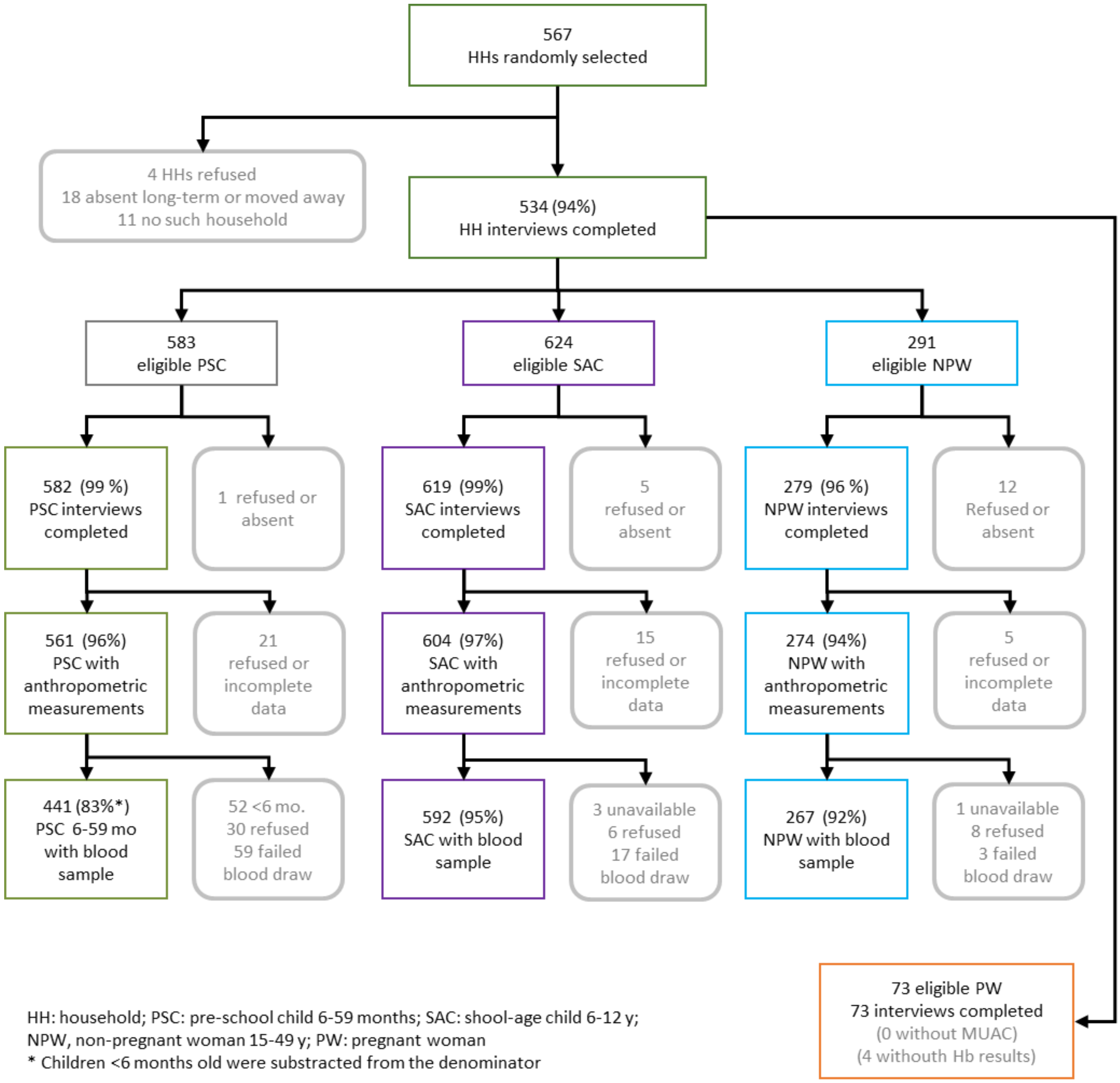

Figure 4-1. **Response rates at the household and individual level, Syrian camp refugees**

4.2. Household characteristics (Syrian camp refugees)

4.2.1. Demographic characteristics

In Table 4-1, the population distribution of the Syrian camp refugee population is shown. Within camps, the sizes of the camps are reflecting the proportions of respondents.

The characteristics of participating households from the Syrian refugee camp population in the JNMNS 2019 are summarized in Table 4-1 below. In total 534 households were included. Two-thirds of the household heads had elementary education and only about one quarter of the households' heads had secondary or higher education. More than half of the households had one woman of reproductive age living in the household, about 40% no child currently aged 0-59 months, and about 40% had no school-age child 6-12 years old. The vast majority of households had a monthly average household income of less than 200 Jordanian dinar (JOD).

Table 4-1. Demographic characteristics of households, Syrian camp refugees

Characteristic	Number of households	Percent or mean [a]	95% CI [b]
Camp of residence			
Mrajeeb Al Fhood	30	5.6%	(1.3, 20.9)
Azraq	123	23.0%	(12.3, 38.9)
Zaatari	381	71.3%	(54.9, 83.6)
Number of household members (mean)	534	5.4	(5.2, 5.7)
Households with given number of non-pregnant women 15-49 years of age			
0	114	21.3%	(17.4, 26.0)
1	316	59.2%	(55.0, 63.2)
2	82	15.4%	(12.0, 19.4)
3+	22	4.1%	(2.6, 6.4)
Households with given number of children 0-59 months of age			
0	205	38.7%	(35.2, 42.2)
1	131	24.7%	(21.3, 28.5)
2	136	25.7%	(22.0, 29.6)
3+	58	10.9%	(8.2, 14.5)
Households with given number of children 6-12 years of age			
0	230	43.4%	(38.3, 48.6)
1	100	18.9%	(16.0, 22.1)
2	118	22.3%	(18.6, 26.5)
3+	82	15.5%	(12.3, 19.2)
Highest level of school attended by household head			
None	75	14.0%	(9.6, 20.1)
Elementary	353	66.1%	(60.8, 71.1)
Secondary	61	11.4%	(8.6, 15.0)
Higher	45	8.4%	(6.2, 11.4)
Average monthly household's earning			
<200 JOD	484	91.0%	(85.4, 94.6)
200-600 JOD	48	9.0%	(5.4, 14.6)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages and means are weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.

4.2.2. Water and sanitation

As shown in Table 4-2 almost all surveyed households used natural gas for cooking. All households had access to a safe water source and consequently drink safe water. Similarly, the vast majority of households had adequate sanitation and almost every household had a handwashing place with soap and water.

Table 4-2. Indicators of household cooking fuel, water and sanitation, Syrian camp refugees

Characteristic	Number of households	Percent [a]	95% CI [b]
Cooking fuel used			
Natural gas	532	99.6	(98.5, 99.9)
Kerosene	1	0.2	(0.0, 1.4)
No food cooked	1	0.2	(0.0, 1.4)
Water source			
Piped into housing unit	269	50.4%	(40.2, 60.5)
Piped to yard/plot	140	26.2%	(17.8, 36.8)
Rainwater	1	0.2%	(0.0, 1.4)
Bottled water	73	13.7%	(10.3, 17.9)
Water filter	51	9.6%	(6.2, 14.5)
Drink safe water [d]			
Yes	534	100.0%	(100.0, 100.0)
No	0	--	--
Type of sanitation facility			
Flush to piped sewer system	219	41.1%	(32.9, 49.8)
Flush to pit latrine	314	58.9%	(50.2, 67.1)
Share sanitation facility with another household			
Yes	60	11.4%	(6.2, 20.1)
No	465	88.6%	(79.9, 93.8)
Adequate sanitation [d]			
Yes	473	88.7%	(80.3, 93.9)
No	60	11.3%	(6.1, 19.7)
Water and soap at handwashing place			
Yes	481	98.0%	(95.0, 99.2)
No	10	2.0%	(0.8, 5.0)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages and means are weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Composite variable of main source of drinking water and treating water to make safe for drinking; a safe water source was considered to be: Piped into housing unit, piped to yard/plot, rainwater, tanker truck, bottled water, water filter[(59)].
[d] Composite variable of toilet type and if toilet facilities are shared with non-household members; Adequate Sanitation = flush toilet to piped sewer system, flush toilet to latrine, pit latrine with slab not shared with another household.

4.2.3. Bread consumption

Almost all households consumed Komaji type bread. The daily mean purchase per AME was 570g.

Table 4-3. Bread and wheat flour purchasing variables of households, Syrian camp refugees

Characteristic	Number of households	Percent or mean [a]	95% CI [b]
Type of bread usually purchased			
Komaji/Arabic	532	99.6%	(98.4, 99.9)
Tabon	1	0.2%	(0.0, 1.4)
Masrooh	1	0.2%	(0.0, 1.4)
Amount of bread purchased (or baked) per AME per day (mean grams) [c]			
Komaji/Arabic	525	570	(0.45, 0.70)

Note: The n's are un-weighted numerators for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages and means are weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Among only those households reporting purchase of that type of bread; Tabon and Masrooh not calculated due to very small numbers.

4.3. Pre-school children (Syrian camp refugees)

4.3.1. Characteristics

Table 4-4 describes the demographic characteristics of the pre-school children in Syrian refugee camps who participated in the JNMNS 2019. There are more boys than girls, and the age group 12 – 23 months is disproportionately large.

Table 4-4. Description of sampled pre-school age children (0 - 59 months), Syrian camp refugees

Characteristic	n	% [a]	95% CI [b]
Age Group (in months)			
0-5	52	9.0%	(6.8, 11.7)
6-11	64	11.0%	(8.9, 13.6)
12-23	141	24.3%	(21.6, 27.1)
24-35	105	18.1%	(15.4, 21.0)
36-47	105	18.1%	(15.6, 20.8)
48-59	114	19.6%	(16.9, 22.6)
Sex			
Male	315	54.1%	(50.5, 57.7)
Female	267	45.9%	(42.3, 49.5)
Camp			
Mrajeeb Al Fhood	24	4.1%	(0.9, 16.6)
Azraq	126	21.6%	(11.3, 37.5)
Zaatari	432	74.2%	(58.0, 85.7)

Note: The n's are un-weighted numbers in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.

4.3.2. Bread consumption and iron intake from bread

Children 12-59 months residing in the Syrian refugee camps consumed just over 150 g bread per day, with statistically significant differences across wealth quintile but no clear trend pattern(Table 4-5). Almost 100% of the recommended nutrient intake for iron in children in this age group came from bread. Since total iron content of bread was measured, the iron from bread includes both intrinsic and fortification iron.

Table 4-5. Mean daily bread intake and iron intake from bread, as well as estimated %RNI for children 12-59 months of age, by various factors, Syrian camp refugees

Characteristic	Median daily bread intake (g); n=458 [a]	P value [b]	Median % RNI of iron for children 12-59 months; n=113 [a, c]	P value [b]
Total	154.4		99.0%	
Wealth Quintile				
Lowest	161.6	0.022	107.1%	0.017
Second	182.1		86.7%	
Middle	140.9		72.8%	
Fourth	123.9		170.7%	
Highest	169.0		77.6%	
Breastfed in past 24 hours				
Yes	123.2	0.853	49.1%	0.259
No	125.3		88.1%	

[a] Medians and percentages weighted for unequal probability of selection.
[b] P-values are calculated using non-parametric median test; p-value <0.05 indicates that the median in at least one subgroup is statistically significantly different from the values in the other subgroups.
[c] The recommended nutrient intake iron in women is as follows (assuming 12% bioavailability): 12-35 months: 4.8 mg/d; 36-59 months: 5.3 mg/d [(60)]; note that bread was collected only in a sub-sample of households.

4.3.3. Anemia, iron deficiency, and iron deficiency anemia

About 25% of children less than 5 years old were anemic (Table 4-6). Only 0.2% (95%CI: 0.0, 1.8) had severe anemia, with 6.1% (95%CI: 4.3, 8.8) being moderately anemic. According to WHO, anemia in pre-school children living in Syrian refugee camps is to be considered a moderate public health problem[42].

The highest anemia prevalence occurred in children 6-23 months of age and male children were considerably more vulnerable to anemia than were female children. Other variables, such as residence, camp and wealth quintile were not associated with anemia with statistical significance. The distribution of hemoglobin values for children is shown in Figure 4-2. It is roughly symmetric with the majority of values above the cut-off point of 110 g/L. The mean hemoglobin concentration among all Syrian refugee children 6-59 months old was 115.3 g/L (95%CI: 114.2, 116.5).

Iron deficiency was present in almost 40% of Syrian refugee pre-school children. Its prevalence peaked in children 12-36 months of age and was more common in males than females. There were no differences among the two large camps or between children in poorer and wealthier households.

Among anemic preschool children in refugee camps, the prevalence of iron deficiency was 60.2% (95% CI: 50.2, 69.4, n=103), which is higher compared to the Jordanian population. Similar to anemia and iron deficiency, iron deficiency anemia prevalence significantly differed between the different age groups and significantly more male children were affected compared to female children. No statistically significant differences between the two larger camps or wealth quintiles were found.

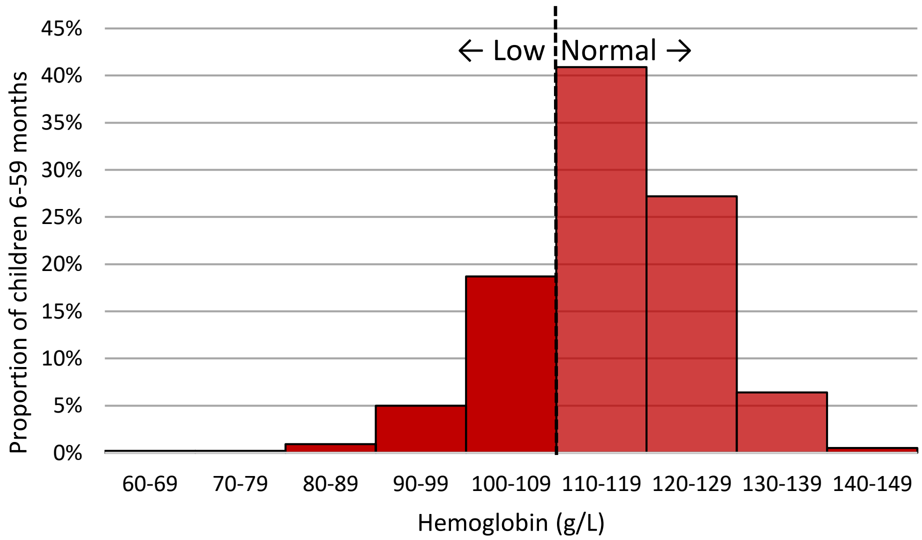

Figure 4-2. Distribution of hemoglobin (g/L) in children 6-59 months, Syrian refugees

Table 4-6. Prevalence of anemia, iron deficiency, and iron deficiency anemia in children 6-59 months, by various demographic characteristics, Syrian camp refugees

Characteristic	Anemia [bb]				Iron deficiency [e]				Iron deficiency anemia [f]			
	N	% [a]	95% CI [c]	p-value [d]	N	% [a]	95% CI [c]	p-value [d]	N	% [a]	95% CI [c]	p-value [d]
TOTAL	441	25.2%	(20.6, 30.4)		424	36.3%	(31.5, 41.4)		434	14.3%	(11.1, 18.3)	
Age (in months)												
6-11	45	37.8%	(22.6, 55.8)	0.000	44	34.1%	(21.8, 48.9)	0.000	44	18.2%	(8.9, 33.5)	0.000
12-23	113	43.4%	(34.8, 52.3)		106	51.9%	(44.3, 59.4)		109	25.7%	(19.0, 33.8)	
24-35	83	30.1%	(20.6, 41.8)		79	40.5%	(30.3, 51.6)		82	20.7%	(12.9, 31.5)	
36-47	95	14.7%	(8.2, 25.1)		91	34.1%	(24.5, 45.1)		94	6.4%	(3.0, 12.9)	
48-59	105	5.7%	(2.6, 12.2)		104	20.2%	(12.6, 30.7)		105	2.9%	(0.9, 8.6)	
Sex												
Male	242	31.8%	(25.3, 39.2)	0.000	233	42.1%	(35.4, 49.0)	0.012	238	19.3%	(14.5, 25.4)	0.006
Female	199	17.1%	(12.6, 22.7)		191	29.3%	(22.9, 36.7)		196	8.2%	(4.6, 14.0)	
Camp [g]												
Azraq	97	30.9%	(24.0, 38.8)	0.117	94	31.9%	(21.6, 44.4)	0.348	95	14.7%	(9.8, 21.5)	0.842
Zaatari	326	23.3%	(17.7, 30.0)		312	38.1%	(32.6, 44.0)		321	14.0%	(10.1, 19.1)	
Wealth quintile												
Poorest	80	21.3%	(14.1, 30.8)	0.419	79	22.8%	(13.2, 36.4)	0.082	79	10.1%	(5.3, 18.5)	0.443
Second	78	26.9%	(16.5, 40.6)		73	35.6%	(25.2, 47.6)		76	13.2%	(7.0, 23.5)	
Middle	99	20.2%	(13.7, 28.8)		96	36.5%	(28.4, 45.3)		99	12.1%	(7.0, 20.3)	
Fourth	88	30.7%	(20.8, 42.7)		84	40.5%	(32.1, 49.5)		87	17.2%	(10.3, 27.5)	
Wealthiest	96	27.1%	(19.9, 35.7)		92	44.6%	(31.7, 58.2)		93	18.3%	(12.3, 26.3)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Anemia defined as hemoglobin < 110 g/L adjusted for altitude.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Iron deficiency defined as inflammation-adjusted serum ferritin < 12 μg/l.

[f] Iron deficiency anemia defined as inflammation-adjusted serum ferritin < 12.0 μg/L and hemoglobin < 110 g/L.

[g] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

Table 4-7. Severity of anemia in children 6-59 months, by various demographic characteristics, Syrian camp refugees

Characteristic	Mild anemia [b]			Moderate anemia [b]			Severe anemia [b]		
	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]
TOTAL	82	18.6	(14.7, 23.3)	28	6.3	(4.5, 9.0)	1	0.2	(0.0, 1.7)
Age (in months)									
6-11	12	26.7	(14.5, 43.8)	5	11.1	(3.9, 27.6)	0	0.0	-
12-23	37	32.7	(26.3, 39.9)	12	10.6	(5.8, 18.6)	0	0.0	-
24-35	15	18.1	(11.3, 27.6)	9	10.8	(5.6, 20.1)	1	1.2	(0.2, 9.0)
36-47	13	13.7	(7.3, 24.1)	1	1.1	(0.1, 7.6)	0	0.0	-
48-59	5	4.8	(1.9, 11.2)	1	1.0	(0.1, 6.7)	0	0.0	-
Sex									
Male	59	24.4	(18.8, 30.9)	18	7.4	(5.2, 10.6)	0	0.0	-
Female	23	11.6	(7.8, 16.7)	10	5.0	(2.7, 9.2)	1	0.5	(0.1, 3.7)
Camp[d]									
Azraq	19	19.6	(13.2, 28.1)	10	10.3	(5.7, 18.1)	1	1.0	(0.1, 7.4)
Zaatari	60	18.4	(13.6, 24.4)	16	4.9	(3.2, 7.5)	0	0.0	-
Wealth quintile									
Poorest	20	12.3	(6.9, 21.0)	10	6.3	(2.7, 14.1)	-	-	-
Second	9	9.6	(4.7, 18.6)	3	3.3	(0.7, 15.4)	-	-	-
Middle	5	5.1	(2.2, 11.5)	0	0	-	-	-	-
Fourth	6	5.1	(1.4, 16.5)	0	0	-	-	-	-
Wealthiest	4	19.6	(7.7, 41.6)	0	0	-	-	-	-

Note: The n's are the numerators for a specific sub-group.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among strata.

[b] Mild, moderate, and severe anemia defined as hemoglobin 100-109 g/L, 70-99 g/L, and <70 g/L, respectively.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.3.4. Vitamin A deficiency

Based on serum retinol, about 9% of pre-school children in Syrian camps had vitamin A deficiency (Table 4-8); based on retinol binding protein, this proportion was more than 50% lower. WHO classifies vitamin A deficiency as a mild public health problem with a prevalence of 2-9%, as a moderate problem with a prevalence 10-19%, and a severe problem with a prevalence of 20% or more. According to this classification, vitamin A deficiency denotes a mild public health problem in children when using either indicator [(33)]. For both indicators, child's sex, residence, camp or the wealth of the household the child was living in were not predictors of vitamin A deficiency.

Table 4-8. Prevalence of vitamin A deficiency in children 6-59 months, by various demographic characteristics, Syrian camp refugees

	Based on serum retinol				Based on retinol-binding protein			
Characteristic	**N**	**% VAD [a,b]**	**95% CI [c]**	**p-value [d]**	**N**	**% VAD [a,b]**	**95% CI [c]**	**p-value [d]**
TOTAL	380	8.9%	(6.1, 12.9)		424	3.5%	(2.2, 5.6)	
Age (in months)								
6-11	34	8.8%	(2.7, 25.3)	0.012	44	2.3%	(0.3, 14.7)	0.935
12-23	89	15.7%	(9.3, 25.4)		106	4.7%	(2.0, 10.6)	
24-35	71	11.3%	(5.8, 20.8)		79	3.8%	(1.2, 11.3)	
36-47	86	9.3%	(4.6, 17.9)		91	3.3%	(1.1, 9.6)	
48-59	100	1.0%	(0.1, 7.1)		104	2.9%	(0.9, 8.9)	
Sex								
Male	211	10.9%	(7.3, 15.9)	0.173	233	4.3%	(2.4, 7.5)	0.328
Female	169	6.5%	(3.1, 13.0)		191	2.6%	(1.1, 6.0)	
Camp [e]								
Azraq	90	8.9%	(4.8, 16.0)	0.955	94	5.3%	(2.1, 12.7)	0.330
Zaatari	276	8.7%	(5.3, 13.8)		312	3.2%	(1.9, 5.4)	
Wealth quintile								
Poorest	72	12.5%	(6.4, 23.1)	0.768	79	7.6%	(3.5, 15.6)	0.179
Second	66	9.1%	(4.1, 18.8)		73	4.1%	(1.6, 10.2)	
Middle	86	8.1%	(3.8, 16.6)		96	2.1%	(0.5, 8.7)	
Fourth	74	9.5%	(3.1, 25.7)		84	3.6%	(1.2, 9.8)	
Wealthiest	82	6.1%	(2.5, 14.0)		92	1.1%	(0.1, 8.0)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages and means are weighted for unequal probability of selection.

[b] VAD = Vitamin A deficiency was defined either as serum retinol ≤0.7 µmol/L or as RBP adjusted for inflammation ≤0.7 µmol/L; RBP was adjusted for inflammation based on BRINDA[(46)].

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

The distribution of RBP and serum retinol values for Syrian refugee children is shown in Figure 4-3. The majority of values for both indicators are above the cut-off (>0.7 µmol/L).

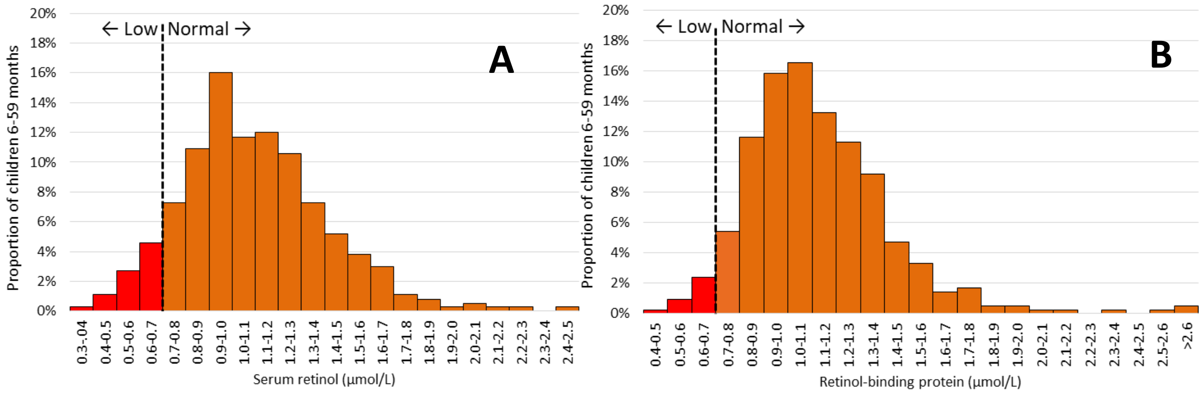

Figure 4-3. Distribution of serum retinol (A) and inflammation-adjusted RBP (B) in children 6-59 months, Syrian camp refugees

Mean serum retinol concentration in this group was 1.09 µmol/L (95%CI: 1.06, 1.16), and the mean inflammation-adjusted retinol binding protein concentration was 1.12 µmol/L (95%CI: 1.09, 1.16).

4.3.5. Vitamin D deficiency and insufficiency

The prevalence of vitamin D deficiency and insufficiency in Syrian refugee children under 5 years of age was about 10% and 46%, respectively (Table 4-9). The prevalence of vitamin D deficiency is highest in children 6-11 months and decreases thereafter, while insufficiency is relatively age independent. Further, both deficiency and insufficiency were found more frequently in females. The difference between the two larger camps was not significant, although children in Zaatari tended to be more affected by sub-optimal vitamin D status. There were also differences by wealth quintiles but without a clear trend.

The geometric mean vitamin D concentration was 20.3 ng/mL (95%CI: 19.3, 21.3).

Table 4-9. Prevalence of vitamin D deficiency and insufficiency in children 6-59 months of age, by various demographic characteristics, Syrian camp refugees

		Deficient [a]		Insufficient [a]			Deficient or insufficient		
Characteristic	**N**	**% [b]**	**95% CI [c]**	**% [b]**	**95% CI [c]**	**p-value [d]**	**% [b]**	**95% CI [c]**	**p-value [d]**
TOTAL	390	9.7%	(7.0, 13.3)	36.7%	(31.5, 42.1)		46.4%	(41.0, 51.9)	
Age (in months)									
6-11	35	34.3%	(20.5, 51.4)	37.1%	(23.3, 53.5)	0.002	71.4%	(51.2, 85.6)	0.043
12-23	95	7.4%	(3.3, 15.6)	30.5%	(21.5, 41.4)		37.9%	(27.4, 49.6)	
24-35	74	8.1%	(4.0, 15.6)	40.5%	(28.8, 53.5)		48.6%	(38.0, 59.4)	
36-47	86	4.7%	(1.4, 14.7)	40.7%	(31.2, 51.0)		45.3%	(34.4, 56.8)	
48-59	100	9.0%	(4.0, 18.9)	36.0%	(25.9, 47.5)		45.0%	(34.5, 56.0)	
Sex									
Male	214	8.9%	(5.6, 13.9)	29.4%	(23.2, 36.6)	0.003	38.3%	(31.6, 45.5)	0.002
Female	176	10.8%	(7.1, 16.1)	45.5%	(37.6, 53.6)		56.3%	(48.1, 64.1)	
Camp [e]									
Azraq	90	5.6%	(3.1, 9.9)	32.2%	(21.8, 44.8)	0.068	37.8%	(26.6, 50.4)	0.066
Zaatari	285	11.6%	(8.0, 16.4)	39.3%	(33.3, 45.6)		50.9%	(44.4, 57.3)	
Wealth quintile									
Poorest	74	9.5%	(4.6, 18.4)	25.7%	(18.0, 35.3)	0.039	35.1%	(24.9, 46.9)	0.081
Second	67	9.0%	(4.8, 16.0)	32.8%	(24.0, 43.0)		41.8%	(31.6, 52.7)	
Middle	87	13.8%	(7.7, 23.6)	43.7%	(31.9, 56.2)		57.5%	(45.9, 68.3)	
Fourth	78	14.1%	(7.5, 24.8)	37.2%	(25.6, 50.4)		51.3%	(37.6, 64.8)	
Wealthiest	84	2.4%	(0.7, 7.9)	41.7%	(31.1, 53.1)		44.0%	(32.6, 56.1)	

Note: The n's are un-weighted numbers (denominators) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Deficient <12 ng/mL; Insufficient 12.1-19.9 ng/mL.
[b] Percentages weighted for unequal probability of selection.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.
[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.3.6. Zinc deficiency

Zinc deficiency in Syrian refugee pre-school children was slightly over 10% (Table 4-10). No significant differences in zinc deficiency were found by age group, between male and female children, between children living in the different camps and children living in poorer and wealthier households.

Mean serum zinc concentration among these children was 74.3 µg/dL (95% CI: 72.4, 76.3).

Table 4-10. Prevalence of zinc deficiency in children 6-59 months, by various demographic characteristics, Syrian camp refugees

Characteristic	N	% [a, b]	95% CI [c]	p-value [d]
TOTAL	347	12.7%	(8.9, 17.7)	
Age (in months)				
6-11	30	13.3%	(5.7, 28.2)	0.730
12-23	78	15.4%	(8.4, 26.6)	
24-35	66	12.1%	(6.2, 22.4)	
36-47	77	14.3%	(7.9, 24.5)	
48-59	96	9.4%	(4.6, 18.0)	
Sex				
Male	196	13.8%	(8.9, 20.7)	0.584
Female	151	11.3%	(6.1, 20.0)	
Camp [e]				
Azraq	81	7.4%	(3.6, 14.6)	0.098
Zaatari	253	14.2%	(9.5, 20.8)	
Wealth quintile				
Poorest	67	13.4%	(6.4, 26.0)	0.906
Second	62	11.3%	(6.4, 19.2)	
Middle	81	14.8%	(8.4, 24.9)	
Fourth	69	13.0%	(6.4, 24.7)	
Wealthiest	68	10.3%	(4.6, 21.6)	

Note: The n's are un-weighted numbers (denominators) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Zinc deficiency, defined as follows: morning non-fasting: <65 µg/dL, afternoon non-fasting: <57 µg/dL
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.
[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.3.7. Sickle cell, α- and β-thalassemia

Of the 441 pre-school children from the Syrian camps with complete blood count, 1.4% (95% CI: 0.5, 3.8) displayed sickle cell mutations, 3.2% (95% CI: 1.7, 5.8) were carriers of at least one α-thalassemia gene, while 2.3% (95% CI: 1.0, 4.9) carried at least one β-thalassemia gene.

Due to the low number with affected children, no further sub-group analyses were conducted.

4.3.8. Birthweight, recent morbidity and current inflammation

Table 4-11 below shows various health indicators for the camp children less than 5 years of age included in the survey sample. About half of the caretakers reported birthweight from an official document and the other half reported the birth weight from recall. Almost every sixth child was reported to have low birthweight. Also, various forms of recent morbidity was relatively common. More than every tenth child had diarrhea, one-third of children had fever and every fifth child had lower respiratory infection (LRI) two weeks prior to the survey. Almost 60% of the children had no elevated inflammatory markers at the time of the survey, and only a small proportion had an early-stage inflammation. The largest proportion of children with any inflammation were in the late convalescence stage of the inflammatory response.

Table 4-11. Health indicators in children less than 5 years of age, Syrian camp refugees

Characteristic	Number of children	% [a]	95% CI [b]
Birthweight reported from official document			
Yes	244	45.7	(35.3, 56.5)
No	290	54.3	(43.5, 64.7)
Birthweight in kilograms (mean)	523	2.97	(2.89, 3.04)
Birthweight			
<2500 grams	523	15.4	(11.7, 20.0)
2500+ grams	523	84.6	(80.0, 88.3)
Had diarrhea in past 2 weeks			
Yes	582	10.3	(7.4, 14.2)
No	582	89.7	(85.8, 92.6)
Had fever in past 2 weeks			
Yes	582	33.2	(27.0, 39.9)
No	582	66.8	(60.1, 73.0)
Had lower acute respiratory infection in past 2 weeks			
Yes	575	21.4	(16.4, 27.4)
No	575	78.6	(72.6, 83.6)
Inflammation stage			
None (Neither CRP nor AGP elevated)	424	59.4	(53.0, 65.6)
Incubation (CPR elevated, AGP normal)	424	2.1	(1.2, 3.9)
Early convalescence (both CPR and AGP elevated)	424	12.3	(9.3, 16.0)
Late convalescence (CRP normal, AGP elevated)	424	26.2	(21.1, 32.0)

Note: The n's are un-weighted numbers (denominators) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.

4.3.9. Stunting

The prevalence of stunting, both nationwide and in all subgroups, was statistically significantly greater than the 2.3% found in the WHO Growth Standard, as shown with confidence intervals that do not cross 2.3. In addition, the prevalence does not show the progressive increase with age shown in many other countries. There were no statistically significant differences by sex and camp. Significant differences were found for household wealth, with more than one quarter of children living in the poorest households being stunted, and by maternal stature, with children of short mothers having a much higher prevalence of stunting than children of taller mothers.

The distribution of height-for-age z-scores is obviously shifted to the left, as shown in Figure 4-4, indicating that the population of Syrian refugee children is relatively stunted. The mean height-for-age z-score was -0.90 (95% CI: -1.00, 0.80), with a standard deviation of 1.22.

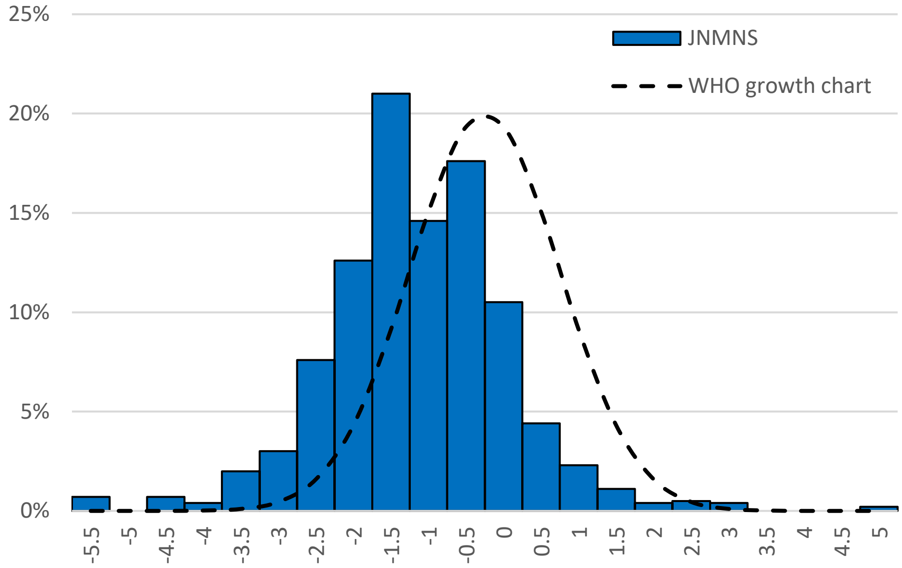

Figure 4-4. **Distribution of height-for-age z-scores in children less than 5 years of age, Syrian camp refugees**

4.3.10. Wasting and underweight

Wasting prevalence was low in Syrian camp refugee children (1.1%; 95% CI: 0.5, 2.3), with only 4 children being severely wasted and 2 children being moderately wasted. As shown in Figure 4-5, the weight-for-height z-score distribution is similar to the WHO growth chart. The mean weight-for-height z-score was 0.49 (95% CI: 0.40, 0.58). Thus, no further sub-group analyses were conducted for wasting.

The prevalence of underweight was very low in Syrian refugee children under 5 years of age. Overall, 3.7% (95%CI: 2.3, 5.9) of the surveyed children had underweight; 1.6% (n=9) were severely underweight and 2.1% (n=12) were moderately underweight. No further sub-group analyses were conducted due to the small numbers.

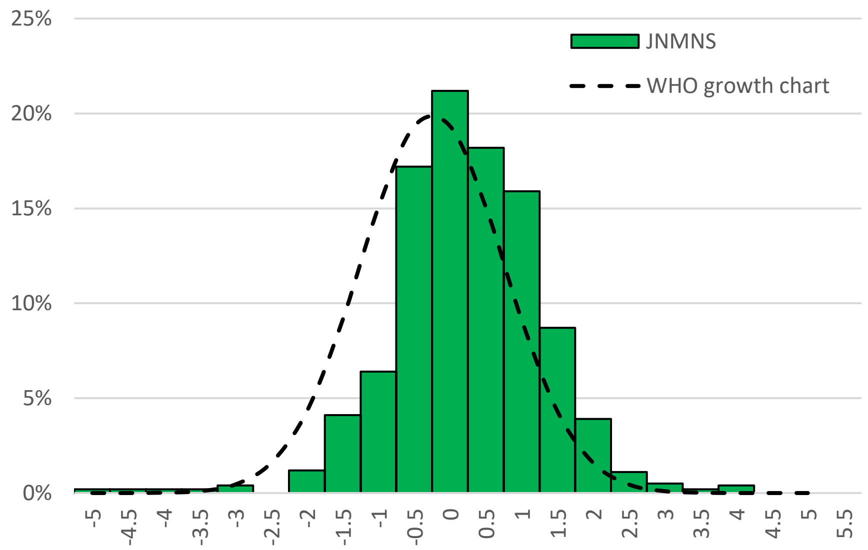

Figure 4-5. **Distribution of weight-for-height z-scores in children 6-59 months, Syrian camp refugees (standard deviation: 1.04)**

4.3.11. Overweight and obesity

Overweight or obesity affected 6% of Syrian refugee children under 5 years of age (see Table 4-13), which according to WHO poses a 'mild' public health problem [24]. An age pattern emerged with younger children being more often diagnosed with overweight or obesity than older children. No other demographic factors revealed significant differences.

Table 4-12. Prevalence of stunting in children 0-59 months, by various demographic characteristics, Syrian camp refugees

		Severely stunted [b]		Moderately stunted [b]			Total stunted [c]		
Characteristic	**N**	**% [a]**	**95% CI [d]**	**% [a]**	**95% CI [d]**	**p-value [e]**	**%**	**95% CI**	**p-value [e]**
TOTAL	563	3.9%	(2.5, 6.1)	9.9%	(7.3, 13.5)		13.9%	(10.4,1 8.2)	
Age (in months)									
0-11	110	4.5%	(1.6, 12.0)	10.0%	(5.4, 17.7)	0.991	14.5%	(8.7, 23.3)	0.946
12-23	138	4.3%	(2.0, 9.3)	8.7%	(5.2, 14.1)		13.0%	(8.6, 19.4)	
24-35	99	4.0%	(1.6, 9.9)	10.1%	(5.3, 18.3)		14.1%	(8.6, 22.4)	
36-47	104	3.8%	(1.2, 12.0)	11.5%	(6.6, 19.4)		15.4%	(9.2, 24.7)	
48-59	112	2.7%	(0.9, 7.8)	9.8%	(5.2, 17.7)		12.5%	(7.1, 21.0)	
Sex									
Male	306	4.6%	(2.7, 7.6)	11.1%	(7.7, 15.9)	0.378	15.7%	(11.4, 21.1)	0.142
Female	257	3.1%	(1.5, 6.4)	8.6%	(5.2, 13.7)		11.7%	(7.9, 17.0)	
Camp [f]									
Azraq	121	5.0%	(2.0, 12.0)	9.9%	(4.5, 20.5)	0.849	14.9%	(8.5, 24.8)	0.782
Zaatari	418	3.6%	(2.1, 6.2)	10.0%	(7.2, 13.9)		13.6%	(9.8, 18.7)	
Wealth quintile									
Poorest	108	11.1%	(6.3, 18.9)	16.7%	(9.2, 28.3)	0.008	27.8%	(17.9, 40.4)	0.004
Second	96	2.1%	(0.5, 7.6)	7.3%	(3.3, 15.2)		9.4%	(4.4, 19.0)	
Middle	129	2.3%	(0.6, 8.9)	8.5%	(4.5, 15.7)		10.9%	(5.6, 20.1)	
Fourth	112	1.8%	(0.5, 6.3)	10.7%	(6.5, 17.2)		12.5%	(7.2, 20.9)	
Wealthiest	118	2.5%	(0.9, 7.2)	6.8%	(2.8, 15.5)		9.3%	(5.0, 16.6)	
Mother's stature									
Short (≤ 150 cm)	23	8.7%	(2.1, 29.7)	21.7%	(9.4, 42.7)	0.048	30.4%	(14.4, 53.2)	0.025
Normal (> 150 cm)	218	5.0%	(2.5, 9.8)	8.3%	(5.4, 12.5)		13.3%	(8.8, 19.5)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages and means are weighted for unequal probability of selection.

[b] Severe stunting is defined as having a height-for-age z-score below -3 standard deviations from the WHO Child Growth Standards population median; moderate stunting is defined as having a height-for-age z-score equal to or above -3 standard deviations and less than -2 SD from the WHO Child Growth Standards population median.

[c] Total stunting includes both severely and moderately stunted children.

[d] CI=confidence interval calculated taking into account the complex sampling design.

[e] P value <0.05 indicates that at least one subgroup is significantly different from the others. Chi-square results are based on total stunting.

[f] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

Table 4-13. Prevalence of overweight and obesity in children 0-59 months, by various demographic characteristics, Syrian camp refugees

Characteristic	N	Obesity [b]		Overweight [b]			Overweight or obesity		
		% [a]	95% CI [c]	% [a]	95% CI [c]	p-value [d]	%	95% CI [c]	p-value [d]
TOTAL	565	1.1%	(0.4, 2.6)	5.0%	(3.4, 7.2)		6.0%	(4.1, 8.7)	
Age (in months)									
0-11	112	2.7%	(0.9, 7.9)	8.0%	(4.2, 14.8)	0.115	10.7%	(6.3, 17.5)	0.020
12-23	137	1.5%	(0.3, 6.0)	6.6%	(3.6, 11.8)		8.0%	(4.4, 14.2)	
24-35	99	1.0%	(0.1, 7.3)	2.0%	(0.5, 7.6)		3.0%	(1.0, 8.8)	
36-47	103	0.0%	--	1.9%	(0.5, 8.0)		1.9%	(0.5, 8.0)	
48-59	113	0.0%	--	4.4%	(1.9, 10.0)		4.4%	(1.9, 10.0)	
Sex									
Male	308	1.3%	(0.4, 4.2)	5.5%	(3.3, 9.0)	0.638	6.8%	(4.1, 11.1)	0.316
Female	257	0.8%	(0.2, 3.2)	4.3%	(2.6, 7.0)		5.1%	(3.3, 7.8)	
Camp [e]									
Azraq	123	0.0%	--	6.5%	(3.0, 13.6)	0.411	6.5%	(3.0, 13.6)	0.848
Zaatari	418	1.4%	(0.6, 3.5)	4.5%	(2.9, 7.0)		6.0%	(3.9, 9.2)	
Wealth quintile									
Poorest	108	1.9%	(0.5, 6.9)	7.4%	(3.3, 15.9)	0.686	9.3%	(4.5, 18.1)	0.550
Second	97	1.0%	(0.1, 7.5)	4.1%	(1.6, 10.0)		5.2%	(2.3, 11.3)	
Middle	129	0.8%	(0.1, 6.0)	5.4%	(2.7, 10.4)		6.2%	(3.2, 11.5)	
Fourth	112	1.8%	(0.4, 7.4)	2.7%	(0.9, 7.3)		4.5%	(2.0, 9.8)	
Wealthiest	119	0.0%	--	5.0%	(2.1, 11.6)		5.0%	(2.1, 11.6)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages and means are weighted for unequal probability of selection.

[b] Overweight is defined as having a weight-for-height z-score greater than +2 but less than or equal to +3 standard deviations from the WHO Child Growth Standards population median; obesity is defined as having a weight-for-height z-score greater than +3 standard deviations from the WHO Child Growth Standards population median

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that one at least subgroup is significantly different from the others. Chi-square results are based on overweight or obese.

[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.3.12. Infant and young child feeding indicators and supplements

Figure 4-6 provides a summary of the various infant and young child feeding indicators as per WHO/UNICEF recommendations[27]. Almost all children had been breastfed (indicator #9), and early initiation of breastfeeding (indicator #1) was common. On the other hand, the prevalence of exclusive breastfeeding (indicator #2) is very poor in children less than 6 months of age. About one-half of children were breastfed at 1 year of age and one quarter were still being breastfed at 2 years of age (indicators # 3 and 10). The median duration of breastfeeding among children less than 24 months was less than 13 months, indicating a relatively short breastfeeding period (data not shown). Age-appropriate and predominant breastfeeding (indicators # 11 and 12) are relatively poor.

Indicators of complementary feeding, including introduction of solid foods, minimum dietary diversity, minimum meal frequency, and minimum dietary acceptability (indicators #4-7) are not optimal. Only about one half of children meet the criteria for minimum dietary diversity or minimum meal frequency. As a result, relatively few children eat a minimally acceptable diet. A third of children had eaten iron-rich foods or taken iron supplements in the 24 hours prior to data collection (indicator #8).Only one quarter of children had received food from a bottle in the prior 24 hours (indicator #13). On the other hand, of those children who are not currently breast-feeding, more than two thirds receive minimum milk feedings.

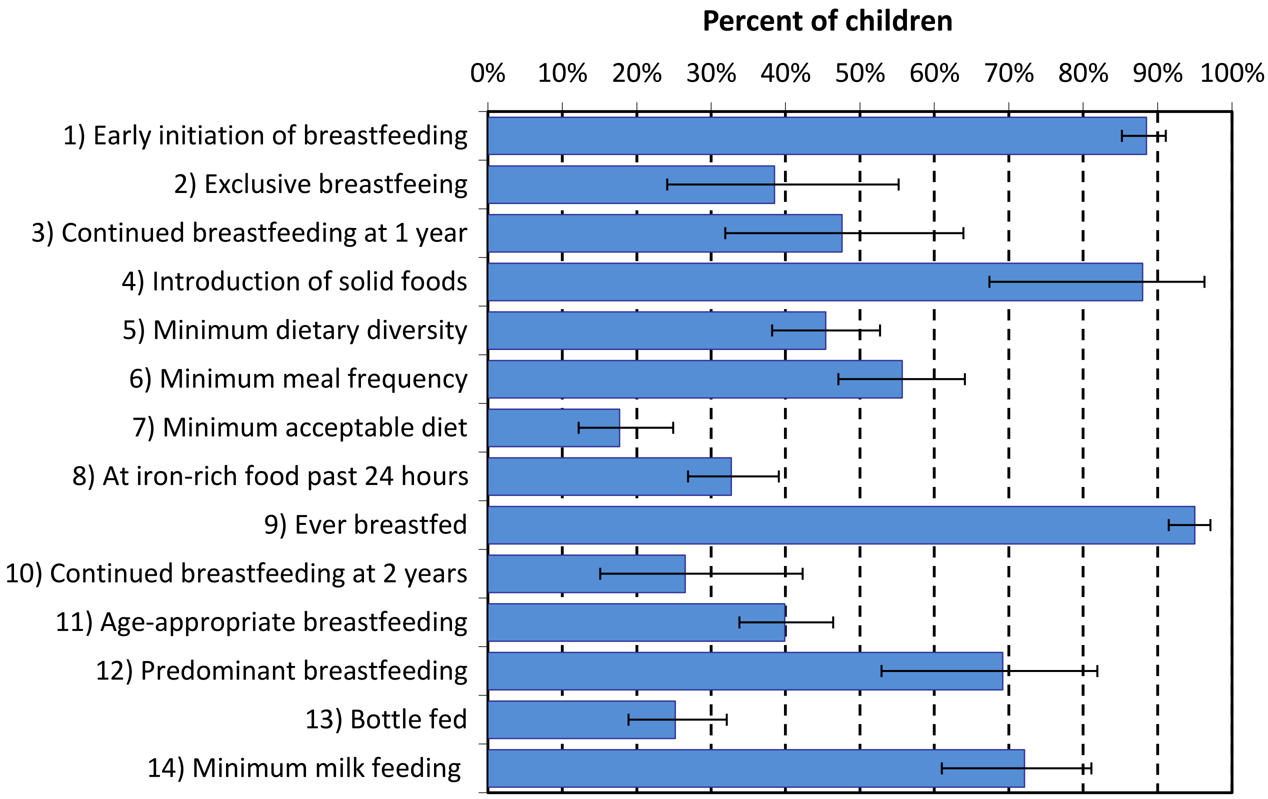

Figure 4-6. Prevalence of standard WHO/UNICEF infant and young child feeding indicators in children of various ages, Syrian camp refugees

In children less than six months of age, the most commonly consumed liquids other than breast milk was water; however, one-half of children 6-23 months of age had eaten sugary foods and/or drunk sugary beverages in the past 24 hours (Table 4-14). About one third of the 6-23 months old children ate fried/salty snacks.

Table 4-14. Additional dietary indicators in children less than 24 months of age, Syrian camp refugees

Characteristic	Number of children	% [a]	95% CI [b]
Liquids other than breastmilk consumed in past 24 hours (<6 months of age; N=52)			
Plain water	23	44.2	(29.7, 59.8)
Infant formula	6	11.5	(4.8, 25.4)
Tinned, powdered, or other non-human milk	3	5.8	(1.8, 17.3)
Juice or juice drinks	2	3.8	(0.9, 14.7)
Shourba or clear broth	2	3.8	(0.5, 24.9)
Yogurt	6	11.5	(4.1, 28.5)
Thin porridge	2	3.8	(0.8, 16.2)
Other liquids	5	9.6	(2.9, 27.3)
Ate sugary foods in past 24 hours (6-23 months of age)			
Yes	97	47.3	(37.6, 57.3)
No	108	52.7	(42.7, 62.4)
Consumed sugary drinks in past 24 hours (6-23 months of age) [c]			
Yes	105	51.2	(41.8, 60.6)
No	100	48.8	(39.4, 58.2)
Ate salty/fried foods in past 24 hours (6-23 months of age) [d]			
Yes	70	34.1	(26.0, 43.3)
No	135	65.9	(56.7, 74.0)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] The question was about 'Sugar-sweetened beverages (soft drinks/fizzy drinks, chocolate drinks, malt drinks, yoghurt drinks, sweet tea or coffee with sugar, sweetened fruit juices and "juice drinks")'.
[d] The question was about 'Salty or fried snacks: Crisps and chips, fried dough or other fried snacks (e.g. Samposic)'.

Consumption of micronutrient supplements or anthelmintic treatment courses in the preceding six months was rather low in this age group. The most commonly consumed was vitamin A, and fewer than one fifth of children had received it in the past six months (Figure 4-7).

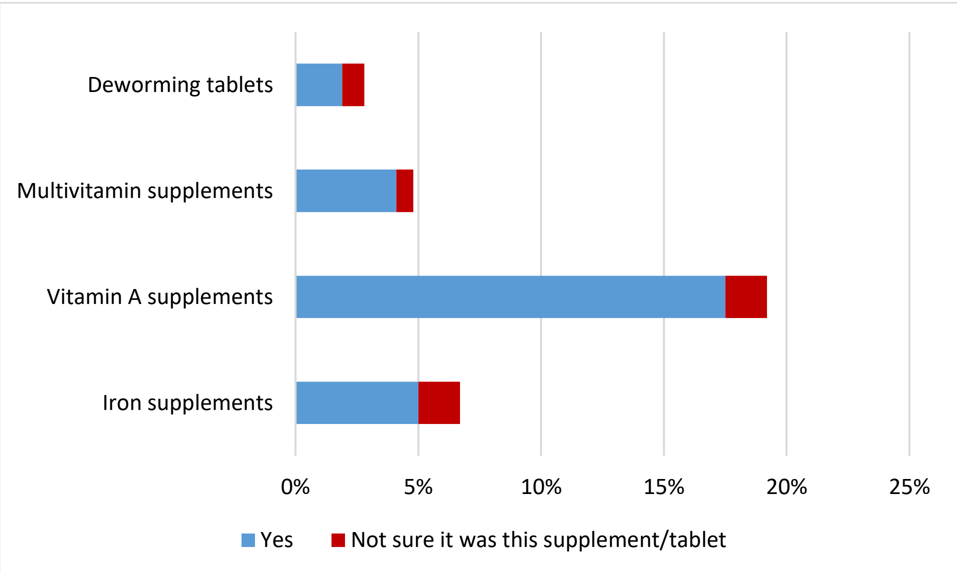

Figure 4-7. Proportion of children less than 5 years of age who took various supplements in past 6 months, Syrian camp refugees

4.3.13. Sun exposure

Table 4-15 shows indicators of sun exposure in Syrian refugee children under 5 years of age. Most children did not usually protect their heads from the sun when outdoors, whereas two-thirds of the children protected their arms at least some of the time. Roughly one quarter of children spent 1-30 minutes outdoor, one quarter 30-60 minute and another quarter 1-2 hours. Very few used sunscreen when outdoors. Almost 20% had a sun exposure index of 0 and about a quarter had a sun exposure index of 20 or greater.

Table 4-15. Sun exposure in children less than 5 years of age, Syrian camp refugees

Characteristic	n	Mean or % [a]	95% CI [b]
Child's head usually protected from sun when outside			
Never/rarely	478	82.1%	(76.6, 86.6)
Sometimes	59	10.1%	(6.4, 15.7)
Most of the time	8	1.4%	(0.7, 2.6)
All the time	37	6.4%	(3.9, 10.3)
How usually protect child's head from sun [c]			
Scarf/headcloth	30	28.8%	(16.7, 45.0)
Hat	64	61.5%	(45.7, 75.3)
Umbrella	7	6.7%	(2.6, 16.4)
Blanket	3	2.9%	(0.7, 11.5)
Child's arms usually protected from sun when outside			
Never/rarely	192	33.0%	(26.5, 40.2)
Sometimes	158	27.1%	(20.0, 35.7)
Most of the time	135	23.2%	(18.0, 29.3)
All the time	97	16.7%	(11.8, 23.1)
How much time per day typically child spend under the sun			
None	79	13.6%	(10.1, 18.1)
1-29 minutes	136	23.4%	(19.0, 28.5)
30-59 minutes	123	21.2%	(16.3, 27.2)
1-2 hours	132	22.8%	(18.3, 27.9)
More than 2 but less than 3 hours	63	10.9%	(8.5, 13.9)
More than 3 hours	47	8.1%	(5.2, 12.3)
Child usually has sunscreen			
Never/rarely	576	99.0%	(97.7, 99.5)
Sometimes	4	0.7%	(0.3, 1.8)
Most of the time	0	0.0%	--
All the time	2	0.3%	(0.1, 1.4)
Sun index			
20+	147	25.3%	(20.3, 31.1)
10-19	137	23.6%	(19.0, 28.9)
0.01-9.9	196	33.8%	(28.7, 39.3)
0	100	17.2%	(12.8, 22.9)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Of those that sometimes, most of the time or always protect child's head.

4.3.15. Physical activity and sleep

Table 4-16 below shows various indicators of physical activity and sleep patterns in Syrian refugee pre-school children. Overall, children watch about 2.3 hours of television per day on average, and play video or computer games for one-half hour. Only about one third never or rarely watch television while eating, and about two-thirds have a television in their bedrooms. Children average more than 10 hours of sleep per day.

Mothers of most children report their children of average physical activity. Although few children participate in organized physical activities, children walk in their neighborhoods or play outdoors for more than 30 minutes on an average of 5 days per week.

Table 4-16. Physical activity and sleep patterns in children less than 5 years of age, Syrian camp refugees, Jordan

Characteristic	n	Mean or % [a]	95% CI [b]
Hours of television or video watching per day (mean)	320	2.3	(2.0, 2.6)
Hours of video or computer games per day (mean)	322	0.5	(0.37, 0.70)
Watch television while eating			
No or rarely	116	35.8%	(28.1, 44.3)
1 meal per day	132	40.7%	(32.5, 49.5)
2 meals per day	15	4.6%	(2.7, 7.9)
3 or more meals per day	55	17.0%	(11.3, 24.6)
9 don't know	6	1.9%	(0.5, 6.4)
Television or computer in room where child sleeps			
Yes	220	67.9%	(59.3, 75.4)
No	104	32.1%	(24.6, 40.7)
Hours sleep per 24-hour period (mean)	324	10.2	(9.88, 10.49)
Mother ranks child's activities relative to other children			
A lot less active	1	0.3%	(0.0, 2.3)
Less active	11	3.4%	(1.8, 6.4)
Same	213	65.7%	(56.1, 74.3)
More active	72	22.2%	(16.3, 29.6)
A lot more active	26	8.0%	(4.2, 14.7)
Organized physical activity in typical week			
Yes	7	2.2%	(0.9, 5.2)
No	317	97.8%	(94.8, 99.1)
Days in past 7 days walked in neighborhood (mean)	324	4.8	(4.03, 5.49)
Days in past 7 days played outdoors 30+ minutes (mean)	324	5.7	(5.11, 6.20)
Type of child care facility typically attends			
None, stays at home	206	63.6%	(55.5, 71.0)
Informal (family, friends)	81	25.0%	(17.7, 34.1)
Day care <8 hours	3	0.9%	(0.2, 4.0)
Pre-school	34	10.5%	(6.0, 17.8)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.

4.3.16. Risk factors for anemia, iron deficiency and vitamin D status

Table 4-17 and Table 4-18 below show the association between various factors and anemia or iron deficiency in Syrian refugee children 6-59 months of age. Anemia was not statistically significantly related to either diarrhea or LRI in the past 2 weeks; however, children with fever in the past 2 weeks at a significantly elevated prevalence of anemia. None of these forms of recent morbidity were associated with iron deficiency. Although inflammation was not statistically significantly associated with anemia, children with inflammation had a substantially lower prevalence of iron deficiency than children without inflammation. The prevalence of anemia was about three times higher in children with iron deficiency or vitamin A deficiency compared to those without. However, the association between vitamin A deficiency and iron deficiency was not statistically significant. In contrast, children with vitamin D deficiency or insufficiency were significantly less likely to have anemia, but not iron deficiency. Zinc deficiency was statistically significantly associated with neither anemia nor iron deficiency. Both α- and β- thalassemia traits were statistically significantly associated with anemia, but not with iron deficiency.

Table 4-17. Correlation between various factors and anemia and iron deficiency in children 6-59 months of age, Syrian camp refugees

Characteristic	N	% [a] anemic	p-value [b]	n	% [a] iron deficient	p-value [b]
Child had diarrhea						
Yes	41	29.3%	0.463	40	37.5%	0.863
No	400	24.8%		384	36.2%	
Child had fever						
Yes	146	31.5%	0.035	139	36.0%	0.920
No	295	22.0%		285	36.5%	
Child had lower respiratory infection						
Yes	88	25.0%	0.957	82	36.6%	0.924
No	348	24.7%		337	36.2%	
Child has inflammation						
Yes	171	27.5%	0.180	172	29.7%	0.020
No	252	22.2%		252	40.9%	
Child iron deficient						
Yes	154	40.3%	0.000			
No	269	15.2%				
Child vitamin A deficient						
Yes	15	73.3%	0.000	15	46.7%	0.381
No	408	22.5%		409	35.9%	
Child vitamin D insufficient or deficient						
Yes	181	18.2%	0.030	181	35.4%	0.584
No	208	28.4%		209	38.3%	
Child zinc deficient						
Yes	44	27.3%	0.416	44	29.5%	0.318
No	302	22.2%		303	38.0%	
Child has α-thalassemia trait						
Yes	13	61.5%	0.001	11	45.5%	0.458
No	394	23.1%		381	36.7%	
Child has β-thalassemia trait						
Yes	9	55.6%	0.024	9	22.2%	0.261
No	394	23.1%		381	36.7%	

Note: The N's are un-weighted numbers (denominator) of all children with characteristic; the sum of subgroups may not equal the total because of missing data.
[a] Percentages are weighted for unequal probability of selection.
[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

None of the factors investigated relating to consumption of iron-rich foods and supplements were associated with anemia or iron deficiency. The lack of statistical significance in these bivariate tables could be partly explained by the small number of affected children.

Table 4-18. Anemia, iron deficiency and iron-deficiency anemia in pre-school age children 6-59 months of age, by vitamin and mineral supplement indicators, Syrian camp refugees, Jordan

	Anemia			Iron deficiency		
Characteristic	**N**	**% [a]**	**p-value [b]**	**N**	**% [a]**	**p-value [b]**
Consumed iron-fortified foods yesterday						
No	434	25.3	0.529	417	35.7	0.060
Yes	7	14.3		7	71.4	
Consumed iron tablets or syrup in past six months						
No	410	25.1	0.682	394	35.8	0.301
Yes	24	29.2		24	45.8	
Consumed multivitamins in past six months						
No	419	25.5	0.596	404	36.1	0.618
Yes	20	20.0		19	42.1	
Received deworming medication in past six months						
No	428	25.7	0.257	411	36.3	0.967
Yes	10	10.0		10	40.0	

Note: The n's are un-weighted denominators in each subgroup; the sum of subgroups may not equal the total because of missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

Table 4-19 presents associations between sub-optimal vitamin D status and various factors, none of which show a substantial association or statistical significance.

Table 4-19. Correlation between various factors and sub-optimal vitamin D status in children 6-59 months of age, Syrian camp refugees, Jordan.

Characteristic	N	% [a] VDD or insufficiency	p-value [b]
Child had diarrhea			
Yes	36	47.2%	0.920
No	354	46.3%	
Child had fever			
Yes	125	44.0%	0.505
No	265	47.5%	
Child had lower respiratory infection			
Yes	76	50.0%	0.453
No	309	46.0%	
Child has inflammation			
Yes	156	44.9%	0.707
No	234	47.4%	
Child iron deficient			
Yes	144	44.4%	0.584
No	246	47.6%	
Child vitamin A deficient			
Yes	13	38.5%	0.526
No	377	46.7%	
Child zinc deficient			
Yes	42	42.9%	0.508
No	302	48.3%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

4.3.17. Correlation between micronutrient deficiencies and growth indices

Correlations between various micronutrient deficiencies and growth indices are presented in Table 4-20. The survey did not yield any substantial associations or statistical significance between stunting or overweight/obesity and the investigated micronutrient deficiencies or anemia. The small number of children with underweight or wasting precluded their inclusion in the analyses.

Table 4-20. Correlation between various micronutrient deficiencies and growth indices in children 6-59 months of age, Syrian camp refugees, Jordan

Characteristic	N	% [a] Stunted	p-value [b]	N	% [a] Overweight or obese	p-value [b]
Child anemic						
Yes	109	16.5%	0.197	109	3.7%	0.578
No	328	12.2%		327	5.2%	
Child iron deficient						
Yes	152	14.5%	0.555	151	3.3%	0.170
No	268	12.3%		269	5.9%	
Child vitamin A deficient						
Yes	15	20.0%	0.441	15	6.7%	0.748
No	405	12.8%		405	4.9%	
Child vitamin D insufficient or deficient						
Yes	178	10.7%	0.288	179	5.0%	0.346
No	208	15.4%		207	3.4%	
Child zinc deficient						
Yes	44	18.2%	0.255	44	4.5%	0.737
No	299	11.7%		299	3.7%	

Note: The N's are un-weighted numbers (denominator) of all children with characteristic; the sum of subgroups may not equal the total because of missing data.
[a] Percentages are weighted for unequal probability of selection.
[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

4.3.18. Correlation between physical activity and growth indices

The correlation between physical activities and growth indices in Syrian refugee children is presented in Table 4-21. The small number of children with underweight or wasting precluded their inclusion in the analyses. Stunting was neither correlated with statistical significance with how active the mother considered the child compared to others nor with the type of childcare. On the other hand, children whose mothers considered their children less active than other children were much more likely to be overweight or obese than children whose mothers considered them to be more active or equally active as other children.

Table 4-21. Correlation between physical activities and growth indices among children less than 5 years old, Syrian camp refugees, Jordan

Characteristic	N	% [a] Stunted	p-value [b]	% [a] Overweight or obese	p-value [b]
Time watching TV or playing video games					
≤ 2 hours	158	15.2%	0.521	3.8%	0.399
> 2 hours	140	12.1%		2.1%	
How active does mother consider the child compared to others					
More/lot more	97	16.5%	0.070	2.1%	0.008
Same	206	11.7%		2.9%	
Less/lot less	11	36.4%		18.2%	
Type of childcare					
Day care/pre-school	36	8.3%	0.348	0.0%	0.319
Informal/home	279	14.7%		3.6%	

Note: The N's are un-weighted numbers (denominator) of all children with characteristic; the sum of subgroups may not equal the total because of missing data.
[a] Percentages and means are weighted for unequal probability of selection.
[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

4.3.19. Correlation between sun exposure and vitamin D deficiency

In Syrian refugee pre-school children, there is no apparent dose-response relationship between sun exposure and vitamin D deficiency or insufficiency (Table 4-22).

Table 4-22. Association between sun exposure and vitamin D deficiency in children 6-59 months of age, Syrian camp refugees

	N	%[a] VDD	% VD insufficient	p-value [b]	% [a] VDD/ insufficient	p-value [b]
Sun exposure index						
<10	176	12.5%	37.5%	0.422	50.0%	0.377
10-19	96	5.2%	34.4%		39.6%	
>20	117	9.4%	37.6%		47.0%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Chi-square test; P value <0.05 indicates that the groups are statistically significantly different from each other.

4.4. School-age children (Syrian camp refugees)

4.4.1. Characteristics

In Table 4-23, the demographic characteristics of school-age children living in Syrian refugee camps are shown. The JNMNS camp sample was slightly biased toward younger and male children. Similar to the household demographics, the distribution across the camps follows estimated number of people residing there. Almost all children attended school at the time of the survey.

Table 4-23. Description of sampled school-age children 6-12 years, Syrian camp refugees

Characteristic	N	% [a]	(95% CI) [b]
Age Group (in years)			
6-7	196	31.7%	(28.8, 34.7)
8-9	186	30.1%	(27.8, 32.5)
10-11	160	25.9%	(23.0, 29.1)
12	76	12.3%	(10.1, 14.9)
Sex			
Male	324	52.4%	(48.6, 56.2)
Female	294	47.6%	(43.8, 51.4)
Camp			
Mrajeeb al Fhood	36	5.8%	(1.3, 22.6)
Azraq	144	23.3%	(12.0, 40.3)
Zaatari	438	70.9%	(53.2, 83.9)
Has ever attended school			
Yes	587	95.0%	(92.4, 96.7)
No	31	5.0%	(3.3, 7.6)
Currently attends school			
Yes	575	93.0%	(89.9, 95.3)
No	43	7.0%	(4.7, 10.7)

Note: The n's are un-weighted numbers (denominator) in each subgroup; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval, calculated taking into account the complex sampling.

4.4.2. Anemia, iron deficiency, and iron deficiency anemia

Overall, 11% of school-aged children in the Syrian refugee camps were anemic, a prevalence considered to be a mild public health problem according to WHO[42] (Table 4-24). There were no cases of severe anemia found in school-age children (Table 4-25). Children in the Azraq camp had a higher prevalence of anemia, albeit with borderline statistical significance, than children in Zaatari Camp. There were no statistically significant differences in anemia prevalence by age, sex or household wealth. About one-third of children had iron deficiency, and iron deficiency was neither strongly nor statistically significantly associated with any of the demographic variables in Table 4-25. A smaller proportion of children had iron deficiency anemia and, like iron deficiency, there were no substantial or statistically significant associations between iron deficiency anemia and any of the demographic characteristics listed in table 4 – 25. Among anemic school-age children in refugee camps, the prevalence of iron deficiency was 58.5 % (95% CI: 44.1, 71.6, n=65).

The distribution of hemoglobin values is shown in Figure 4-8. There were no children with values less than 80 g/L, and therefore no cases of severe anemia in this population. Because the cut-off point defining anemia differs by age within this age group, no such cut-off could be indicated in this figure. The mean hemoglobin concentration among all refugee school-age children was 127.0 g/L (95%CI: 125.9, 128.1).

Table 4-24. Prevalence of anemia, iron deficiency, and iron deficiency anemia in school-age children 6-12 years, by various demographic characteristics, Syrian camp refugees

Characteristic	Anemia [b]				Iron deficiency [e]				Iron deficiency anemia [f]			
	N	% [a]	95% CI [c]	p-value [d]	N	% [a]	95% CI [c]	p-value [d]	N	% [a]	95% CI [c]	p-value [d]
TOTAL	592	11.0%	(8.5, 14.1)		590	35.1%	(29.9, 40.7)		593	6.4%	(4.6, 8.8)	
Age (in years)												
6-7	187	12.3%	(8.5, 17.4)	0.219	187	34.2%	(26.3, 43.1)	0.830	188	7.4%	(4.6, 11.9)	0.098
8-9	177	10.2%	(6.6, 15.4)		176	33.5%	(26.7, 41.1)		177	4.5%	(2.2, 9.2)	
10-11	154	7.8%	(4.6, 12.9)		153	35.9%	(27.7, 45.1)		154	4.5%	(2.3, 8.8)	
12	74	16.2%	(8.5, 28.8)		74	39.2%	(26.2, 53.9)		74	12.2%	(5.9, 23.5)	
Sex												
Male	311	10.0%	(7.0, 14.1)	0.270	310	31.9%	(25.9, 38.6)	0.087	311	5.5%	(3.6, 8.2)	0.170
Female	281	12.1%	(9.2, 15.8)		280	38.6%	(32.0, 45.5)		282	7.4%	(5.1, 10.8)	
Camp[g]												
Azraq	140	13.6%	(10.2, 17.8)	0.050	139	29.5%	(20.9, 39.8)	0.387	140	5.7%	(3.2, 10.0)	0.729
Zaatari	417	8.4%	(5.6, 12.4)		416	34.6%	(28.3, 41.5)		418	5.0%	(3.1, 8.1)	
Wealth quintile												
Poorest	124	11.3%	(7.2, 17.3)	0.676	124	34.7%	(23.6, 47.7)	0.365	124	4.0%	(1.8, 8.7)	0.597
Second	113	8.8%	(5.1, 14.8)		113	24.8%	(15.7, 36.8)		113	5.3%	(2.9, 9.5)	
Middle	112	13.4%	(7.0, 24.1)		112	38.4%	(28.1, 49.8)		113	8.8%	(4.7, 16.0)	
Fourth	113	13.3%	(6.9, 24.1)		113	36.3%	(23.4, 51.5)		113	8.0%	(3.6, 16.6)	
Wealthiest	130	8.5%	(3.9, 17.6)		128	40.6%	(31.2, 50.8)		130	6.2%	(2.0, 17.5)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection among governorates.

[b] Anemia defined as hemoglobin < 115 g/L (children 5-11 y) and <120 g/L (children 12+ y), adjusted for altitude.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Iron deficiency defined as inflammation-adjusted serum ferritin < 12 μg/l.

[f] Iron deficiency anemia defined the combination of iron deficiency and anemia.

[g] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

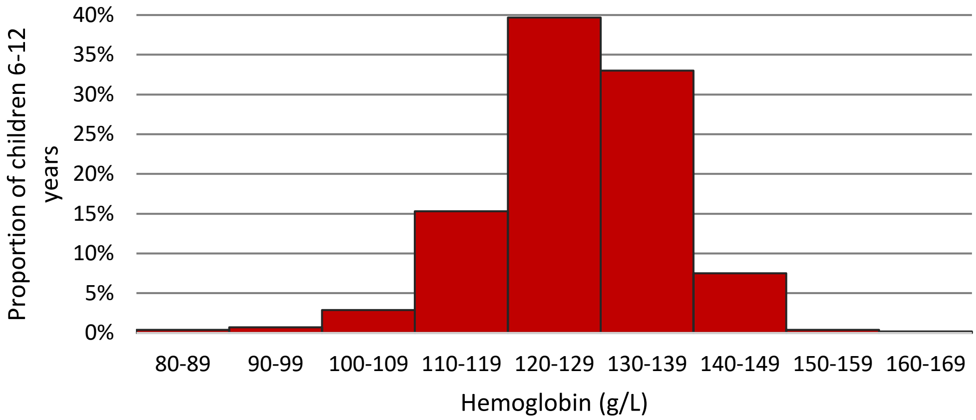

Figure 4-8. **Distribution of hemoglobin (g/L) in school-age children 6-12 years, Syrian camp refugees**

Table 4-25. **Severity of anemia in school-age children 6-12 years, by various demographic characteristics, Syrian camp refugees**

Characteristic	Mild anemia [b]			Moderate anemia [b]			Severe anemia [b]		
	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]
TOTAL	41	6.9	(4.7, 10.0)	24	4.1	(2.6, 6.3)	0	-	-
Age (in years)									
6-7	12	6.4	(3.7, 11.0)	11	5.9	(3.0, 11.2)	-	-	-
8-9	15	8.5	(4.7, 14.8)	3	1.7	(0.5, 5.1)	-	-	-
10-11	5	3.2	(1.2, 8.8)	7	4.5	(2.3, 8.7)	-	-	-
12	9	12.2	(5.6, 24.6)	3	4.1	(1.3, 12.2)	-	-	-
Sex									
Male	18	5.8	(3.3, 10.1)	13	4.2	(2.2, 7.7)	-	-	-
Female	23	8.2	(5.7, 11.7)	11	3.9	(2.3, 6.6)	-	-	-
Camp[d]									
Azraq	11	7.9	(4.7, 12.8)	8	5.7	(2.8, 11.4)	-	-	-
Zaatari	21	5.0	(3.2, 7.8)	14	3.4	(1.8, 6.1)	-	-	-
Wealth quintile									
Poorest	18	6.9	(2.9, 15.6)	11	2.7	(1.2, 6.1)	-	-	-
Second	11	2.9	(1.1, 7.3)	1	0.1	(0.0, 1.0)	-	-	-
Middle	4	1.0	(0.2, 4.5)	1	0.4	(0.1, 2.7)	-	-	-
Fourth	4	4.7	(1.8, 12.0)	6	2.8	(0.9, 8.7)	-	-	-
Wealthiest	6	5.2	(1.4, 17.6)	5	5.0	(1.8, 13.0)	-	-	-

Note: The n's are the numerators for a specific sub-group.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection among strata.
[b] Mild, moderate, and severe anemia defined as hemoglobin 110-114 g/L, 80-109 g/L, and <80 g/L, respectively.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.4.3. Vitamin A deficiency

Just over 7% of Syrian refugee school-aged children are vitamin A deficient, constituting only a mild public health problem according to the WHO [33]. Although not reaching statistical significance, there is a suggestion of a progressive decline in the prevalence of vitamin A deficiency with age. Male children were about twice as likely to be vitamin A deficient than female children (Table 4-26). No other demographic variables assessed show significant differences in the prevalence of vitamin A deficiency.

Table 4-26. Prevalence of vitamin A deficiency in school-age children 6-12 years, by various demographic characteristics, Syrian camp refugees

Characteristic	N	% VAD [a, b]	95% CI [c]	p-value [d]
TOTAL	590	7.1%	(5.0, 10.1)	
Age (in years)				
6-7	187	11.2%	(7.1, 17.3)	0.079
8-9	176	6.3%	(3.0, 12.7)	
10-11	153	5.2%	(2.5, 10.6)	
12	74	2.7%	(0.6, 10.6)	
Sex				
Male	310	9.4%	(6.2, 13.8)	0.029
Female	280	4.6%	(2.6, 8.2)	
Camp [e]				
Azraq	139	5.8%	(2.4, 13.1)	0.633
Zaatari	416	7.2%	(4.6, 11.0)	
Wealth quintile				
Poorest	124	5.6%	(2.0, 14.7)	0.851
Second	113	6.2%	(2.8, 13.3)	
Middle	112	9.8%	(5.1, 18.2)	
Fourth	113	8.0%	(3.1, 18.8)	
Wealthiest	128	6.3%	(2.4, 15.4)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] VAD = Vitamin A deficiency was defined as RBP adjusted for inflammation ≤0.7 µmol/L[61].

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

Figure 4-9 shows the distribution of RBP. The mean RBP concentration among school-age children residing in the Syrian refugee camps was 1.07 µmol/L (95% CI: 1.04, 1.10).

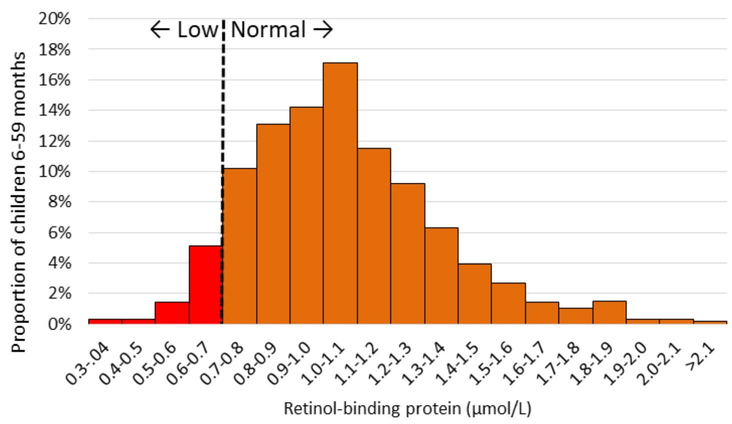

Figure 4-9. **Distribution of inflammation-adjusted RBP in school-age children 6-12 years, Syrian camp refugees**

4.4.4. Vitamin D deficiency and insufficiency

Inadequate vitamin D status affected almost two thirds of school-age children in refugee camps (Table 4-27). Of these two-thirds, one quarter had vitamin D deficiency, while the remainder had vitamin D insufficiency. Older age, being female and residing in the Zaatari camp were associated with poorer vitamin D status. Notably, the prevalence of vitamin D deficiency was almost 5 times higher among girls than boys. Wealth was not a significant factor associated with vitamin D deficiency or insufficiency, nor was there any suggestion of a dose-response relationship. In school-age children residing in the camps, the mean vitamin D concentration was 18.9 ng/mL (95%CI: 18.2, 19.6).

Table 4-27. **Prevalence of vitamin D deficiency and insufficiency in school-age children 6-12 years, by various demographic characteristics, Syrian camp refugees**

		Deficient [a]		Insufficient [a]			Deficient or insufficient		
Characteristic	**N**	**% [b]**	**95% CI [c]**	**% [b]**	**95% CI [c]**	**p-value [d]**	**% [b]**	**95% CI [c]**	**p-value [d]**
TOTAL	581	15.5%	(12.3, 19.3)	43.2%	(39.0, 47.5)		58.7%	(54.3, 62.9)	
Age (in years)									
6-7	181	7.7%	(4.4, 13.3)	40.9%	(33.1, 49.1)	0.000	48.6%	(41.3, 56.0)	0.000
8-9	173	9.2%	(6.0, 14.0)	46.2%	(39.7, 52.9)		55.5%	(48.3, 62.5)	
10-11	153	22.9%	(16.9, 30.1)	42.5%	(34.7, 50.6)		65.4%	(57.2, 72.7)	
12	74	33.8%	(21.0, 49.5)	43.2%	(29.9, 57.7)		77.0%	(63.4, 86.6)	
Sex									
Male	306	5.9%	(3.3, 10.1)	37.9%	(32.7, 43.4)	0.000	43.8%	(37.3, 50.5)	0.000
Female	275	26.2%	(21.0, 32.2)	49.1%	(42.8, 55.4)		75.3%	(69.7, 80.1)	
Camp [e]									
Azraq	138	8.7%	(5.1, 14.6)	34.1%	(30.4, 38.0)	0.000	42.8%	(37.2, 48.5)	0.000
Zaatari	408	8.6%	(4.6, 23.4)	46.6%	(40.6, 52.6)		65.2%	(59.4, 70.6)	
Wealth quintile									
Poorest	122	13.1%	(8.3, 20.2)	44.3%	(39.0, 49.6)	0.172	57.4%	(49.7, 64.7)	0.058
Second	110	14.5%	(8.6, 23.5)	33.6%	(24.6, 44.1)		48.2%	(38.5, 58.0)	
Middle	109	14.7%	(9.1, 22.9)	46.8%	(37.0, 56.8)		61.5%	(50.5, 71.4)	
Fourth	113	21.2%	(12.4, 34.0)	47.8%	(37.1, 58.7)		69.0%	(59.3, 77.3)	
Wealthiest	127	14.2%	(9.3, 20.9)	43.3%	(36.5, 50.3)		57.5%	(47.7, 66.8)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Deficient <12 ng/mL; Insufficient 12.1-19.9 ng/mL.
[b] Percentages weighted for unequal probability of selection.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others
[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.4.5. Zinc deficiency

Almost one out of ten school-age children in the Syrian refugee camps were zinc deficient (see Table 4-28), and this prevalence is substantially higher than that among children living in the settled population. There were no substantial or statistically significant differences in the prevalence of zinc deficiency by any of the demographic variables listed below The mean serum zinc concentration among these children was 74.8 µg/dL (95% CI: 73.1, 76.2).

Table 4-28. Prevalence of zinc deficiency in school-age children 6-12 years, by various demographic characteristics, Syrian camp refugees

Characteristic	N	% [a, b]	95% CI [c]	p-value [d]
TOTAL	569	9.0%	(6.2, 12.8)	
Age (in years)				
6-7	178	11.2%	(6.2, 19.4)	0.449
8-9	168	9.5%	(5.5, 15.9)	
10-11	150	6.0%	(3.2, 10.9)	
12	73	8.2%	(3.4, 18.5)	
Sex				
Male	303	10.2%	(6.6, 15.5)	0.174
Female	266	7.5%	(4.9, 11.3)	
Camp [e]				
Azraq	138	10.1%	(5.5, 17.9)	0.767
Zaatari	396	9.1%	(5.8, 14.1)	
Wealth quintile				
Poorest	119	6.7%	(3.4, 13.0)	0.385
Second	110	9.1%	(4.7, 16.9)	
Middle	107	12.1%	(7.6, 18.9)	
Fourth	107	12.1%	(6.3, 22.1)	
Wealthiest	126	5.6%	(1.7, 16.7)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection among governorates.

[b] Zinc deficiency, defined as follows: children 6-9.9 years: morning non-fasting: <65 µg/dL, afternoon non-fasting: <57 µg/dL; girls 10-12.9 years: morning non-fasting: <66 µg/dL, afternoon non-fasting: <59 µg/dL; boys 10-12.9 years: morning non-fasting: <70 µg/dL, afternoon non-fasting: <61 µg/dL.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.4.6. Folate and vitamin B12 deficiency

Only 2.2% (95% CI: 1.4, 3.7) of school-age children from the Syrian camps had folate deficiency. No meaningful sub-group analyses could be conducted due to the low numbers. The mean serum folate concentration was 13.9 ng/mL (95%CI: 13.3, 14.5).

Similar to folate deficiency, vitamin B12 deficiency was rare: only 2.1% (95% CI: 1.0, 4.1) . On the other hand, almost 10% of children had marginal B12 status (Table 4-29). Vitamin B12 status seems to deteriorate with age; however, this association is not statistically significant. There is little Association between vitamin B12 status and sex. Children in Zaatari Camp have poorer vitamin B12 status than children in Azraq Camp, albeit without statistical significance. Vitamin B12 status seems to deteriorate with increasing household wealth.

The geometric mean vitamin B12 concentration was 436.7 pg/mL (95%CI: 420.9, 453.0).

Table 4-29. Prevalence of vitamin B12 deficiency in school-age children 6-12 years, by various demographic characteristics, Syrian camp refugees

Characteristic		B12 deficiency [a]		Marginal B12 status [a]			B12 deficiency or marginal [a]		
	N	% [b]	95% CI [c]	% [b]	95% CI [c]	p-value [d]	% [b]	95% CI [c]	p-value [d]
TOTAL	581	2.1%	(1.0, 4.1)	9.8%	(7.9, 12.2)		11.9%	(9.4, 15.0)	
Age (in years)									
6-7	181	2.2%	(0.6, 7.3)	7.2%	(4.8, 10.7)	0.204	9.4%	(5.7, 15.0)	0.149
8-9	173	1.2%	(0.3, 4.7)	9.8%	(5.9, 16.0)		11.0%	(6.9, 17.0)	
10-11	153	1.3%	(0.3, 5.5)	11.1%	(7.6, 16.0)		12.4%	(8.6, 17.6)	
12	74	5.4%	(2.2, 12.6)	13.5%	(6.9, 24.7)		18.9%	(11.9, 28.7)	
Sex									
Male	306	1.3%	(0.5, 3.5)	9.2%	(6.7, 12.4)	0.309	10.5%	(7.5, 14.5)	0.342
Female	275	2.9%	(1.3, 6.5)	10.5%	(7.4, 14.9)		13.5%	(9.2, 19.2)	
Camp [e]									
Azraq	138	0.7%	(0.1, 5.2)	5.8%	(3.0, 11.0)	0.134	6.5%	(3.3, 12.4)	0.059
Zaatari	408	2.2%	(1.0, 4.8)	10.3%	(8.0, 13.1)		12.5%	(9.7, 15.9)	
Wealth quintile									
Poorest	122	--		7.4%	(4.5, 11.9)	0.076	7.4%	(4.5, 11.9)	0.021
Second	110	0.9%	(0.1, 6.1)	7.3%	(3.7, 13.8)		8.2%	(4.5, 14.4)	
Middle	109	5.5%	(1.9, 14.7)	11.9%	(7.3, 18.9)		17.4%	(10.3, 27.9)	
Fourth	113	1.8%	(0.5, 6.1)	8.0%	(3.7, 16.1)		9.7%	(5.6, 16.3)	
Wealthiest	127	2.4%	(0.8, 6.9)	14.2%	(10.2, 19.4)		16.5%	(12.4, 21.6)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Vitamin B12 deficiency defined as plasma B12 <150 pmol/L (<203 pg/mL); marginal status as 150-220 pmol/L (203-297 pg/mL).

[b] Percentages weighted for unequal probability of selection.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.4.7. Recent morbidity and current inflammation

Recent diarrhea was uncommon in this age group, as shown in Table 4-30. Almost one fifth of the children had recent fever and just over 10% showed signs of lower acute respiratory infection. This relatively low burden of morbidity is consistent with the low proportion of children with elevated inflammatory markers.

Table 4-30. Health indicators in school-age children 6-12 years, Syrian camp refugees

Characteristic	Number of children	% [a]	95% CI [b]
Had diarrhea in past 2 weeks			
Yes	23	3.8%	(2.3, 6.0)
No	589	96.2%	(94.0, 97.7)
Had fever in past 2 weeks			
Yes	113	18.3%	(13.8, 23.9)
No	504	81.7%	(76.1, 86.2)
Had lower acute respiratory infection in past 2 weeks			
Yes	77	12.6%	(9.2, 17.2)
No	532	87.4%	(82.8, 90.8)
Inflammation stage			
None (Neither CRP nor AGP elevated)	446	75.6%	(71.7, 79.1)
Incubation (CPR elevated, AGP normal)	8	1.4%	(0.6, 3.0)
Early convalescence (both CPR and AGP elevated)	30	5.1%	(3.6, 7.1)
Late convalescence (CRP normal, AGP elevated)	106	18.0%	(14.3, 22.3)

Note: The n's are un-weighted numerators for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.

4.4.8. Stunting

Stunting is uncommon in school-age children residing in camps (Table 4-31). Severe and moderate stunting are present in 0.5% (95% CI: 0.2, 1.4) and 4.3% (95% CI: 2.9, 6.3), respectively.

None of the demographic characteristics listed in table 4 – 31 had a substantial or statistically significant association with stunting. In addition, there was no apparent dose-response relationship between stunting and either age or household wealth. The mean height-for-age z-score is -0.41 (95% CI: -0.49, -0.32) with a standard deviation of 1.08. The distribution shown in Figure 4-10 does not show an obvious shift to the left relative to the distribution of height-for-age z-scores in the WHO Growth Standard.

Table 4-31. Prevalence of stunting in school-age children 6-12 years, by various demographic characteristics, Syrian camp refugees

Characteristic	N	% [a, b]	95% CI [c]	p-value [d]
TOTAL	604	4.8%	(3.3, 6.8)	
Age (in years)				
6-7	192	2.1%	(0.8, 5.6)	0.074
8-9	182	6.6%	(4.2, 10.3)	
10-11	156	4.5%	(2.2, 9.0)	
12	74	8.1%	(3.6, 17.3)	
Sex				
Male	316	5.4%	(3.4, 8.4)	0.446
Female	288	4.2%	(2.4, 7.0)	
Camp [e]				
Azraq	144	6.3%	(3.5, 10.9)	0.431
Zaatari	425	4.7%	(3.0, 7.3)	
Wealth quintile				
Poorest	127	6.3%	(2.5, 15.1)	0.446
Second	116	5.2%	(2.5, 10.4)	
Middle	114	3.5%	(1.2, 10.0)	
Fourth	113	1.8%	(0.4, 7.0)	
Wealthiest	134	6.7%	(3.5, 12.6)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Stunting is defined as having a height-for-age z-score below -2 standard deviations from the WHO Child Growth Standards population median.
[b] Percentages weighted for unequal probability of selection.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] P value <0.05 indicates that at least one subgroup is significantly different from the others.
[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Flood camp was excluded from the camp sub-group; however, Mrajeeb al Flood participants' data have been included for all other analyses in this table.

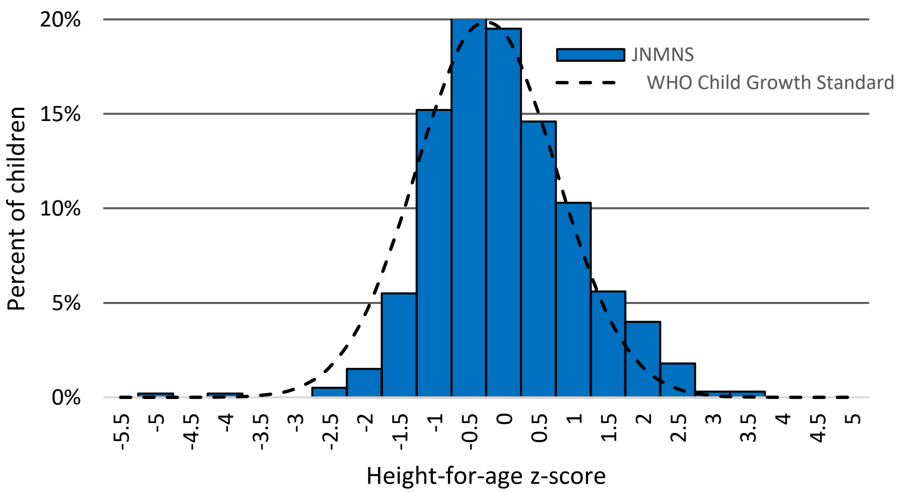

Figure 4-10. Distribution of height-for-age z-scores in school-aged children 6-12 years, Syrian camp refugees

4.4.10. Thinness, overweight and obesity

Thinness was rare; only 1.4% (95% CI: 0.8, 2.6) of children had a BMI-for-age z-score less than -2.0. The low number of affected children precluded any meaningful sub-group analyses. The mean BMI-for-age z-score was 0.01 (95%CI: -0.07, 0.01) with a standard deviation of 1.05.

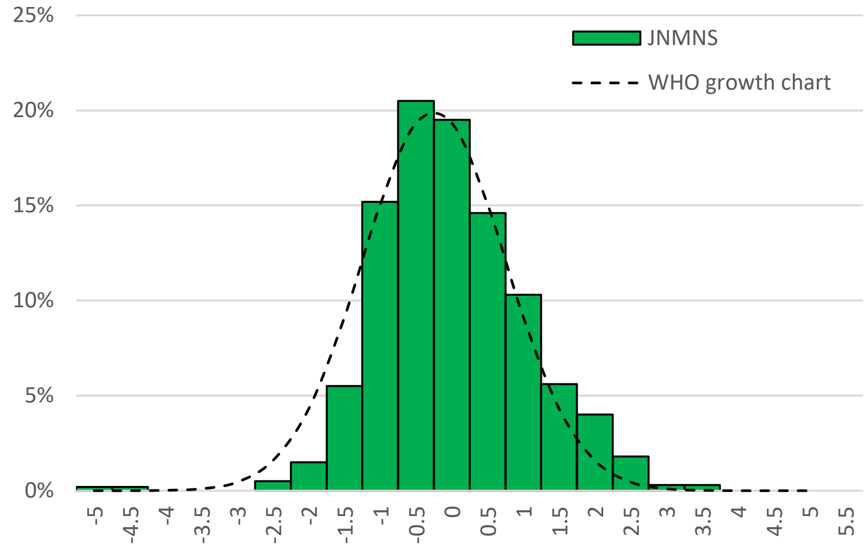

Figure 4-11. Distribution of BMI for age z-scores in school-aged children 6-12 years, Syrian camp refugees

Overall, a bit less than one quarter of school-age children living in refugee camps are overweight or obese. Overweight and obesity tend to increase with age, and female children are more often overweight or obese than male children. School-age children in the Zaatari camp tended to be more often overweight or obese than their Azraq peers, but household wealth show little association or dose-response relationship with overweight or obesity (Table 4-32).

Table 4-32. Prevalence of overweight and obesity in school-age children 6-12 years, by various demographic characteristics, Syrian camp refugees

		Obesity [b]		Overweight [b]			Obesity or overweight		
Characteristic	**N**	**% [a]**	**95% CI [c]**	**%**	**95% CI [c]**	**p-value [c]**	**%**	**95% CI [c]**	**p-value [c]**
TOTAL	604	6.3%	(4.4, 8.9)	15.9%	(13.2, 19.0)		22.2%	(18.7, 26.2)	
Age (in years)									
6-7	192	3.6%	(1.8, 7.4)	15.1%	(10.7, 21.0)	0.055	18.8%	(14.0, 24.6)	0.069
8-9	182	8.8%	(5.4, 14.0)	11.5%	(7.2, 18.0)		20.3%	(14.6, 27.6)	
10-11	156	4.5%	(1.9, 10.1)	18.6%	(12.5, 26.7)		23.1%	(16.7, 31.0)	
12	74	10.8%	(5.1, 21.3)	23.0%	(14.6, 34.2)		33.8%	(22.8, 46.9)	
Sex									
Male	316	5.1%	(2.8, 8.9)	13.3%	(9.8, 17.7)	0.081	18.4%	(13.7, 24.1)	0.029
Female	288	7.6%	(5.0, 11.4)	18.8%	(14.7, 23.6)		26.4%	(21.8, 31.6)	
Camp [e]									
Azraq	144	4.2%	(1.2, 13.1)	9.7%	(5.5, 16.6)	0.101	13.9%	(7.5, 24.4)	0.048
Zaatari	425	6.8%	(4.8, 9.6)	18.1%	(15.0, 21.7)		24.9%	(21.1, 29.3)	
Wealth quintile									
Poorest	127	3.9%	(1.1, 12.9)	15.0	(10.7, 20.5)	0.491	18.9%	(13.0, 26.7)	0.511
Second	116	5.2%	(2.2, 11.8)	13.8	(7.5, 24.1)		19.0%	(10.7, 31.4)	
Middle	114	8.8%	(5.0, 14.9)	15.8	(10.2, 23.6)		24.6%	(17.0, 34.1)	
Fourth	113	5.3%	(1.8, 14.6)	23.0	(15.9, 32.1)		28.3%	(18.6, 40.7)	
Wealthiest	134	8.2%	(4.1, 15.8)	12.7	(8.2, 19.1)		20.9%	(14.7, 28.8)	

Note: The n's are un-weighted numerators for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection among governorates.

[b] Overweight is defined as having a BMI-for-age z-score greater than +2 but less than or equal to +3 standard deviations from the WHO Child Growth Standards population median; obesity is defined as having a BMI-for-age z-score greater than +3 standard deviations from the WHO Child Growth Standards population median.

[c] CI=confidence interval calculated taking into account the complex sampling design.[d] P value <0.05 indicates that one at least subgroup is significantly different from the others.

[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.4.11. Underweight (only children 6-10 years)

Underweight can only be assessed up to 10 years of age, since no reference z-scores exist for older children. Overall, the prevalence of underweight is low with just 1.1% (95%CI: 0.5, 2.5), and only 0.3% were severely underweight. The low numbers of affected children precluded a meaningful sub-group analysis.

4.4.12. Dietary habits, dietary diversity and supplement consumption

More than 9 out of 10 children were ever breastfed, which is in line with reports of over 90% of pre-school children ever breastfed (Table 4-33).

Over half of the school-age children in the camps achieve minimum dietary diversity, but almost three quarters of children drink tea and/or coffee frequently engough at inappropriate times to potentially inhibit the absorption of ingested iron.

Two thirds of children eat breakfast before going to school, but few children take a meal from home to school. A large majority of children receive a free snack at school which consists of a biscuit or datebar, or a fruit or vegetable pastry. In addition, almost two thirds of children get some money to buy snacks outside the home, and they predominantly buy chips, biscuits, chocolate, or juice.

Table 4-33. Child dietary habits and current dietary diversity, school-age children 6-12 years, Syrian camp refugees

Characteristic	n	Mean or % [a]	95% CI [b]
Child was ever breastfed			
Yes	569	92.1%	(87.6, 95.0)
No	49	7.9%	(5.0, 12.4)
Number of food groups consumed (mean)	618	4.64	(4.36, 4.92)
Meets minimum dietary diversity (≥ 5 food groups)[c]			
Yes	339	54.9%	(47.6, 61.9)
No	279	45.1%	(38.1, 52.4)
Iron-inhibiting coffee/tea drinking behavior [d]			
Yes	441	71.4%	(62.8, 78.6)
No	177	28.6%	(21.4, 37.2)
Child typically has breakfast before going to school			
Yes	422	68.3%	(61.1, 74.7)
No	196	31.7%	(25.3, 38.9)
Of these 422 children, what the child typically has for breakfast			
Tea	122	62.2%	(50.7, 72.6)
Milk	60	30.6%	(21.2, 41.9)
Juice	10	5.1%	(1.9, 13.0)
Bread/ Sandwich	183	93.4%	(87.8, 96.5)
Labneh/ Yoghurt/ Cheese	172	87.8%	(82.2, 91.7)
Fruit	24	12.2%	(6.1, 23.1)
Vegetable	65	33.2%	(24.6, 43.0)
Eggs	102	52.0%	(40.4, 63.5)
Cereals	8	4.1%	(1.6, 10.3)
Child typically takes a meal from home to school			
Yes	44	7.1%	(4.9, 10.2)
No	574	92.9%	(89.8, 95.1)
Of these 44 children, what the child typically takes to school			
Tea	2	4.5%	(1.1, 17.4)
Milk	1	2.3%	(0.3, 15.1)
Juice	1	2.3%	(0.3, 13.8)
Bread/ Sandwich	40	90.9%	(77.5, 96.7)
Labneh/ Yoghurt/ Cheese	31	70.5%	(52.6, 83.7)
Fruit	5	11.4%	(3.8, 29.2)
Vegetable	2	4.5%	(0.6, 27.6)
Child typically receives free snack at school			
Yes	558	90.3%	(83.2, 94.6)
No	60	9.7%	(5.4, 16.8)
Of these 558 children, what snack the child typically receives			
Biscuit/datebar	13	2.3%	(0.9, 5.9)
Pastry with fruit and vegetable	545	97.7%	(94.1, 99.1)
Child typically receives money to buy snack			
Yes	369	59.7%	(50.3, 68.5)
No	249	40.3%	(31.5, 49.7)
Of these 369 children, what the child typically buys from this money			
Sandwich/ school meal	53	14.4%	(7.0, 27.4)
Juice	156	42.3%	(33.5, 51.6)

Characteristic	n	Mean or % [a]	95% CI [b]
Soda	31	8.4%	(2.9, 22.1)
Biscuits	251	68.0%	(57.5, 77.0)
Crackers	140	37.9%	(26.8, 50.5)
Chips	307	83.2%	(75.0, 89.1)
Chocolate	159	43.1%	(34.3, 52.4)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Based on reference [63].
[d] The combination of drinking coffee/tea once or several times per day and drinking it during or just after a meal.

4.4.13. Sun exposure

Table 4-34 shows indicators of sun exposure in Syrian refugee school-age children. Three quarters did not usually protect their heads from the sun when outdoors, and of those that did, two thirds used a scarf. About three quarters of the children spend 1 hour or more outdoors each day. About one fifth of children had no sun exposure of the head.

Table 4-34. Sun exposure in school-age children 6-12 years, Syrian refugees

Characteristic	n	% [a]	95% CI [b]
Child's head usually protected from sun when outside			
Never/rarely	460	74.4%	(67.1, 80.6)
Sometimes	59	9.5%	(6.1, 14.6)
Most of the time	16	2.6%%	(1.2, 5.6)
All the time	83	13.4%	(10.3, 17.4)
How usually protect child's head from sun			
Scarf/headcloth	99	62.7%	(50.1, 73.7)
Hat	59	37.3%	(26.3, 49.9)
How much time per day typically child spend under the sun			
None	17	2.8%	(1.4, 5.4)
1-29 minutes	60	9.8%	(6.4, 14.5)
30-59 minutes	100	16.3%	(10.7, 23.9)
1-2 hours	171	27.8%	(22.9, 33.3)
More than 2 but less than 3 hours	135	22.0%	(16.6, 28.4)
3 hours or more	132	21.5%	(15.1, 29.6)
Child usually has sunscreen			
Never/rarely	610	98.7%	(97.0, 99.4)
Sometimes	5	0.8%	(0.3, 2.3)
All the time	3	0.5%	(0.2, 1.5)
Child's skin color			
Very white	14	2.3%	(1.0, 5.2)
White	194	31.4%	(24.3, 39.5)
Olive	312	50.5%	(42.7, 58.2)
Dark	94	15.2%	(11.5, 19.8)
Very dark/black	4	0.6%	(0.3, 1.6)
Head exposure sun index [c]			
10-19	241	39.2%	(30.9, 48.1)
0.01-9.9	272	44.2%	(37.9, 50.8)
0	102	16.6%	(13.2, 20.6)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.

Characteristic	n	% [a]	95% CI [b]

[b] CI=confidence interval calculated taking into account the complex sampling design.

[c] Because all school-age children were only asked about sun exposure to the head, the sun index for this age group is based only on this exposure, unlike other groups for whom the sun exposure includes exposure to the head, the arms, and in women, the hands.

4.4.14. Physical activity

School-age children generally like physical activities and outdoor playing, and the majority of caregivers consider their child to be equally or more active than his or her peers. More than two thirds of children were physically active for more than one hour per day (Table 4-35).

Table 4-35. Physical activity patterns in school-age children 6-12 years, Syrian camp refugees

Characteristic	n	% [a]	95% CI [b]
Child likes physical activity and outdoor playing			
Does not like	18	3.0%	(1.8, 4.7)
Likes	338	55.4%	(46.8, 63.7)
Likes a lot	254	41.6%	(33.4, 50.4)
Caregiver ranks child's activities relative to other children			
A lot less active	0	0.0%	--
Less active	27	4.4%	(2.8, 7.0)
Same	341	55.9%	(47.3, 64.2)
More active	242	39.7%	(31.9, 48.0)
A lot more active	0	0.0%	--
Time child typically spends physically active per day			
< 30 minutes	32	5.2%	(3.5, 7.7)
30-60 minutes	143	23.1%	(16.6, 31.3)
> 60 minutes	427	69.1%	(60.7, 76.4)
Don't know	16	2.6%	(0.8, 7.8)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] CI=confidence interval calculated taking into account the complex sampling design.

4.4.15. Risk factors for anemia and iron deficiency

Table 4-36 and Table 4-37 below show the association between various risk factors and anemia or iron deficiency in school-age children in the Syrian refugee camps. No significant association was found between anemia or iron deficiency and iron or multivitamin supplements, with the exception that children having consumed multivitamins in the previous 6 months are more likely to be iron deficient.

Table 4-36. Anemia and iron deficiency in school-age children 6-12 years, by vitamin and mineral supplement indicators, Syrian camp refugees

		Anemia		Iron deficiency	
Characteristic	n	% [a]	p-value [b]	% [a]	p-value [b]
Consumed iron tablets or syrup in past six months					
No	576	10.6%	0.173	34.8%	0.219
Yes	13	23.1%		53.8%	
Consumed multivitamins in past six months					
No	574	10.8%	0.455	34.3%	0.042
Yes	17	17.6%		58.8%	

Note: The N's are un-weighted numbers of all children with characteristic; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

Characteristic	n	Anemia % [a]	Anemia p-value [b]	Iron deficiency % [a]	Iron deficiency p-value [b]

[d] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups

[c] Analyses for this variable only include 25% of the households, as bread samples were only collected in a sub-sample.

Children with recent LRI were statistically significantly less likely to have iron deficiency than children without LRI. Anemia was about 3 times more common in children with iron deficiency compared to those without. Vitamin A deficiency was not significantly associated with anemia, and no other factors were significantly associated with anemia or iron deficiency.

Table 4-37. Correlation between various factors and anemia and iron deficiency in school-age children 6-12 years, Syrian camp refugees

Characteristic	n	% [a] anemic	p-value [b]	% [a] iron deficient	p-value [b]
Child had diarrhea					
Yes	22	0.0%	0.150	45.5%	0.334
No	564	11.2%		34.5%	
Child had fever					
Yes	109	11.0%	0.996	32.1%	0.566
No	482	11.0%		35.6%	
Child had lower respiratory infection					
Yes	75	6.7%	0.145	25.3%	0.038
No	508	11.6%		37.0%	
Child has inflammation					
Yes	144	10.4%	0.771	28.5%	0.067
No	445	11.2%		37.2%	
Child iron deficient					
Yes	207	18.4%	0.000		
No	382	7.1%			
Child vitamin A deficient					
Yes	42	19.0%	0.096	42.9%	0.306
No	547	10.4%		34.5%	
Child vitamin D insufficient or deficient					
Yes	340	10.3%	0.495	37.2%	0.251
No	240	12.5%		31.7%	
Child vitamin B12 deficient or marginal					
Yes	60	6.7%	0.415	31.7%	0.790
No	485	10.3%		33.3%	
Child zinc deficient					
Yes	51	11.8%	0.868	31.4%	0.523
No	517	11.0%		35.5%	

Note: The N's are un-weighted numbers (denominator) of all children with characteristic; the sum of subgroups may not equal the total because of missing data.

[a] Percentages and means are weighted for unequal probability of selection.

[b] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

Figure 4-12 illustrates the overlap between anemia and iron deficiency in these school age children, showing that over half of the anemic children had concurrent iron deficiency.

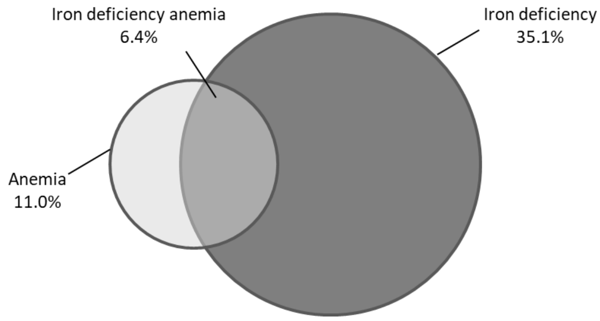

Figure 4-12. **Venn diagram showing overlap between anemia and iron deficiency in school-age children 6-12 years, Syrian camp refugees**

4.4.16. Correlation between physical activity and growth indices

The correlation between physical activities and overweight and/or obesity in Syrian refugee school children is presented in Table 4-38. No significant associations between obesity and/or overweight and any of the investigated risk factors were identified in this survey. The small number of children with underweight, stunting or wasting precluded the inclusion of those growth indices in the analyses.

Table 4-38. **Correlation between physical activities and growth indices among school-age children 6-12 years, Syrian camp refugees**

Characteristic	N	% [a] Obese	% [a] Overweight	p-value [b]	% [a] Overweight or obese	p-value [b]
Child likes physical activity and outdoor playing						
Does not like	17	5.9%	35.3%	0.313	41.2%	0.245
Likes	331	6.9%	16.6%		23.6%	
Likes a lot	248	5.2%	13.3%		18.5%	
Caregiver ranks child's activities relative to other children						
Less active	27	3.7%	18.5%	0.252	22.2%	0.176
Same	332	8.4%	17.2%		25.6%	
More active	237	3.4%	13.9%		17.3%	
Time child typically spends physically active per day						
< 30 minutes	32	3.1%	34.4%	0.229	37.5%	0.266
30-60 minutes	137	9.5%	16.1%		25.5%	
> 60 minutes	419	5.5%	15.0%		20.5%	
Don't know	16	6.3%	0.0%		6.3%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[d] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

4.4.17. Correlation between sun exposure and vitamin D deficiency

Children with higher sun exposure are about 5 times less likely to be vitamin D deficient, while the prevalence of vitamin D insufficiency did not vary to the same extent (Table 4-39).

Table 4-39. Association between sun exposure and vitamin D deficiency in school-age children 6-12 years, Syrian camp refugees

Characteristic	N	% [a] VDD	% [a] VD insufficient	p-value [b]	% [a] VDD/insufficient	p-value [b]
Head sun exposure index						
0	100	43.0%	38.0%	0.000	81.0%	0.000
0.01 – 9.9	256	11.7%	46.1%		57.8%	
10-19	223	7.6%	42.2%		49.8%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

[c] Analyses for this variable only include 25% of the households, as bread samples were only collected in a sub-sample.

4.6. Non-pregnant women (Syrian camp refugees)

4.6.1. Characteristics

Among non-pregnant women 15-49 years of age, the age group 15-19 years of age is disproportionately large. Almost three quarters of women have had only elementary education and are currently married. Of married women, over 95% have ever been pregnant. Of those having given birth to a child, one third were breastfeeding at the time of the survey. Just over half of women with a blood sample have no elevated inflammatory markers.

Table 4-40. Description of non-pregnant women 15 - 49 years, Syrian camp refugees

Characteristic	Number of women	% [a]	95% CI [b]
Age (in years)			
15-19	58	21.6%	(16.9, 27.3)
20-24	33	12.3%	(8.3, 17.8)
25-29	36	13.4%	(9.3, 18.9)
30-34	38	14.2%	(10.3, 19.1)
35-39	44	16.4%	(12.3, 21.5)
40-44	32	11.9%	(8.5, 16.5)
45-49	27	10.1%	(7.5, 13.5)
Camp			
Marieeb al Fhood	11	3.9%	(0.9, 16.1)
Azraq	55	19.7%	(10.0, 35.2)
Zaatari	213	76.3%	(60.4, 87.2)
Wealth Quintile			
Poorest	53	20.2%	(11.9, 32.2)
Second	38	14.5%	(9.3, 22.0)
Middle	59	22.5%	(16.0, 30.7)
Fourth	55	21.0%	(14.3, 29.7)
Wealthiest	57	21.8%	(13.6, 32.9)
Woman's education			
Elementary	165	73.0%	(66.9, 78.4)
Secondary	49	21.7%	(16.8, 27.5)
Higher	12	5.3%	(3.1, 8.9)
Marital Status			
Never married	51	19.0%	(15.4, 23.3)
Currently married	200	74.6%	(68.2, 80.2)
Widowed	8	3.0%	(1.3, 6.7)
Divorced or separated	9	3.4%	(1.6, 7.1)
Number of times been pregnant [c]			
0	9	4.5%	(2.3, 8.8)
1-2	44	22.0%	(16.3, 29.1)
3-4	46	23.0%	(16.7, 30.7)
5-6	55	27.5%	(21.5, 34.4)
7+	46	23.0%	(17.9, 29.0)
Number of times given birth [d]			
0	2	1.0%	(0.3, 4.1)
1-2	46	24.1%	(17.4, 32.4)
3-4	52	27.2%	(20.7, 34.9)
5-6	60	31.4%	(24.5, 39.3)
7+	31	16.2%	(12.1, 21.4)

Characteristic	Number of women	% [a]	95% CI [b]
Currently breastfeeding a child [e]			
Yes	63	33.3%	(26.5, 40.9)
No	126	66.7%	(59.1, 73.5)
Inflammation stage [f]			
None (Neither CRP nor AGP elevated)	150	58.8%	(53.4, 64.1)
Incubation (CPR elevated, AGP normal)	22	8.6%	(5.9, 12.5)
Early convalescence (both CPR and AGP elevated)	40	15.7%	(11.8, 20.5)
Late convalescence (CRP normal, AGP elevated)	43	16.9%	(12.2, 22.8)

[a] Percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Among currently married women
[d] Among currently married women who reported a prior pregnancy
[e] Among currently married women who reported a prior birth
[f] Only available for these women with a successful blood draw.

4.6.2. Bread consumption and iron intake from bread

Results of bread consumption and iron intake from bread for non-pregnant women in the refugee camp population are shown in Table 4-41. Overall, about 30% of additional RNI comes from bread consumption, without statistically significant differences by camp of residence or household wealth.

Table 4-41. Mean daily bread intake, and iron intake from bread, as well as estimated %RNI for non-pregnant women, by various factors, Syrian camp refugees

Characteristic	Median daily bread intake (g); n=269 [a, c]	P value [b]	Median % RNI of iron for non-pregnant woman; n=135 [a, c]	P value [b]
Total	328.7		30.8%	
Camp [d]				
Azraq	366.9	0.033	32.5%	0.125
Zaatari	308.6		26.8%	
Wealth Quintile				
Lowest	344.5	0.891	32.1%	0.178
Second	356.5		27.1%	
Middle	321.8		23.1%	
Fourth	289.0		36.7%	
Highest	331.9		28.6%	

[a] Medians and percentages weighted for unequal probability of selection.
[b] P-values are calculated using non-parametric median test; p-value <0.05 indicates that the median in at least one subgroup is statistically significantly different from the values in the other subgroups.
[c] The recommended nutrient intake iron in women is as follows (assuming 12% bioavailability): 15-17 years: 25.8 mg/d; 18-50 years: 24.5 mg/d[(60)]; note that bread was collected only in a sub-sample of households, explaining the lower number.
[d] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.6.4. Anemia, iron deficiency, and iron deficiency anemia

Table 4-42 shows the prevalence of anemia, iron deficiency and iron deficiency anemia for non-pregnant women residing in Syrian refugee camps. Just over a third of women are anemic and over two thirds are iron deficient. This prevalence of anemia is classified of 'moderate' public health importance as per WHO criteria [(42)]. Severe anemia is rare, but moderate anemia is prevalent in this population group (Table 4-43).

Although there is neither statistical significance nor a clear dose-response relationship for either factor, there is some suggestion that there is a higher prevalence of anemia in older women and women in wealthier households. No other demographic factors investigated here are significantly associated with anemia, iron deficiency, or iron deficiency anemia. Among anemic non-pregnant women in refugee camps, the prevalence of iron deficiency was 86.8% (95% CI: 77.9, 92.5, n=91).

The distribution of hemoglobin concentrations is shown in Figure 4-13. The mean hemoglobin concentration among all non-pregnant women residing in the refugee camps is 123.1 g/L (95%CI 121.0, 125.2).

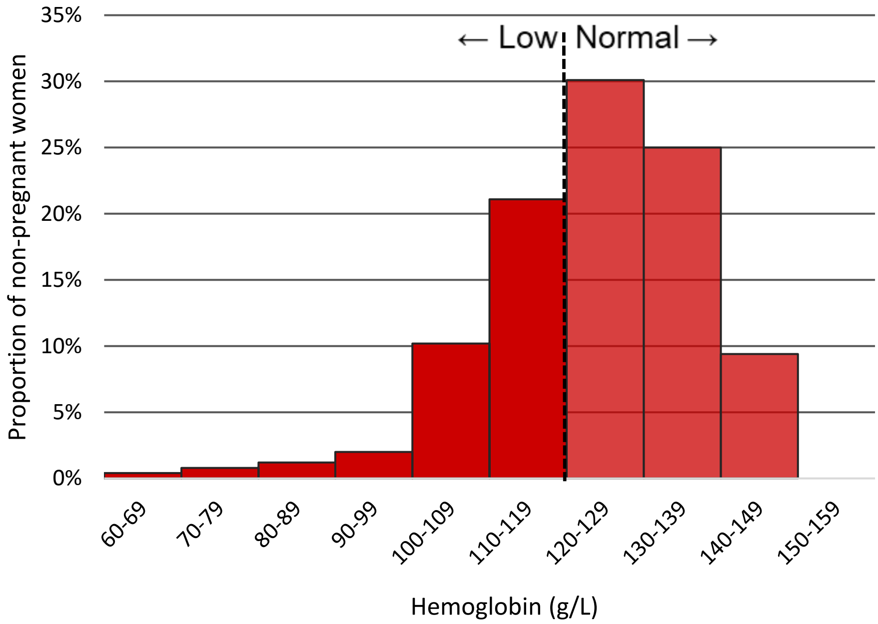

Figure 4-13. Distribution of hemoglobin values in non-pregnant women 15-49 years of age, Syrian camp refugees

Table 4-42. Prevalence of anemia, iron deficiency, and iron deficiency anemia in non-pregnant women 15-49 years of age, by various demographic characteristics, Syrian camp refugees

	Anemia [a]				Iron deficiency [e]				Iron deficiency anemia [f]			
Characteristic	**n**	**% [b]**	**95% CI [c]**	**p-value [d]**	**n**	**% [b]**	**95% CI [c]**	**p-value [d]**	**n**	**% [b]**	**95% CI [c]**	**p-value [d]**
TOTAL	256	35.5%	(28.7, 43.0)		255	68.2%	(61.1, 74.6)		256	30.9%	(24.2, 38.4)	
Age (in years)												
15-19	57	29.8%	(18.5, 44.3)	0.009	57	80.7%	(66.3, 89.9)	0.188	57	29.8%	(18.5, 44.3)	0.129
20-24	33	36.4%	(21.8, 54.0)		33	57.6%	(40.8, 72.8)		33	27.3%	(16.3, 42.0)	
25-29	34	29.4%	(16.9, 46.1)		34	70.6%	(52.3, 84.0)		34	23.5%	(12.1, 40.8)	
30-34	35	20.0%	(9.7, 36.8)		34	55.9%	(39.2, 71.3)		35	20.0%	(9.7, 36.8)	
35-39	41	36.6%	(23.9, 51.4)		41	68.3%	(49.3, 82.7)		41	34.1%	(21.5, 49.5)	
40-44	31	64.5%	(47.2, 78.7)		31	74.2%	(53.2, 87.9)		31	51.6%	(32.5, 70.3)	
45-49	25	40.0%	(22.8, 60.1)		25	60.0%	(39.0, 77.9)		25	32.0%	(16.3, 53.2)	
Camp [g]												
Azraq	50	34.0%	(23.9, 45.8)	0.782	50	62.0%	(44.5, 76.9)	0.379	50	30.0%	(21.0, 40.9)	0.870
Zaatari	206	35.9%	(28.0, 44.7)		205	69.8%	(62.1, 76.5)		206	31.1%	(23.4, 40.0)	
Wealth quintile												
Poorest	43	30.2%	(18.8, 44.9)	0.837	43	53.5%	(37.1, 69.1)	0.130	43	20.9%	(12.4, 33.1)	0.510
Second	36	30.6%	(18.6, 45.8)		36	63.9%	(49.3, 76.3)		36	30.6%	(18.6, 45.8)	
Middle	59	39.0%	(23.3, 57.3)		58	69.0%	(56.2, 79.4)		59	37.3%	(21.9, 55.7)	
Fourth	55	36.4%	(23.4, 51.7)		55	76.4%	(63.4, 85.8)		55	29.1%	(17.9, 43.6)	
Wealthiest	57	38.6%	(26.0, 52.9)		57	71.9%	(58.0, 82.6)		57	33.3%	(21.3, 48.0)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection.
[b] Anemia defined as hemoglobin < 120 g/L adjusted for altitude and smoking.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.
[e] Iron deficiency defined as serum ferritin < 15 µg/l after adjustment for inflammation.
[f] Iron deficiency anemia defined as serum ferritin < 15 µg/L and hemoglobin < 120 g/L.
[g] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

Table 4-43. Severity of anemia in non-pregnant women 15-49 years of age, by various demographic characteristics, Syrian camp refugees

Characteristic	Mild anemia [b]			Moderate anemia [b]			Severe anemia [b]		
	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]
TOTAL	54	21.1	(15.3, 28.4)	34	13.3	(9.7, 18.0)	3	1.2	(0.3, 5.1)
Age (in years)									
15-19	7	12.3	(5.6, 24.9)	8	14.0	(7.0, 26.0)	2	3.5	(0.5, 21.8)
20-24	5	15.2	(6.1, 33.0)	7	21.2	(9.6, 40.6)	0	0.0	-
25-29	8	23.5	(13.0, 38.7)	2	5.9	(1.5, 20.2)	0	0.0	-
30-34	5	14.3	(6.1, 29.8)	2	5.7	(1.3, 22.0)	0	0.0	-
35-39	10	24.4	(13.8, 39.5)	5	12.2	(4.9, 27.3)	0	0.0	-
40-44	14	45.2	(31.8, 59.3)	6	19.4	(10.5, 33.0)	0	0.0	-
45-49	5	20.0	(8.8, 39.3)	4	16.0	(6.0, 36.2)	1	4.0	(0.5, 23.9)
Camp[d]									
Azraq	11	22.0	(12.5, 35.8)	6	12.0	(6.3, 21.6)	0	0.0	-
Zaatari	43	20.9	(14.3, 29.5)	28	13.6	(9.5, 19.1)	3	1.5	(0.3, 6.2)
Wealth quintile									
Poorest	8	18.6	(10.9, 30.0)	5	11.6	(5.3, 23.5)	0	0.0	-
Second	5	13.9	(6.1, 28.4)	6	16.7	(8.3, 30.5)	0	0.0	-
Middle	15	25.4	(13.4, 43.0)	8	13.6	(5.2, 30.8)	0	0.0	-
Fourth	7	12.7	(6.4, 23.8)	10	18.2	(10.6, 29.3)	3	5.5	(1.3, 19.8)
Wealthiest	18	31.6	(21.4, 44.0)	4	7.0	(3.0, 15.8)	0	0.0	-

Note: The n's are the numerators for a specific sub-group.

[a] All percentages except region-specific estimates are weighted for unequal probability of selection among strata.

[b] Mild, moderate, and severe anemia defined as hemoglobin 110-119 g/L, 80-109 g/L, and <80 g/L, respectively.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.6.5. Vitamin A deficiency

Only 2.7% (95%CI: 1.2, 5.9; n=7) of non-pregnant women 15-49 years residing in Syrian refugee camps are vitamin A deficient. As such, no sub-group analyses for vitamin A deficiency was conducted. Figure 4-14 shows the distribution of the RBP values. The mean concentration of retinol-binding protein among non-pregnant women in the camps is 1.35 µmol/L (95% CI: 1.30, 1.40).

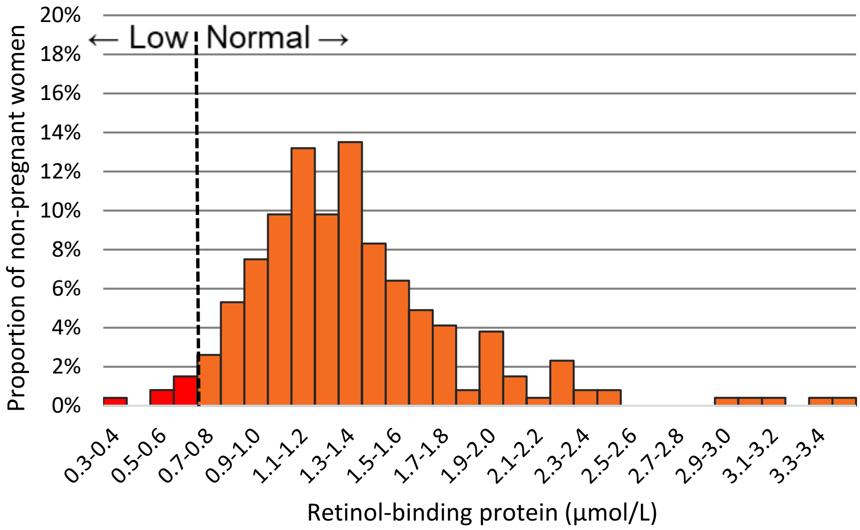

Figure 4-14. Distribution of inflammation-adjusted RBP values in non-pregnant women 15-49 years of age, Syrian camp refugees

4.6.6. Folate and vitamin B12 deficiency

Serum folate deficiency occurs in 5.1% (95% CI: 3.1, 8.4) of non-pregnant women 15-49 years of age in the Syrian refugee camps. Due to the low numbers of women with folate deficiency, no further sub-group analyses are presented. The geometric mean serum folate concentration is 8.7 ng/mL (95%CI: 8.3, 9.1)

Vitamin B12 deficiency was more common that folate deficiency, and marginal vitamin B12 status was found in almost one-third of women. There is a suggestion of a progressive rise in vitamin B12 deficiency with age, albeit without statistical significance. The same was not true for marginal B12 status. There was no statistically significant difference in the prevalence of vitamin B12 deficiency or marginal B12 status by camp of residence or household wealth.

The geometric mean of vitamin B12 values is 317.5 pg/mL (95%CI: 296.2, 340.4).

Table 4-44. Prevalence of vitamin B12 deficiency in non-pregnant women 15-49 years of age, by various demographic characteristics, Syrian camp refugees

Characteristic	N	B12 deficiency [a]		Marginal B12 status [a]			B12 deficiency or marginal status [a]		
		% [b]	95% CI [c]	% [b]	95% CI [c]	p-value [d]	% [b]	95% CI [c]	p-value [d]
TOTAL	253	12.3%	(9.2, 16.2)	30.4%	(23.8, 30.8)		42.7%	(34.5, 51.3)	
Age (in years)									
15-19	56	5.4%	(1.2, 20.9)	23.2%	(12.8, 38.4)	0.100	28.6%	(16.0, 45.7)	0.109
20-24	33	9.1%	(2.9, 25.0)	30.3%	(18.8, 44.9)		39.4%	(26.4, 54.1)	
25-29	33	9.1%	(2.7, 26.2)	42.4%	(26.0, 60.7)		51.5%	(33.1, 69.5)	
30-34	34	14.7%	(6.6, 29.5)	23.5%	(12.6, 39.6)		38.2%	(23.1, 56.1)	
35-39	41	12.2%	(5.6, 24.7)	34.1%	(20.4, 51.3)		46.3%	(27.9, 65.8)	
40-44	31	25.8%	(4.6, 41.5)	19.4%	(8.6, 38.1)		45.2%	(29.3, 62.1)	
45-49	25	16.0%	(6.0, 36.3)	48.0%	(30.9, 65.5)		64.0%	(44.0, 80.1)	
Camp [e]									
Azraq	48	8.3%	(4.2, 15.7)	25.0%	(15.2, 38.2)	0.250	33.3%	(21.5, 47.7)	0.176
Zaatari	205	13.2%	(9.6, 17.8)	31.7%	(24.1, 40.4)		44.9%	(35.4, 54.8)	
Wealth quintile									
Poorest	41	14.6%	(7.7, 26.0)	26.8%	(16.8, 40.0)	0.959	41.5%	(29.3, 54.7)	0.936
Second	36	8.3%	(2.7, 23.0)	30.6%	(15.3, 51.7)		38.9%	(22.7, 58.0)	
Middle	58	15.5%	(8.4, 26.9)	31.0%	(19.0, 46.3)		46.6%	(31.6, 62.1)	
Fourth	55	12.7%	(5.2, 28.0)	30.9%	(22.1, 41.4)		43.6%	(29.6, 58.8)	
Wealthiest	57	8.8%	(3.5, 20.1)	31.6%	(18.1, 49.2)		40.4%	(26.0, 56.6)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Vitamin B12 deficiency defined as plasma B12 <150 pmol/L (<203 pg/mL); marginal status as 150-220 pmol/L (203-297 pg/mL).
[b] Percentages weighted for unequal probability of selection.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.
[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.6.7. Vitamin D deficiency and insufficiency

Table 4-45 shows that almost 6 out of 10 women are vitamin D deficient and 9 out of 10 have sub-optimal vitamin D status. There is little association between age or household wealth and either vitamin D deficiency or vitamin D insufficiency. On the other hand, women residing in the Zaatari camp have considerably more vitamin D deficiency, although the prevalence of vitamin D insufficiency prevalence is comparable. The geometric mean of the vitamin D values is 11.2 ng/mL (95%CI: 10.5, 12.0).

Table 4-45. Prevalence of vitamin D deficiency and insufficiency in non-pregnant women 15-49 years of age, by various demographic characteristics, Syrian camp refugees

Characteristic	N	Deficient % [a]	Deficient 95% CI [b]	Insufficient % [a]	Insufficient 95% CI [b]	p-value [c]	Deficient or insufficient % [a]	Deficient or insufficient 95% CI [b]	p-value [c]
TOTAL	254	56.3%	(49.8, 62.6)	33.9%	(28.2, 40.0)		90.2%	(85.3, 93.6)	
Age (in years)									
15-19	57	56.1%	(44.2, 67.4)	33.3%	(22.7, 46.0)	0.927	89.5%	(79.7, 94.8)	0.789
20-24	33	54.5%	(38.5, 69.7)	33.3%	(18.6, 52.3)		87.9%	(70.2, 95.7)	
25-29	33	57.6%	(40.6, 72.9)	33.3%	(21.0, 48.5)		90.9%	(76.3, 96.9)	
30-34	34	64.7%	(45.6, 80.0)	32.4%	(19.3, 48.9)		97.1%	(82.4, 99.6)	
35-39	41	56.1%	(41.2, 69.9)	34.1%	(21.0, 50.2)		90.2%	(78.5, 95.9)	
40-44	31	58.1%	(40.8, 73.5)	29.0%	(15.0, 48.7)		87.1%	(69.5, 95.2)	
45-49	25	44.0%	(26.2, 63.5)	44.0%	(25.9, 63.9)		88.0%	(66.8, 96.4)	
Camp [d]									
Azraq	50	34.0%	(22.9, 47.2)	48.0%	(32.3, 64.1)	0.002	82.0%	(72.8, 88.6)	0.021
Zaatari	204	61.8%	(54.4, 68.6)	30.4%	(24.6, 36.9)		92.2%	(86.3, 95.6)	
Wealth quintile									
Poorest	43	55.8%	(38.6, 71.7)	34.9%	(21.0, 51.8)	0.938	90.7%	(77.4, 96.5)	0.880
Second	35	54.3%	(35.5, 71.9)	37.1%	(21.4, 56.1)		91.4%	(76.6, 97.2)	
Middle	58	51.7%	(38.8, 64.4)	36.2%	(24.2, 50.2)		87.9%	(76.3, 94.3)	
Fourth	55	65.5%	(50.7, 77.7)	27.3%	(17.2, 40.3)		92.7%	(76.5, 98.0)	
Wealthiest	57	54.4%	(39.2, 68.8)	33.3%	(20.2, 49.8)		87.7%	(76.1, 94.1)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages weighted for unequal probability of selection; <12 ng/mL, deficiency; <20 ng/mL, insufficiency.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.
[d] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.6.8. Undernutrition and overweight

As is shown in Figure 4-15, undernutrition is rare in non-pregnant women 15-49 years. Thus, no further sub-group analyses were conducted of undernutrition.

Conversely, overweight and obesity are highly prevalent in non-pregnant women (Table 4-46). Moreover, there is a progressive rise in the prevalence of obesity with age, but such a dose-response relationship is not seen with overweight. Differences in the prevalence of overweight and obesity by camp of residence and household wealth are insubstantial. Figure 4-16 shows the distribution of BMI values in this population.

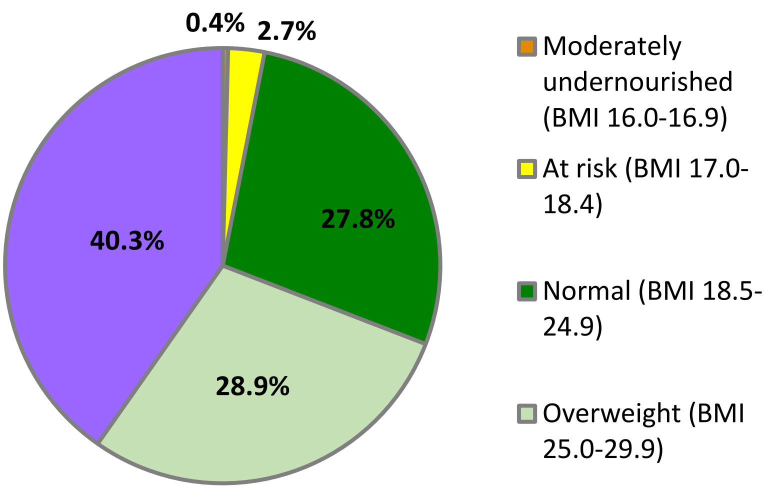

Figure 4-15. Underweight and overweight based on BMI in non-pregnant women 15-49 years of age, Syrian camp refugees

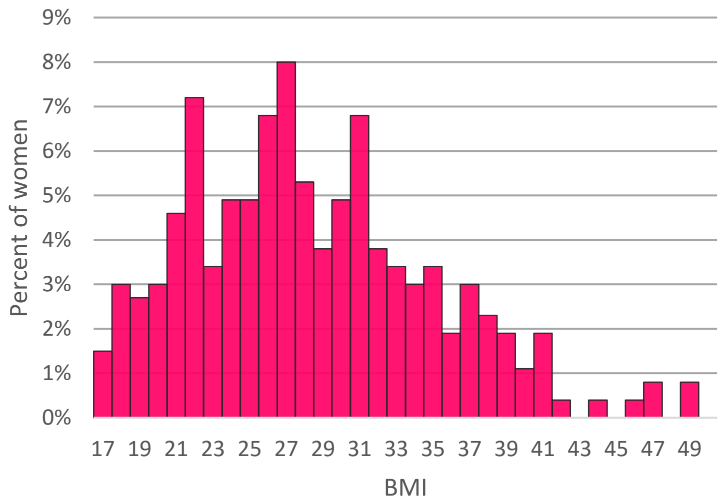

Figure 4-16. Distribution of BMI values in non-pregnant women 15-49 years of age, Syrian camp refugees

Table 4-46. Prevalence of low and high BMI in non-pregnant women 15-49 years of age, by various demographic characteristics, Syrian camp refugees

Character-istic		Overweight [b]		Obese [b]			Overweight or obese (BMI 25+)		
	N	% [a]	95% CI [c]	% [a]	95% CI [c]	p-value [d]	% [a]	95% CI [c]	P value [d]
TOTAL	263	28.9%	(23.9, 34.5)	40.3%	(34.4, 46.5)		69.2%	(64.0, 73.9)	
Age (in years)									
15-19	58	25.9%	(15.4, 40.1)	10.3%	(4.4, 22.6)	0.000	36.2%	(24.5, 49.8)	0.000
20-24	33	33.3%	(19.4, 50.9)	15.2%	(5.7, 34.3)		48.5%	(29.2, 68.2)	
25-29	36	33.3%	(18.2, 53.0)	47.2%	(30.6, 64.5)		80.6%	(63.1, 90.9)	
30-34	35	34.3%	(20.5, 51.4)	42.9%	(29.3, 57.5)		77.1%	(59.7, 88.5)	
35-39	43	27.9%	(14.5, 46.8)	53.5%	(39.2, 67.3)		81.4%	(66.0, 90.8)	
40-44	31	32.3%	(18.2, 50.5)	61.3%	(43.6, 76.4)		93.5%	(76.6, 98.5)	
45-49	27	14.8%	(6.0, 32.3)	77.8%	(57.6, 90.0)		92.6%	(76.4, 98.0)	
Camp [e]									
Azraq	54	33.3%	(23.1, 45.4)	37.0%	(26.5, 49.0)	0.612	70.4%	(60.9, 78.4)	0.779
Zaatari	209	27.8%	(22.2, 34.1)	41.1%	(34.4, 48.2)		68.9%	(62.9, 74.3)	
Wealth quintile									
Poorest	51	31.4%	(24.1, 39.7)	35.3%	(25.3, 46.8)	0.124	66.7%	(54.8, 76.7)	0.421
Second	36	27.8%	(15.8, 44.2)	44.4%	(31.4, 58.3)		72.2%	(58.3, 82.9)	
Middle	58	37.9%	(27.8, 49.3)	32.8%	(23.1, 44.1)		70.7%	(58.9, 80.2)	
Fourth	55	14.5%	(8.6, 23.6)	47.3%	(33.0, 62.0)		61.8%	(49.0, 73.2)	
Wealthiest	57	31.6%	(19.6, 46.6)	43.9%	(31.8, 56.7)		75.4%	(65.0, 83.5)	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Severe undernutrition defined as BMI <16.0; moderate undernutrition defined as BMI 16.0-16.9; at risk of undernutrition defined as BMI 17.0-18.5; normal BMI defined as BMI 18.5 – 24.9; overweight defined as BMI 25.0-29.9; obese defined as BMI $\geq$30.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] Chi-square p-value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.6.9. Dietary diversity and supplement consumption or injection

Non-pregnant women residing in the camps consumed, on average, 4.7 food groups in the 24 hours prior to the interview. Over half of them met the minimum dietary diversity (Table 4-47). Consumption of oral vitamin and mineral supplements was not common; the most commonly consumed supplement was iron, reported by only 10% of women. Less than one in ten women had ever received a vitamin B12 injection.

Table 4-47. Measures of dietary diversity in non-pregnant women 15 - 49 years, Syrian camp refugees

Characteristic	N	Mean or % [a]	95% CI [b]
Number of MDD-W [c] food groups consumed (mean)	268	4.69	(4.40, 4.98)
Meets minimum dietary diversity (MDD-W, 5+ food groups)			
Yes	147	54.9%	(47.3, 62.2)
No	121	45.1%	(37.8, 52.7)
Consumed iron tablets or syrup in past three months			
Yes	29	10.8%	(7.1, 16.1)
No	239	89.2%	(83.9, 92.9)
Consumed folic acid tablets or syrup in past three months			
Yes	4	1.5%	(0.5, 4.1)
No	262	98.5%	(95.9, 99.5)
Consumed vitamin A tablets in past six months			
Yes	4	1.5%	(0.6, 3.7)
No	263	98.5%	(96.3, 99.4)
Consumed vitamin D tablets or syrup in past six months			
Yes	16	6.0%	(3.0, 11.7)
No	251	94.0%	(88.3, 97.0)
Consumed multivitamin tablets in past six months			
Yes	13	4.9%	(2.8, 8.4)
No	253	95.1%	(91.6, 97.2)
Ever had a vitamin B12 injection			
Yes	19	7.1%	(4.5, 11.1)
No	247	92.2%	(88.0, 95.0)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.
[a] Means and percentages weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.
[c] MDD-W = Minimum dietary diversity for women as recommended in FAO and FHI 360[64].

4.6.10. Physical activity and sleep

Non-pregnant women residing in Syrian refugee camps spend on average almost 3.5 hours in front of a screen (television, video or computer), but almost half of them report not watching TV while eating (Table 4-48). Conversely, almost two thirds report having a TV in the room where they sleep.

Overall, women in this group tend to have a rather sedentary lifestyle: the majority of women report no METs at all. Among those women who did report some METs, the mean METs per week was quite high. Overall, few women met the WHO recommendations on physical activity for health and even fewer routinely undertook vigorous physical activity. Women also spend considerable time with sedentary activities.

Table 4-48. Physical activity and sleep patterns in non-pregnant women 15-49 years of age, Syrian camp refugees

Characteristic	n	% or mean [a]	95% CI [b]
Hours of television or video watching per day (mean)	278	2.45	(2.15, 2.80)
Hours of video or computer games per day (mean)	276	1.03	(0.76, 1.30)
Watch television while eating			
No or rarely	122	45.5%	(37.8, 53.3)
1 meal per day	90	33.6%	(26.7, 41.2)
2 meals per day	15	5.6%	(3.2, 9.6)
3 or more meals per day	35	13.1%	(7.9, 20.8)
Television or computer in bedroom			
Yes	160	59.7%	(49.8, 68.9)
No	108	40.3%	(31.1, 50.2)
Categories of METs (minutes per week) [c]			
0	190	72.5%	(61.1, 81.6)
0.01-600	36	13.7%	(9.1, 20.3)
600+	36	13.7%	(8.5, 21.4)
Among women with non-0 METs, mean METs per week[c]	72	1234	(745, 1722)
Meeting WHO recommendations on physical activity for health[c]			
Yes	36	13.7%	(8.5, 21.4)
No	226	86.3%	(78.6, 91.5)
Undertakes any vigorous physical activity			
Yes	9	3.4%	(1.5, 7.5)
No	257	96.6%	(92.5, 98.5)
Sedentary activities on average per day (mean), hours	244	4.21	(3.68, 4.74)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.

[a] Means and percentages weighted for unequal probability of selection.

[b] CI=confidence interval calculated taking into account the complex sampling design.

[c] MET = Metabolic equivalent of task, as per [58].

4.6.11. Sun exposure

Almost all women cover their head and arms whenever outside, but three quarters do not cover their hands. In addition, the large majority of women spend at least some time outdoors under the sun each day and never or rarely use sunscreen. As a result, in spite of covering head and arms, about two thirds of women have a sun exposure index greater than 0.

Table 4-49. Sun exposure in non-pregnant women 15-49 years of age, Syrian camp refugees

Characteristic	n	% [a]	95% CI [b]
Usually protect head from sun when outside			
Never/rarely	1	0.4%	(0.0, 2.8)
Sometimes	2	0.7%	(0.2, 3.0)
Most of the time	1	0.4%	(0.0, 2.8)
All the time	264	98.5%	(96.2, 99.4)
How usually protect head from sun			
Scarf/headcloth	267	100.0%	(100.0, 100.0)
Usually cover arms when outside			
Never/rarely	2	0.7%	(0.1, 5.6)
Sometimes	1	0.4%	(0.0, 2.8)
Most of the time	9	3.4%	(1.5, 7.3)
All the time	256	95.5%	(90.8, 97.9)
Usually cover hands when outside			
Never/rarely	193	72.0%	(59.3, 82.0)
Sometimes	6	2.2%	(1.0, 4.9)
Most of the time	2	0.7%	(0.2, 3.0)
All the time	67	25.0%	(15.5, 37.8)
How much time per day spend under the sun			
None	21	7.8%	(4.9, 12.3)
1-29 minutes	63	23.5%	(18.6, 29.2)
30-59 minutes	65	24.3%	(18.1, 31.8)
1-<2 hours	71	26.5%	(21.7, 31.9)
More than 2 hours	48	17.9%	(12.1, 25.6)
Usually use sunscreen			
Never / rarely	245	91.4%	(84.7, 95.3)
Sometimes	10	3.7%	(1.7, 8.2)
Most of the time	6	2.2%	(0.9, 5.3)
All the time	7	2.6%	(1.0, 6.8)
Sun exposure index			
2.0+	57	21.3%	(15.5, 28.4)
0.5-1.99	80	29.9%	(21.6, 39.6)
0.01-0.49	44	16.4%	(11.6, 22.7)
0	87	32.5%	(23.1, 43.4)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.

[a] Means and percentages weighted for unequal probability of selection.

[b] CI=confidence interval calculated taking into account the complex sampling design.

4.6.12. Risk factors for anemia and iron deficiency

Table 4-50 shows the analysis of several possible risk factors with anemia and iron deficiency. Women with inflammation are more likely to be anemic but somewhat less likely to be iron deficient. Iron deficient women are more than 3 times more likely to be anemic than their iron replete peers. Women with vitamin A or vitamin D deficiency or insufficiency are more likely to be anemic. On the other hand, vitamin A deficient women are significantly less likely to have iron deficiency, and vitamin D deficiency or insufficiency is not statistically significantly associated with iron deficiency.

Having consumed multivitamin supplements in the past six months was significantly associated with iron deficiency, in the direction opposite to that expected.

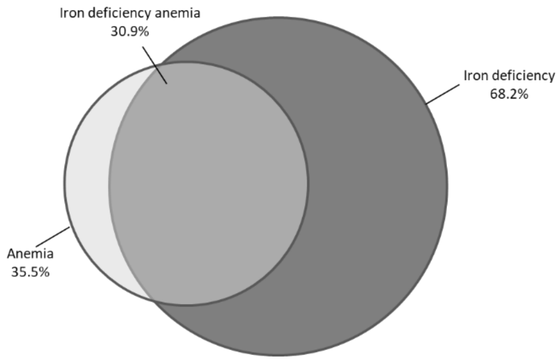

Figure 4-17. **Venn diagram showing overlap between anemia and iron deficiency in non-pregnant women 15-49 years of age, Syrian camp refugees**

Table 4-50. **Correlation between various factors and anemia and iron deficiency in non-pregnant women 15-49 years of age, Syrian camp refugees**

Characteristic	n	% [a] anemic	p-value [b]	% [a] ID	p-value [b]
Woman's household has adequate sanitation					
Yes	225	35.1%	0.788	69.2%	0.171
No	24	37.5%		58.3%	
Woman is overweight or obese					
Yes	177	36.7%	0.557	67.8%	0.832
No	78	33.3%		69.2%	
Woman has inflammation					
Yes	105	41.9%	0.042	61.9%	0.082
No	150	31.3%		72.7%	
Woman is iron deficient					
Yes	174	45.4%	0.000		
No	81	14.8%			
Woman is vitamin A deficient					
Yes	7	85.7%	0.011	28.6%	0.009
No	248	34.3%		69.4%	
Woman is vitamin D deficient or insufficient					
Yes	229	38.0%	0.030	69.9%	0.112
No	25	16.0%		56.0%	
Woman is folate deficient					
Yes	14	42.9%	0.553	57.1%	0.406
No	239	35.6%		69.0%	
Woman is vitamin B12 deficient					
Yes	31	48.4%	0.076	74.2%	0.479
No	222	34.2%		67.6%	
Consumed iron tablets or syrup in past three months					
Yes	27	40.7%	0.589	70.4%	0.804
No	229	34.9%		68.0%	
Consumed multivitamins in past six months					
Yes	12	33.3%	0.884	41.7%	0.036
No	242	35.5%		69.3%	

Note: The n's are un-weighted numbers (denominator) in each subgroup; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] P-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

4.6.13. Risk factors for overweight and obesity

An analysis for risk factors for overweight and obesity is shown below in Table 4-51. Time spent on screens, watching television while eating, and meeting the WHO minimum recommendations are not statistically signficantly associated with overweight or obesity. On the other hand, women who spend more time sitting are significantly more likely to be overweight or obese.

Table 4-51. Correlation between various factors and overweight and obesity in non-pregnant women 15-49 years of age, Syrian camp refugees

Characteristic	N	% [a] overweight or obese	p-value [b]
Average hours per day watching video or playing computer games			
>2 hours	146	69.2%	0.688
≤ 2 hours	114	71.1%	
Ever watch television while eating			
Yes	135	64.4%	0.055
No	122	73.8%	
Average hours per day sitting			
>4 hours	92	77.2%	0.003
≤ 4 hours	148	62.8%	
Meeting WHO recommendations on physical activity for health [c]			
Yes	35	65.7%	0.597
No	222	69.8%	

Note: The n's are un-weighted numbers (denominator) in each subgroup; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] P-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

[c] As per [58].

4.6.14. Correlation between sun exposure and vitamin D deficiency

No association between sun exposure and vitamin D deficiency or insufficiency was found in non-pregnant women residing camps.

Table 4-52. Association between sun exposure and vitamin D deficiency in non-pregnant women 15-49 years of age, Syrian camp refugees

Characteristic	N	% [a] VDD	% [a] VD insufficient	p-value [b]	% [a] VDD/insufficient	p-value [b]
Sun exposure index						
>2.0	54	55.6%	33.3%	0.822	88.9%	0.818
0.5-1.99	76	55.3%	32.9%		88.2%	
0.01-0.49	44	65.9%	27.3%		93.2%	
0	80	52.5%	38.8%		91.3%	

Note: The n's are un-weighted numbers (denominator) for each subgroup; subgroups that do not sum to the total have missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Chi-square p-value <0.05 indicates that the proportion in at least one subgroup is statistically significantly different from the values in the other subgroups.

4.8. Pregnant women (Syrian camp refugees)

4.8.1. Characteristics

A total of 73 pregnant women were enrolled into the survey. Almost one half of women were 20-29 years. Three quarters of pregnant women have only an elementary school education. Although the largest proportion of women were in the second trimester, the sample included many women in the first trimester. Most women had been pregnant and given birth before the current pregnancy.

Table 4-53. Description of pregnant women, Syrian camp refugees

Characteristic	n	% [a]	95% CI [b]
Age (in years)			
15-19	14	19.7%	(12.6, 29.5)
20-29	33	46.5%	(34.4, 59.0)
30-39	22	31.0%	(21.5, 42.4)
40+	2	2.8%	(0.6, 11.7)
Camp			
Marieeb	2	2.7%	(0.3, 19.1)
Azraq	13	17.8%	(7.4, 36.9)
Zaatari	58	79.5%	(60.1, 90.9)
Wealth Quintile			
Poorest	13	19.1%	(8.6, 37.3)
Second	13	19.1%	(10.0, 33.3)
Middle	19	27.9%	(17.7, 41.2)
Fourth	12	17.6%	(10.1, 29.1)
Wealthiest	11	16.2%	(7.8, 30.6)
Woman's education			
Elementary	48	77.4%	(64.5, 86.6)
Secondary	10	16.1%	(8.4, 28.7)
Higher	4	6.5%	(2.5, 15.6)
Trimester of pregnancy			
1	18	25.4%	(17.7, 35.0)
2	29	40.8%	(30.4, 52.2)
3	24	33.8%	(22.9, 46.8)
Number of times been pregnant			
1-2	23	32.4%	(21.8, 45.1)
3-4	19	26.8%	(17.4, 38.9)
5-6	20	28.2%	(18.3, 40.7)
7+	9	12.7%	(6.3, 23.7)
Number of times given birth			
0	8	11.3%	(5.3, 22.4)
1-2	21	29.6%	(19.4, 42.3)
3-4	22	31.0%	(19.1, 46.1)
5-6	12	16.9%	(9.8, 27.6)
7+	8	11.3%	(5.1, 23.0)

Note: The n's are un-weighted numerators for each subgroup; subgroups that do not sum to the total have missing data.
[a] Percentages and means are weighted for unequal probability of selection.
[b] CI=confidence interval calculated taking into account the complex sampling design.

4.8.2. Anemia

Almost 40% of pregnant women were anemic (Table 4-54). This is slightly higher than in non-pregnant women residing in camps, but considerably higher than in pregnant women living in the settled population. Although anemia prevalence was higher in Azraq camp, and there is a suggestion of a progressive rise in prevalence with pregnancy stage, these differences were not statistically significant, likely due to the small number of pregnant women in the sample.

The hemoglobin distribution of pregnant women residing in Syrian camps is shown in Figure 4-18. There were no cases of severe anemia. The mean hemoglobin concentration among pregnant women was 113.4g/L (95% CI: 110.5, 116.3).

Table 4-54. Prevalence of anemia in pregnant women, by various demographic characteristics, Syrian camp refugees

Characteristic	n	% [a] with anemia [b]	95% CI [c]	p-value [d]
TOTAL	67	37.3%	(27.9, 47.8)	
Age (in years)				
15-19	14	35.7%	(13.8, 65.8)	0.645
20-29	30	30.0%	(16.6, 48.1)	
30-39	21	47.6%	(27.9, 68.1)	
40+	2	50.0%	(5.2, 94.8)	
Camp [e]				
Azraq	13	53.8%	(26.8, 78.8)	0.168
Zaatari	54	33.3%	(24.1, 44.1)	
Trimester of pregnancy				
1	18	22.2%	(8.7, 46.0)	0.209
2	28	39.3%	(24.9, 55.8)	
3	21	47.6%	(28.5, 67.5)	

Note: The n's are un-weighted numbers (denominator) in each subgroup; the sum of subgroups may not equal the total because of missing data.

[a] Percentages weighted for unequal probability of selection.

[b] Anemia defined as hemoglobin < 110 g/L adjusted for altitude.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] P value <0.05 indicates that at least one subgroup is statistically significantly different from the others.

[e] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

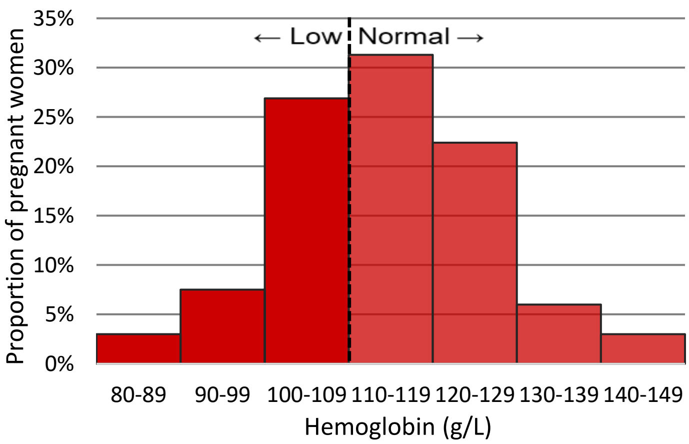

Figure 4-18. Distribution of hemoglobin (g/L) in pregnant women, Syrian camp refugees

Table 4-55. Severity of anemia in pregnant women, by various demographic characteristics, Syrian camp refugees

Characteristic	Mild anemia [b]			Moderate anemia [b]			Severe anemia [b]		
	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]	n	% [a]	95% CI [c]
TOTAL	18	26.9	(19.5, 35.8)	7	10.4	(5.1, 20.3)	-	-	-
Age (in years)									
15-19	5	35.7	(13.9, 65.6	0	0.0	--	-	-	-
20-29	7	23.3	(12.7, 39.0)	2	6.7	(1.7, 23.3)	-	-	-
30-39	5	23.8	(9.9, 47.1)	5	23.8	(9.9, 47.1)	-	-	-
40+	1	50.0	(5.0, 95.0)	0	0.0	--	-	-	-
Camp[d]									
Azraq	4	30.8	(16.3, 50.4)	3	23.1	(8.3, 49.9)	-	-	-
Zaatari	14	25.9	(17.8, 36.1)	4	7.4	(2.8, 18.1)	-	-	-
Trimester of pregnancy									
1	3	16.7	(5.7, 39.7)	1	5.6	(0.7, 34.0)	-	-	-
2	7	25.0	(13.1, 42.4)	4	14.3	(5.2, 33.7)	-	-	-
3	8	38.1	(21.6, 57.8)	2	9.5	(2.1, 34.1)	-	-	-

Note: The n's are the numerators for a specific sub-group.
[a] All percentages except region-specific estimates are weighted for unequal probability of selection among strata.
[b] Mild, moderate, and severe anemia defined as hemoglobin 100-109 g/L, 70-99 g/L, and <70 g/L, respectively.
[c] CI=confidence interval calculated taking into account the complex sampling design.
[d] Because of poor precision resulting from small sample size and large design effect, the Mrajeeb al Fhood camp was excluded from the camp sub-group; however, Mrajeeb al Fhood participants' data have been included for all other analyses in this table.

4.8.3. Underweight

Only 1.4% (95%CI: 0.2, 9.9) of 71 pregnant women had a low MUAC; this is too few women to allow subgroup analyses.

4.8.4. Dietary diversity and consumption of vitamins and supplements

Less than half of pregnant women consumed a diet that meets minimum diversity, and one half of pregnant women have consumed iron and folic acid supplements in the three months preceding the survey (Table 4-55). Consumption of other vitamin and mineral supplements was much less common.

Table 4-56. Dietary diversity and supplement consumption in pregnant women, Syrian camp refugees

Characteristic	n	Mean or %[a]	95% CI[b]
Number of MDD-W[c] food groups consumed (mean)	71	4.39	(3.98, 4.81)
Meets minimum dietary diversity (MDD-W, 5+ food groups)			
Yes	34	47.9%	(35.9, 60.2)
No	37	52.1%	(39.8, 64.1)
Consumed iron tablets or syrup in past three months			
Yes	35	50.0%	(36.0, 64.0)
No	35	50.0%	(36.0, 64.0)
Consumed folic acid tablets or syrup in past three months			
Yes	37	52.1%	(39.7, 64.3)
No	34	47.9%	(35.7, 60.3)
Consumed vitamin A tablets in past six months			
Yes	1	1.5%	(0.2, 10.9)
No	67	98.5%	(89.1, 99.8)
Consumed vitamin D tablets or syrup in past six months			
Yes	2	2.9%	(0.7, 11.6)
No	68	97.1%	(88.4, 99.3)
Consumed multivitamin tablets in past six months			
Yes	6	8.8%	(3.9, 18.9)
No	62	91.2%	(81.1, 96.6)
Ever had a vitamin B12 injection			
Yes	3	4.3%	(1.4, 13.1)
No	66	95.7%	(86.9, 98.6)

Note: The n's are un-weighted numbers for each subgroup; subgroups that do not sum to the total have missing data.

[a] Means and percentages weighted for unequal probability of selection.

[b] CI=confidence interval calculated taking into account the complex sampling design.

[c] MDD-W = Minimum dietary diversity for women as recommended in FAO and FHI 360[(64)].

5. RESULTS: COMPARISON BETWEEN THE 2010 AND THE 2019 SURVEYS

For the comparison of the results of the JNMNS 2019 and the National Micronutrient Survey 2010, the data analysis methods of the JNMNS were matched as closely as possible to the methods used in the 2010 survey. As such, the results from this analysis should only be used for the comparison; these results do not indicate current micronutrient, nutrition, or health status. To illustrate, some of the adaptations made to the JNMNS 2019 analysis procedures were:

- Data from the settled population only was included from the JNMNS 2019;
- The age range for pre-school children was restricted to 12-59 months because no children younger than 12 months were included in the 2010 survey;
- No adjustment for inflammation was done for ferritin or RBP values because this was not done in 2010;
- Red blood cell folate, not serum folate, was used for the folate deficiency comparison;
- To define fortified bread in the 2019 survey, a cutoff of 15 ppm was used to replicate as closely as possible the iron spot test used in the 2010 survey; this threshold was determined to yield decent sensitivity compared to quantitative measurements.

The household coverage of bread made from fortified flour increased during this time period, regardless whether coverage calculations included only Arabic bread or all types of bread. The prevalence of anemia in children 12-59 months decreased by 6 percentage points; however, the prevalence of iron deficiency increased by about 7 percentage points. The prevalence of iron deficiency anemia remained largely unchanged. The prevalence of vitamin A deficiency decreased, but the prevalence of vitamin D deficiency increased, albeit without statistical significance. The prevalence of stunting and wasting in children decreased over this time period, while the prevalence of child underweight, overweight and obesity remained largely unchanged.

As in children, non-pregnant women 15-49 years of age show a decline in the prevalence of anemia, an increase in the prevalence of iron deficiency, and little change in the prevalence of iron deficiency anemia between 2010 and 2019. The prevalence of deficiencies vitamins A and D remained largely the same. On the other hand, the prevalence of both folate and vitamin B12 deficiency increased substantially during this time period. No anthropometric measurements on non-pregnant women were conducted in 2010 and thus, no comparison could be done.

Table 5-1. Comparison of key results between 2010 and 2019 for the settled population, Jordan[1]

Indicator[a]	2010		2019		p-value
	N	% (95%CI)	N	% (95%CI)	
Households					
Fortified bread ≥ 15 ppm[a]	1737	44.1% (40.2, 48.0)	353	83.8% (77.6, 88.6)	<0.001
Fortified Komaji bread ≥ 15 ppm[a]	1274	50.5% (46.2, 54.9)	266	83.3% (76.0, 88.7)	<0.001
Children 12-59 months					
Anemia	919	16.8% (14.2, 19.8)	367	10.6% (7.3, 15.1)	<0.05
Iron deficiency[b]	964	13.7% (11.2, 16.7)	355	20.4% (16.0, 25.7)	<0.05
Iron deficiency anemia[b]	919	4.8% (3.6, 6.5)	350	4.5% (2.6, 7.8)	0.836
Vitamin A deficiency (retinol)[b]	933	18.2% (15.3, 21.4)	300	7.4% (4.4, 12.0)	<0.001
Vitamin D deficiency	933	17.3% (14.4, 20.7)	309	22.9% (17.5, 29.3)	0.089
Underweight (WAZ < -2)	1022	2.6% (1.7, 4.0)	587	1.4% (0.6, 3.3)	0.217
Stunting (HAZ < -2)	1013	11.7% (9.3, 14.5)	575	6.3% (3.7, 10.4)	<0.05
Wasting (WHZ (< -2)	1030	3.5% (2.2, 5.7)	574	0.1% (0.0, 0.4)	<0.001
Overweight (WHZ> +2, ≤ +3)	1017	6.4% (4.4, 9.2)	574	6.2% (4.0, 9.6)	0.931[e]
Obesity (WHZ > +3)	1017	1.8% (1.1, 3.0)	574	2.1% (1.1, 4.1)	
Non-pregnant women 15-49 years					
Anemia	1990	30.6% (28.0, 33.2)	669	25.1% (21.1, 29.6)	<0.05
Iron deficiency[b]	1994	35.0% (32.1, 38.1)	666	50.4% (44.5, 56.3)	<0.001
Iron deficiency anemia[b]	1986	20.0% (18.0, 22.1)	670	20.7% (17.4, 24.5)	0.738
Vitamin A deficiency[c]	1991	4.8% (3.8, 6.0)	667	2.9% (1.6, 5.1)	0.092
Vitamin D deficiency	1991	60.6% (57.4, 63.3)	653	63.6% (57.5, 69.3)	0.408
Folate deficiency (RBC folate)[d]	382	13.4% (10.0, 17.7)	127	33.1% (23.0, 45.1)	<0.001
B12 deficiency	1998	11.3% (9.5, 13.3)	647	18.8% (15.2, 23.0)	<0.001

[1] For better comparability, the 2019 data were trimmed to match the 2010 population and data characteristics as closely as possible, for children, the age range in this table has thus been limited to 12-59 months, since this was the age range used in 2010. Since no school-age children were included in 2010, this population group is not showing here. Also, the Syrian refugee population is not included in this table for better comparability. Lastly, some estimate for 2010 vary slightly from those presented in Jordan's 2010 survey report due to slight differences in the N.

[a] Because in 2010, qualitative testing only was done, the 2019 quantitative results were dichotomized and considered fortified if the iron concentration was >15.0 ppm.

[b] Because in 2010, no inflammation adjustment was done to ferritin or retinol, samples from the 2019 survey for this table have equally not be adjusted. However, it is important to note that inflammation-adjustment of some sort has become standard practice as of now and above results should only be used for comparison.

[c] In 2010, serum retinol was used as the marker for vitamin A deficiency in women, whereas in 2019 it was retinol-binding protein.

[d] Both surveys measured whole blood lysate folate concentrations, and the equation that was applied in the 2010 survey was used: RBC folate (ng/mL)= whole blood folate (ng/mL)/hematocrit (%) * 100, representing a simplified formula described in[51].

[e] This is a p-value comparing the distribution of different degrees of overweight between the 2010 and 2019 surveys.

6. DISCUSSION

6.1. Summary interpretation of key findings

As the JNMNS assessed multiple variables in several population groups, Table 6-1 provides an interpreted summary of key findings from the survey. The arrows indicate the temporal trend compared to the 2010 Jordan Micronutrient Survey, where such a comparison was possible. The colored cells are indicating the category of public health significance, according to the World Health Organization or the scientific literature, where available. Absence of a color scheme simply means that no categorization of the public health significance is available.

Coverage with fortified bread (≥ 15 ppm) has increased between 2010 and 2019.

Besides micronutrient deficiencies, the JNMNS also assessed under- and overnutrition in pre-school and school-age children and non-pregnant women. There is a trend towards smaller proportions of children in the settled population being stunted, wasted and underweight, and prevalence rates are reaching rather low levels; although slightly higher levels are found in children of Syrian refugee camps, they are not alarming. However, the high prevalence of overweight and obesity is reason to worry. The JNMNS did not find increased prevalence of overweight/obesity in pre-school children, but confirmed the high prevalence among non-pregnant women of both the settled population and the Syrian refugee camps. Further, overweight (and to some extent, obesity) prevalence is high in school-age children in particular of the settled population, but also school-age children in the Syrian refugee camps.

With regard to anemia, there has been a decrease in prevalence in the Jordanian population in the past decade. For Syrian refugees residing in camps, anemia mostly constitutes a moderate public health problem and is high in particular in both non-pregnant and pregnant women. Iron and vitamin D deficiency prevalence is high in both the settled and the camp population. Vitamin A and zinc deficiency prevalence is relatively low overall, and for vitamin A deficiency, there has been a reduction in prevalence in the past decade.

Table 6-1. Summary of key findings of the JNMNS, including assessment of temporal trends[1] and of public health relevance

Indicator	Settled population Jordan					Syrian camp refugees			
	HH	PSC	SAC	NPW	PW	PSC	SAC	NPW	PW
Fortified bread (≥ 15 ppm)	84%↗[a]								
Anemia[b]		12% ↘	6%	24% ↘	19%	25%	11%	36%	37%
Iron deficiency		26% ↗	31%	66% ↗		36%	35%	68%	
IDA		5% →	2%	22% →		14%	6%	31%	
Vit. A deficiency[c]		8% ↘	7%	3% →		9%	7%	3%	
Vit. D deficiency		28% →	44%	64% →		10%	16%	56%	
Zinc deficiency[d]		12%	4%			13%	9%		
Folate deficiency			<1%	11% ↗			2%	6%	
Vit. B12 deficiency			7%	19% ↗			2%	12%	
Stunting[e]		7% ↘	3%			14%	5%		
Wasting/underweight[e]		<1% ↘	1%	5%	0%	1%	1%	3%	2%
Overweight/obesity[e]		9% →	28%	60%		6%	22%	69%	
Obesity		2% →	16%	30%		1%	6%	40%	

Level of public health problem[b-e]:	Normal	Mild	Moderate	Severe

[1] Temporal trends are compared against the 2010 national micronutrient survey using the 2010 data analysis approach(65); however, unless otherwise noted, the prevalence estimates presented are those obtained through the 2019 analytical approach.

[a] Because the JNMNS used a quantitative measurement of all iron in bread; when applying a cutoff of 15 ppm to mimick the 2010 survey findings, a higher coverage of fortified bread results.

[b] Public health categorization according to WHO(31): <5% normal, 5-19.9% mild, 20-39.9% moderate, ≥40% severe.

[c] Public health categorization according to WHO (developed for children)(33): <2% normal, 2-9.9% mild, 10-19.9% moderate, ≥20% severe.

[d] Categorization as per iZiNCG: <5% normal, 5-19.9% mild, 20-34.9% moderate, 35-49.9% moderate to severe, ≥50% severe.

[e] Categorization according to de Onis et al. (24) for children less than 5 years and according to WHO for adult women(66).

6.2. Jordan settled population

6.2.1. Household-level findings

The JNMNS found a higher coverage of bread made with fortified flour than the 2010 survey, when using a cutoff of 15 ppm of iron.

6.2.2. Pre-school children

Overall, the prevalence of anemia in children 6-59 months of age in Jordan would be classified as a mild public health problem by WHO. Moreover, the prevalence of anemia in children 12-59 months of age has declined since the 2010 National Micronutrient Survey. . The decline in anemia prevalence since 2010 may be attributable to some extent to Jordan's wheat flour fortification program, and further research is needed to investigate the impact of Jordan's fortification program and the etiology of anemia in Jordan. Pre-school children in Jordan are still at risk of anemia, and existing public health policies and interventions may need to be revised or expanded depending on the finding of future research.

Iron deficiency is more than twice as common as anemia in young children in Jordan. However, its contribution to the etiology of anemia cannot be accurately assessed using the results of the JNMNS. Given the prevalence rates of anemia and iron deficiency, if these two conditions were entirely unrelated, one would see a prevalence of iron deficiency anemia of 3.1%. This is only slightly below the measured prevalence of iron deficiency of anemia. Therefore, it can be concluded that iron deficiency is not responsible for a large proportion of anemia. Nonetheless, because iron deficiency has negative health effects other than anemia, it should be adequately treated and prevented. The 2010 Jordan Micronutrient Survey reported a lower prevalence of iron deficiency; however, because serum ferritin concentrations were not fully corrected for inflammation, the values used to calculate prevalence were probably too high, thus resulting in an underestimated prevalence of iron deficiency.

A meta-analysis on the proportion of anemia attributable to iron deficiency reported 35% for the Middle East and North Africa region [(67)]. Our crude analysis of possible risk factors for anemia reveals that anemia is mainly driven by iron and vitamin A deficiency, which has been repeatedly demonstrated in multiple studies. Although both α- and β-thalassemia are risk factors for anemia, the public health importance of these factors is low because of their rarity.

Vitamin A deficiency decreased significantly since 2010. The change is vitamin A deficiency in pre-school children from 2010 to 2019 may be attributable to the implementation of Jordan's vitamin A supplementation program and changes is dietary patterns over the past decade. The vitamin A supplementation program was intensified in 2012 and is now routinely provide, with the first dose provided to children at 10 months of age and sub-sequent doses also recommended. The estimate of the prevalence of vitamin A deficiency produced by the 2010 survey may not be entirely accurate for two reasons. No inflammation-adjustment was done which would underestimate serum retinol concentrations resulting in an overestimation of the prevalence of vitamin A deficiency. On the other hand, the 2010 survey did not include children 6 to 11 months of age which, as shown in the JNMNS, have a much higher prevalence of vitamin A deficiency than older children.

A relatively large proportion of young children are vitamin D deficient in Jordan. Other studies in the Middle East and North Africa region reported vitamin D deficiency prevalence for this age group ranging from 12-60%[(68,69)]. Although children with a lower sun exposure index tended to be more prone to vitamin D deficiency, this association did not reach statistical significance. The prevalence of vitamin D deficiency did not significantly change between 2010 and 2019. Importantly, the 2019 analysis uses the IOM-recommended deficiency cut-off of <12 ng/ml [37], and our re-analysis of data from Jordan's 2010 micronutrient survey confirmed that a cutoff of <12 ng/ml was used for that survey as well, despite the fact that 2010 survey report mistakenly state that a cutoff of <11 ng/ml was used. This is further confirmed by Nichols et al [70], who published the 2010 survey's vitamin D deficiency prevalence and noted that a deficiency cutoff of <12 ng/ml was used.

The prevalence of zinc deficiency in pre-school children in the settled population of Jordan is lower than global levels reported by the WHO Vitamin and Mineral Nutrition Information System (VMNIS)[71]. Little association between stunting and zinc deficiency was found in the JNMNS which may be due to the low prevalence of both zinc deficiency and stunting.

As already mentioned above, inherited blood disorders are relatively rare in Jordanian pre-school children. Nonetheless, our estimates are consistent with existing literature that demonstrates that α- and β-thalassemia traits are found in 2.3-3.5% and 3.0-5.9% of the Jordanian population, respectively[72], and that sickle cell trait is present in only 0.2%. The methodology applied could not reliably differentiate between trait and disease because not all samples underwent PCR analysis; however, in those samples that were referred for PCR analysis based on complete blood count and electrophoresis (approx. 20%), no cases of thalassemia disease or homozygous sickle cell disease were found.

Overall, the prevalence of undernutrition in young Jordanian children was low; only the prevalence of stunting was statistically significantly different from that in the WHO Growth Standard. These estimates are probably statistically indistinguishable from the results of the 2012 PFHS, in which stunting was prevalent in 8%, wasting in 2%, and underweight in 3%[7]. However, no direct comparison of the results of the JNMNS to those of the PFHS was done. In contrast, overweight or obesity were present in 9% of children, whereas the 2012 PFHS reported just over 4%. If this represents a statistically significant increase, this would not be surprising, as globally obesity prevalence is steadily increasing [73]. As per World Health Organization categorization, a prevalence of 9% represents a 'medium' public health problem that merits attention. Male children are at greater risk of overweight and obesity than their female peers, which is consistent with the results of the PFHS 2012. Since the PFHS 2017-18 did not report anthropometric results, no recent comparative data are available. To reduce overweight and obesity, WHO recommends limiting energy intake from fats and sugar and engaging in regular physical activity[74]. Almost half of children 6-23 months of age included in the JNMNS consumed sugary foods in the previous 24 hours, one third sugary drinks, and over one third salty/fried snacks. Also, very few children participated in organized physical activity. However, no association was found between physical activity and overweight/obesity in young children.

6.2.3. School-age children

The prevalence of anemia in school-age children of the settled population in Jordan is low, and iron deficiency contributes little to anemia. The measured prevalence of iron deficiency anemia is that which would be expected if anemia and iron deficiency were not at all associated. On the other hand, anemia is significantly more common in children with vitamin A deficiency. Consumption of mineral supplements appeared to protect against anemia or iron deficiency.

Overall, vitamin A deficiency, zinc deficiency, and folate deficiency were not common in school children. In contrast, vitamin D deficiency was very common and a large majority of children had sub-optimal vitamin D status. Sun exposure was associated with vitamin D status.

Although one third of children has sub-optimal vitamin B12 status, no widely established cut-off points defining vitamin B12 deficiency exist for this age group and thus, this prevalence may need to be interpreted with caution.

Although the prevalence of stunting is low overall, it is statistically significantly more common in girls than in boys. In addition, children from the poorest households were more likely to be stunted. Other undernutrition indicators, underweight and thinness are also low.

However, overweight and obesity prevalence is high, affecting around a quarter of these children, and older children (>12 years) are more often obese than their younger peers.

6.2.4. Non-pregnant women

A quarter of non-pregnant women in the settled population are anemic, which is significantly lower than in the 2010 survey that used a comparable method of hemoglobin measurement; and it is a considerably lower prevalence than that found in the two previous PFHS. Iron deficiency is found in two thirds of non-pregnant women and almost all anemia can be ascribed to iron deficiency anemia, with inflammation also being a significant risk factor. The prevalence of iron deficiency is considerably higher than in the 2010 survey report, even when a similar data analysis approach is used. Women in the Southern stratum are more likely to be anemic and to have iron deficiency anemia.

Vitamin A deficiency is prevalent in only 3% of non-pregnant women. Folate deficiency affects a bit more than 1 in 10 women, with more women being affected in the Southern stratum. In contrast to this, vitamin B12 deficiency is less common in women in the South than the Center or North, with a national prevalence of just below 20%.

Two thirds of non-pregnant are vitamin D deficient, and over 80% have sub-optimal vitamin D status. These prevalence estimates are high but comparable to the 2010 national micronutrient survey. In comparison to other estimates in the region, the prevalence is among the highest, with a range of vitamin D deficiency prevalence of 14-50% reported [(69)].

While undernutrition is rare, two third of women are overweight or obese, and the prevalence increases with the women's age; although not reaching statistical significance, there is a trend to more overweight/obesity in women that are sitting for 4 or more hours per day.

Dietary diversity is adequate in a bit more than half of these women, but only few consume nutrition supplements; only iron and vitamin D supplements have been reported to be consumed by more than one tenth of respondents.

6.2.5. Pregnant women

Anemia affects one fifth of pregnant women from the settled population, which is surprisingly low and actually, lower than in the non-pregnant women. But similar to the non-pregnant women, pregnant women in the Southern stratum are more likely to be anemic, namely 2-3 more likely than their peers in the Center and North. Further, women in their third trimester of pregnancy are more often anemic than those earlier in pregnancy. This is a well-known phenomenon and has been ascribed to the profound physiological changes a woman's body is undergoing later in pregnancy.

No pregnant woman was diagnosed with undernutrition, as defined by a MUAC of less than 230 mm.

Almost two thirds consume an adequate diet and iron and folic acid supplements are consumed by about 6 in 10 pregnant women. During antenatal care visits, pregnant women are provided with iron and folic acid supplements free of charge. The coverage in the JNMNS is slightly lower than that reported in the 2017-18 PFHS, where almost 8 in 10 women reported having received iron supplements in the previous pregnancy[(9)]. Methodological differences may partly explain the differences.

6.3. Syrian refugee population

6.3.1. Household-level findings

Virtually all households use clean fuel, have access to safe drinking water, have an adequate sanitation and the infrastructure for proper handwashing, indicative of an acceptable water, sanitation and hygiene situation.

6.3.2. Pre-school children

A quarter of pre-school children residing in the camps are anemic, which is considerably higher than among pre-school children in the settled population. Despite this higher prevalence, a similar age pattern as in the settled children emerges: children less than 2 years old have more often anemia than older children. In comparison to the PFHS 17-18, anemia prevalence is lower in the JNMNS in this age group, although the difference is less striking than for the settled population: PFHS found 34% of Syrian pre-school children to be anemic.

Overall, iron deficiency occurs in almost 4 in 10 pre-school children in the camps, and over half of the anemia can be ascribed to iron deficiency. In this population segment, vitamin D deficiency seems to have a protective effect for anemia, which is in contrast to findings from other studies [75,76]. Finally, consumption of fortified foods or supplements are not associated with anemia or iron deficiency.

Vitamin A deficiency was assessed using two different biomarkers, namely serum retinol and retinol-binding protein (RBP). Despite the prevalence of vitamin A deficiency being higher when using serum retinol (9%) than RBP (4%), both biomarkers are indicative of a ‘mild’ public health problem according to WHO[33]. Serum retinol is typically considered the ‘better’ biomarker for vitamin A status, but its analysis is relatively challenging. However, the fact that two biomarkers are both confirming that the vitamin A problem is only mild is reassuring for this group of pre-school children residing in camps. Vitamin A deficiency is higher in zinc deficient children, which is plausible based on the existing literature[77].

Although almost half of the pre-school children in the camps have sub-optimal vitamin D status, it is to be noted that the majority falls into the category of ‘insufficiency’ and only about 10% of these children are considered vitamin D deficient. This is considerably lower than their peers from the settled population. Similar to the settled setting, female children are more likely to have sub-optimal vitamin D status. Youngest children are more prone to be vitamin D deficiency and so are those residing in the Zaatari camp. Zinc deficiency is found in 13% of these children without differences by age, sex, or wealth quintile. Although not reaching significant difference, children in the Zaatari camp tend to have a higher zinc deficiency prevalence than their Azraq counterparts. Consistent with other population segments in this report, the sun exposure index is negatively correlated with sub-optimal vitamin D status, corroborating the importance of the sunlight for the body to synthesize vitamin D.

Undernutrition is reassuringly low in this population group and only stunting merits further discussion with its prevalence of 14% among refugee pre-school children: there are no differences by age category, sex, or camp, but important ones between the poorest and other households (28% versus 9-12%) and between children from short mothers compared to taller mothers (30% versus 13%); both these findings are not very surprising and have been described in the literature.

Overweight and obesity affect 6% of the pre-school children in the camps, but the vast majority of these children (5%) are categorized as overweight. There is a significant trend for a decreasing prevalence of overweight and obesity from younger to older children. Further, children whose caregivers report them to be less active than their peers are more likely to be stunted and overweight/obese.

Infant and young child feeding indicators are mostly sub-optimal with low rates of exclusive breastfeeding and a rather low dietary diversity and subsequently, low minimum acceptable diet, as well as low consumption of iron-rich foods in the past 24 hours. Further, half of children are reported to having consumed sugary snacks and/or sweetened beverages and one third salty or fried snacks on the preceding day.

6.3.3. School-age children

Just over 10% of school-age children in the Syrian refugee camps are anemic, with over one third being iron deficient. Over half of the 11% of anemia are associated with iron deficiency. Anemia in Azraq camp is significantly higher than in Zaatari but no other demographic factors differed significantly for anemia, iron deficiency or iron deficiency anemia: age, sex, wealth quintiles.

Vitamin A deficiency affects 7% of school-age children, and is more prevalent in male children; there is also a non-significant age-trend with younger children being more often vitamin A deficient. Overall though, this prevalence is to be considered as relatively low.

Sub-optimal vitamin D status affects over half of the children in this age group, but vitamin D deficiency is present in only 15% of children, while the remainder has vitamin D insufficiency. Thus, vitamin D deficiency is less of a problem in the camp school-age children than in their peers in the settled population. Girls are almost five times as likely to be vitamin D deficient than boys in this population segment, and older children are more often affected by either vitamin D deficiency or insufficiency. Sun exposure is an important risk factor in particular for vitamin D deficiency: children with a low head sun exposure index are five times more likely to be vitamin D deficient than their peers with the highest head sun exposure index (43% vs. 8%).

Zinc deficiency is present in 9% of these camp children, which is almost a three times higher prevalence than their peers in the settled population, but still not alarming. In contrast, both folate and vitamin B12 deficiency are lower in school-age children residing in the camps, namely just over 2%. Even marginal vitamin B12 status is present in less than 10% of these children. It has to be noted again though that the thresholds are not widely established for this age group and thus, the prevalence estimates have to be used with caution.

Overall, undernutrition is not very common in school-age children in this camp population: stunting affects less than 5%, without notable demographic differences, such as age, sex, camp residence, school attendance and wealth quintile. Severe stunting is affecting just 0.5%. Similarly, thinness and underweight are also very low, both affecting around 1% of children in this age group.

Similar to school-age children in the settled population, almost one quarter of children in the camps are affected by overweight or obesity. Yet, obesity only affects 6%, which is considerably less than in the settled peers. Overweight and obesity increase with the children's age, are more common among girls and in children living in Zaatari camp than in Azraq. However, a sharp rise of overweight and obesity takes place from the oldest group of pre-school children (48-59 months) to the youngest group of school age children (6-7 years), which is of major concern; overweight increases from below 5% to above 15% and obesity from 0% to almost 4%.

6.3.4. Non-pregnant women

Iron from bread provided about 30% of the RNI for iron.

A third of non-pregnant women in the camps are anemic, while iron deficiency is found in more than two thirds of non-pregnant women. Almost all anemia can be ascribed to iron deficiency anemia, with inflammation, vitamin A, D and B12 deficiency also being significant risk factors. Vitamin A deficiency is the only factor identified in this survey to be significantly associated with iron deficiency.

Vitamin A deficiency is prevalent in less than 3% of non-pregnant women in the camps, and folate deficiency is present in less than 6% of these women, both estimates are lower than for the settled peers. Vitamin B12 deficiency affects a bit more than 1 in 10 women, with older women and those residing in the Zaatari camp being more often affected.

Two thirds of non-pregnant are vitamin D deficient, and 9 in 10 have sub-optimal vitamin D status, which is slightly higher than in the settled population. Sun exposure was not associated with vitamin D deficiency, but since virtually all women are completely covered whenever outside, this analysis may be of limited value.

Undernutrition is rare with just over 3% of non-pregnant women having a BMI of less than 18.5. But overweight and obesity affect over two thirds of women. Older age is associated with a higher overweight/obesity prevalence and so is a more sedentary lifestyle.

Dietary diversity is adequate in a bit more than half of these women, but only few consume nutrition supplements; only iron supplements have been reported to be consumed by more than one tenth of respondents.

6.3.5. Pregnant women

Almost 40% of pregnant women in the camps are anemic, which constitutes a higher prevalence than among non-pregnant women or pregnant women in the settled population. There is a trend towards higher anemia prevalence among women in the Azraq camp and women in the third trimester, but due to the small numbers, these differences are not statistically significant. Undernutrition (MUAC<230mm) is prevalent in 1.4% of pregnant women.

Dietary diversity is adequate in about half of these pregnant women and also about half of pregnant women consume iron and folic acid supplements, with other supplements being negligible.

6.4. Strengths and limitations of the JNMNS

The JNMNS was designed to yield data for three strata, each consisting of 4 governorates encompassing the settled population, and a fourth stratum consisting of three Syrian refugee camps. This inclusion of the Syrian refugee population provided the opportunity for a comprehensive nutritional assessment in Syrian refugees. However, Syrian refugees integrated into the host community (that is, not living in a refugee camp) represent a small proportion of the population of Jordan. As a result, without oversampling, relatively few such Syrian refugees households were recruited for participation in the JNMNS. However, UNHCR estimated at the end of 2018 that over 80% of the Syrian refugee population resided with the host community, in particular in Amman and Irbid, whereas the other 20% were registered in the three camps[3]. Thus, while the JNMNS was able to adequately sample Syrian refugees in the camps, the small number of non-camp Syrian refugee households precluded a separate analysis of this group. The original data analysis plan called for non-camp Syrian refugees to be analyzed with the Jordanian population. However, due to the objection of some stakeholders, these refugees were included with Syrian refugee households living in the camps.

This data analysis revealed very high design effects because in most non-camp clusters which contained Syrian refugee households, the number of such households was very small. This produced substantial statistical instability in outcome estimates for Syrian refugee households. In order to provide useful estimates for Syrian refugees, these non-camp Syrian refugee households were excluded from all analyses presented above. An analysis of this small group of Syrian refugees is shown in Appendix 3. However, to meet UNICEF's requirements for data to be included in the 'State Of the World's Children' report, a separate summary analysis of key outcomes was done of all households residing outside the Syrian refugee camps (including both Jordanian and Syrian households); the results of this analysis is also shown in Appendix 3.

The inclusion of school-age children 6-12 years old enables for the first time a comprehensive assessment of the nutritional status in this age group. Survey planners expected difficulty in enrolling school-age children because they would be away from home for much of the day. However, contrary to these expectations, their inclusion did not prove to be a major difficulty because field teams adjusted their work schedules to the school schedules of eligible school children. This meant sometimes returning to a household later in the day after children had returned home from school. Overall response rates in school-age children were satisfactory. Another challenge when including school-age children in a nutrition survey is the interpretation of laboratory testing results. For several blood biomarkers, no established A relatively large proportion of young children are vitamin D deficient in Jordan points defining normal values exist for school-age children. Although there are WHO-recommended cut-off points to define anemia and iron deficiency[31,78], but not to define deficiencies of vitamin A, vitamin D, vitamin B12 or folate in school-age children. We used cut-off points from biomedical literature, where available or, when lacking, cut-off points recommended for other population groups were 'borrowed'.

It was initially anticipated that the JNMNS could select a sub-sample of clusters used by the PFHS which was conducted shortly prior to the JNMNS[9]. However, due to a potential breach of confidentiality, this approach was not feasible. Thus, in collaboration with DOS, the survey management team selected PSUs from the census database. A household listing exercise conducted by DOS-led teams ensured an up-to-date sampling frame or the 2nd stage sampling in PSUs in the Jordanian population. Although for most PSUs, the household listing posed no challenges, 12 clusters had many 'households' in the updated household list that were either not residential buildings or where inhabitants had left the address. This required a re-visit of all households in these 12 PSUs and a re-selection of eligible households at random.

The household response rate was over 85%. However, individual response was substantially lower, especially for blood collection, because of a relatively high refusal rate among pre-school children and difficulties in performing phlebotomy in children less than 2 years of age. While the survey yielded national estimates with satisfactory confidence intervals for pre-school children, the relatively small sample of young children yielded lower than expected precision for subgroup-specific estimates of indicators based on laboratory testing results. These were not problems in other target groups.

The JNMNS assessed a comprehensive panel of micronutrient biomarkers by testing venous blood samples. Collecting venous blood removes the potential of sample dilution compared to capillary sampling [79]. Venous samples also can be tested for complete blood count using auto analyzers which are considered the 'gold standard' for hemoglobin assessment [80]. This method was also used in the 2010 Jordan Micronutrient survey, enhancing the comparability of hemoglobin results between 2010 and 2019. Interestingly the prevalence rates of anemia found in 2010 and 2019 are only about a third to half of the prevalence rates reported in the 2012 and 2017-18 PFHS. These surveys used capillary blood to measure hemoglobin on a portable hemoglobinometer (Hemocue Hb 201+). Recent reports have suggested that hemoglobin measurements from capillary blood samples and portable hemoglobinometers likely yield reduced hemoglobin concentrations and thus, increased anemia prevalence [(81,82)]. Although the literature is not yet conclusive, these suggestions have triggered a more systematical investigation by a USAID-funded initiative termed 'HEME working group' led by SPRING (Strengthening Partnerships, Results, and Innovations in Nutrition Globally) and the US CDC[4]. We think that the point estimates of the anemia prevalence in the JNMNS are most likely valid.

Current recommendations, made after the 2010 Jordan Micronutrient Survey was completed, state that both AGP and CRP levels should be used to adjust iron and vitamin A concentrations for inflammation in all subjects[(41,46,61)]. However, in order to compare iron and vitamin A results from the 2019 JNMNS to the 2010 survey, the JNMNS results were modified so they no longer conform to these updated recommendations. Thus, results presented in the comparison part of the report (Chapter 5) must not be used as measures of the current nutritional status of the Jordanian population.

The 2010 Jordan Micronutrient Survey collected bread samples from all households. These were analyzed semi-qualitatively using the iron-spot test, with a small sub-sample (N=50) of breads tested quantitatively using AAS to validate qualitative findings. The JNMNS collected bread samples from only one quarter of households, but all samples were analyzed quantitatively using AAS. Although the iron spot test is only semi quantitative, it has the advantage of measuring only iron fortificant (ferrous sulphate) and as such, is independent of intrinsic iron levels; in contrast, AAS requires complete ashing of the bread sample and thus, it measures all iron in the sample, including both intrinsic iron and fortificant iron. Thus, direct comparison of survey results from the two different methods is somewhat challenging.

Although the JNMNS was meant to provide an impact assessment of wheat flour fortification, the findings of our comparison of the 2010 and 2019 surveys may not allow clear conclusions for several reasons: first, a series of cross-sectional surveys cannot provide strong evidence of a causal association. At best, such a design can estimate trends; if an observed trend is consistent with other factors, one could claim a plausible impact of such a program[(83)]. This limitation is exacerbated by the fact that Jordan has gone through several changes in the past decade that are independent of the fortification program, including among others economic development and recession, an influx of thousands of Syrian refugees, climate change, etc. [(84)]. Second, the trends in different nutrition indicators were not consistent with each other; the prevalence of anemia decreased between 2010 and 2019 in both pre-school children and non-pregnant women, but the prevalence of iron deficiency increased and the prevalence of iron deficiency anemia remained stable. The prevalence of vitamin A deficiency declined, and vitamin D deficiency remaining unchanged at very high levels.

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[4] https://www.spring-nutrition.org/about-us/activities/anemia-research-working-groups

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8. Appendices

Appendix 1: Response rates for participating household and individuals

Table 8-1. Results of recruitment for interview and anthropometry and phlebotomy in households, pre-school children, school-age children, and women; strata 1 – 3 (including Syrian households), Jordan

	Households (HH)*			Children 0-59 months of age (PSC)*				School-age children (SAC)*				Non-pregnant women (NPW) ONLY*				Pregnant women*			
	Number eligible HH	# with interview	# with salt testing	Number of eligible PSC	# of PSC with inter-view	# of PSC with anthro	# of PSC with blood*	Number of eligible SAC	# of SAC with inter-view	# of SAC with anthro	# of SAC with blood	Number of eligible NPW	# of NPW with inter-view	# of NPW with anthro	# of NPW with blood	Number of eligible PW	# of PW with inter-view	# of PW with anthro	# of PW with blood
Residence																			
Urban	1488	1306	1221	666	649	598	328	1019	992	946	759	768	694	654	564	76	71	70	59
Rural	301	280	270	165	161	147	78	226	224	214	166	166	151	141	130	15	15	15	13
Stratum																			
Central	516	444	419	193	187	171	90	321	316	295	242	261	222	216	180	18	17	17	15
North	719	649	606	364	355	333	168	497	488	468	352	378	349	328	279	42	40	40	34
South	554	493	466	274	268	241	148	427	416	401	334	295	274	251	235	31	29	28	23
TOTAL	1789	1586	1491	831	810	745	406	1245	1220	1164	928	934	845	795	694	91	86	85	72

* All households, including Syrian refugees residing outside the Syrian refugee camps; for the individual-level response rates, members from Syrian refugee households have been excluded.

** Note: blood sampling was only conducted in children 6-59 months of age and thus, the numbers with blood are expected to be slightly lower than for anthropometry, even under 100% response rate assumptions. E.g. for the Total PSC population in strata 1-3, 99 children were less than 6 months old.

Table 8-2. Results of recruitment for interview and anthropometry and phlebotomy in households, pre-school children, school-age children, and women; Syrian refugee population in camps, Jordan

	Households (HH)			Children 6-59 months of age (PSC)				School-age children (SAC)				Non-pregnant women (NPW) ONLY				Pregnant women			
	Number eligible HH	# with interview	# with salt testing	Number of eligible PSC	#of PSC with inter-view	# of PSC with anthro	# of PSC with blood*	Number of eligible SAC	# of SAC with inter-view	# of SAC with anthro	# of SAC with blood	Number of eligible NPW	# of NPW with inter-view	# of NPW with anthro	# of NPW with blood	Number of eligible PW	# of NPW with inter-view	# of PW with anthro	# of PW with blood
Camp																			
Mrajeeb Al Fhood	30	30	29	24	24	24	18	37	36	35	35	12	11	11	11	2	2	2	2
Azraq	145	123	117	127	126	120	97	146	144	144	140	60	55	54	50	13	13	13	13
Zaatari	392	381	365	432	432	417	326	441	439	425	417	219	213	209	206	58	58	58	54
TOTAL	567	534	511	583	582	561	441	624	619	604	592	291	279	274	267	73	73	73	69

* Note: blood sampling was only conducted in children 6-59 months of age and thus, the numbers with blood are expected to be slightly lower than for anthropometry, even under 100% response rate assumptions. E.g. for the Total PSC population in the three camps, 52 children were less than 6 months old.

Appendix 2: Figures comparing serum retinol and retinol-binding protein concentrations

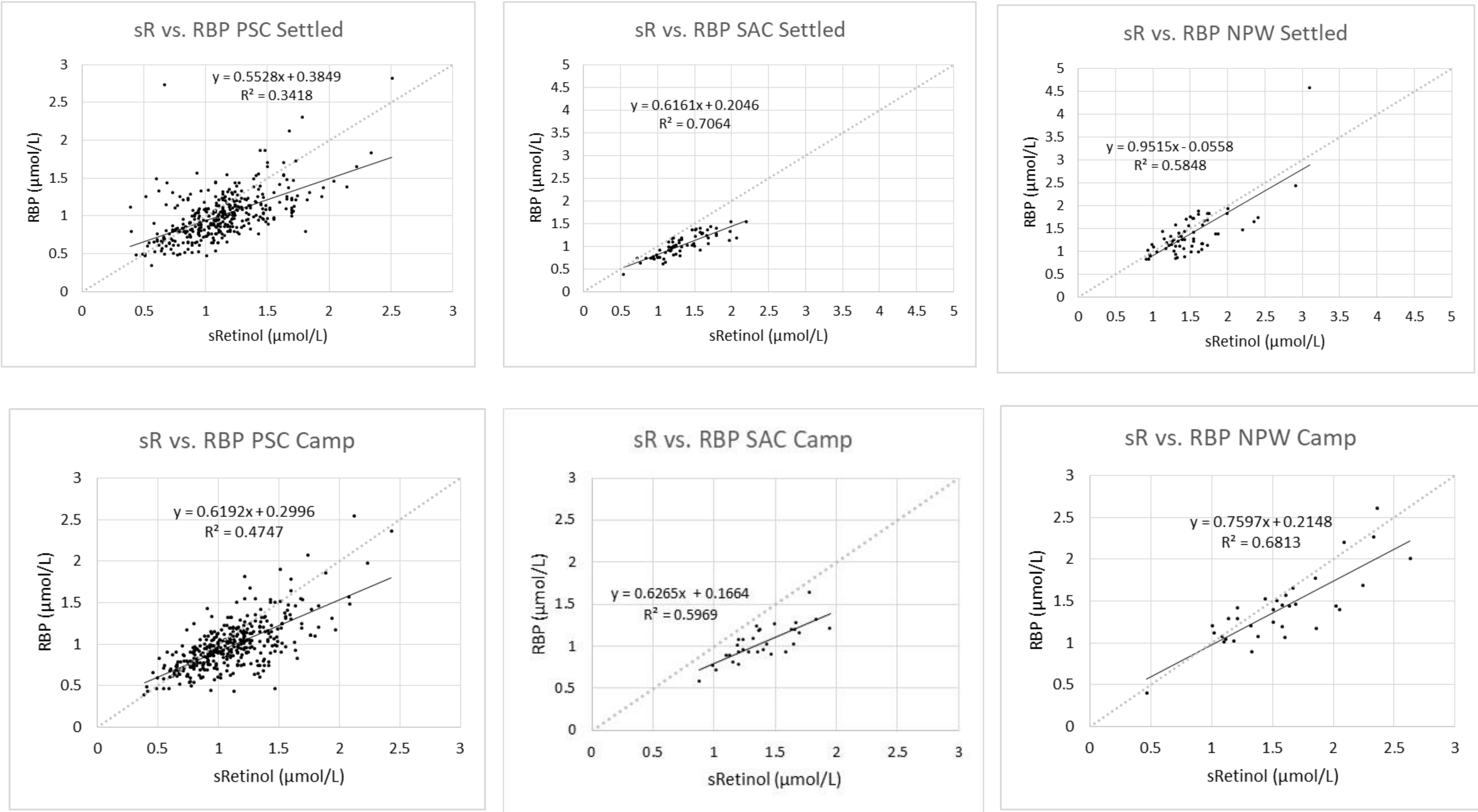


Figure 8-1. Comparison of serum retinol with retinol-binding protein, all population groups, both settled and Syrian camp refugees

Appendix 3: Additional summary tables

Table 8-3. Summary results of the JNMNS for the total settled population [a], Jordan 2019 ('State of the World' children summary table')

Target group	Indicator	N	% [b]	95% CI [c]
Pre-school children				
6-59 months	Anemia (Hb<110 g/L)	445	11.9%	(8.3, 16.8)
	Iron deficiency (sF<12 µg/l)	431	27.9%	(23.1, 33.3)
	Iron deficiency anemia [d]	446	5.7%	(3.3, 9.7)
	Vitamin A deficiency (retinol; ≤0.7 µmol/L)	361	8.5%	(5.6, 12.8)
	Vitamin A deficiency (RBP; ≤0.7 µmol/L)	431	4.4%	(2.4, 8.1)
	Vitamin D deficiency (<12 ng/mL)	373	26.4%	(21.3, 32.2)
	Vitamin D insufficiency (12.1-19.9 ng/mL)	373	34.8%	(28.5, 41.8)
	Zinc deficiency [e]	324	12.7%	(7.8, 19.9)
	Hemoglobinopathies, sickle cell disorder	448	0.8%	(0.2, 3.4)
	Hemoglobinopathies, α-thalassemia	448	4.3%	(2.2, 8.1)
	Hemoglobinopathies, β-thalassemia	448	4.5%	(2.5, 7.9)
0-59 months	Stunting (i.e. HAZ < -2)	816	7.3%	(5.2, 10.3)
	Wasting (i.e. WHZ < -2)	813	0.6%	(0.2, 1.8)
	Underweight (WAZ < -2)	831	2.6%	(1.5, 4.4)
	Overweight (i.e. WHZ > +2, ≤ +3)	813	6.5%	(4.7, 9.1)
	Obesity (i.e. WHZ > +3)	813	2.0%	(1.1, 3.7)
School-age children (6-12 years)				
	Anemia [f]	1002	7.2%	(4.7, 10.8)
	Iron deficiency (SF<12 µg/l)	996	31.9%	(27.0, 37.2)
	Iron deficiency anemia [d]	1005	3.1%	(1.8, 5.5)
	Vitamin A deficiency (RBP; ≤0.7 µmol/L)	996	7.3%	(5.0, 10.6)
	Vitamin D deficiency (<12 ng/mL)	977	44.3%	(38.6, 50.1)
	Vitamin D insufficiency (12.1-19.9 ng/mL)	977	42.8%	(37.3, 48.6)
	Zinc deficiency [e]	870	3.6%	(2.5, 5.1)
	Folate deficiency (<10 nmol/L)	977	0.6%	(0.2, 1.6)
	B_{12} deficiency (<150 pmol/L)	977	7.5%	(5.6, 10.0)
	Marginal B_{12} status (150-220 pmol/L)	977	23.7%	(19.8, 28.1)
	Stunting (i.e. HAZ < -2)	1242	3.7%	(2.1, 6.5)
	Thinness (i.e. BMI-for-age z-score <-2)	1240	1.5%	(0.8, 2.8)
	Overweight (i.e. BMI-for-age Z > +2, ≤ +3)	1240	15.2%	(12.4, 18.6)
	Obesity (i.e. BMI-for-age Z > +3)	1240	11.1%	(8.7, 14.1)
Non-pregnant women (15-49 years)				
	Anemia (Hb<110g/L)	740	24.4%	(19.8, 29.6)
	Iron deficiency (sF<15µg/l)	737	65.6%	(59.6, 71.2)
	Iron deficiency anemia [d]	740	21.8%	(17.5, 26.8)
	Vitamin A deficiency (RBP ≤0.7 µmol/L)	737	2.7%	(1.4, 5.2)
	Vitamin D deficiency (<12 ng/mL)	720	63.1%	(56.2, 69.5)
	Vitamin D insufficiency (12.1-19.9 ng/mL)	720	18.9%	(14.1, 24.8)

Target group	Indicator	N	% [b]	95% CI [c]
	Folate deficiency (<10 nmol/L)	715	9.9%	(7.1, 13.8)
	B_{12} deficiency (<150 pmol/L)	715	18.1%	(14.6, 22.2)
	Marginal B_{12} status (150-220 pmol/L)	715	33.9%	(28.9, 39.3)
	Underweight (BMI≤18.5)	849	5.3%	(3.3, 8.1)
	Overweight (BMI≥25, <30)	849	28.9%	(24.4, 33.8)
	Obesity (BMI≥30)	849	30.8%	(26.6, 35.3)
Pregnant women				
	Anemia (hb<110 g/L)	79	17.3%	(7.8, 34.0)
	Underweight (MUAC <23 cm)	95	0%	-

Hb, Hemoglobin; RBP, retinol binding protein; sF, serum ferritin;

[a] Settled population includes Syrian refugees living in host community; this table has been calculated based on a request from UNICEF headquarters for them to be able to include Jordan in the next State of the World's children report.

[b] Percentages and means are weighted for unequal probability of selection.

[c] CI=confidence interval calculated taking into account the complex sampling design.

[d] Iron deficiency anemia defined as the combination of iron deficiency and anemia

[e] Zinc deficiency, defined as follows: pre-school children morning non-fasting: <65 µg/dL, afternoon non-fasting: <57 µg/dL; children 6-9.9 years: morning non-fasting: <65 µg/dL, afternoon non-fasting: <57 µg/dL; girls 10-12.9 years: morning non-fasting: <66 µg/dL, afternoon non-fasting: <59 µg/dL; boys 10-12.9 years: morning non-fasting: <70 µg/dL, afternoon non-fasting: <61 µg/dL;

[f] Anemia defined as hemoglobin < 115 g/L (children 5-11 y) and <120 g/L (children 12 y).

Table 8-4. Summary results of the JNMNS only for Syrian refugees in host community, Jordan, 2019

Target group	Indicator	N	% [a]	95% CI [b]
Pre-school children				
6-59 months	Anemia (Hb<110 g/L)	39	11.8%	(4.0, 30.1)
	Iron deficiency (sF<12 µg/l)	36	45.7%	(30.7, 61.5)
	Iron deficiency anemia [c]	38	11.3%	(3.6, 30.2)
	Vitamin A deficiency (retinol; ≤0.7 µmol/L)	32	12.5%	(3.6, 34.8)
	Vitamin A deficiency (RBP; ≤0.7 µmol/L)	36	5.5%	(1.8, 15.5)
	Vitamin D deficiency (<12 ng/mL)	33	14.9%	(4.4, 40.1)
	Vitamin D insufficiency (12.1-19.9 ng/mL)	33	50.7%	(30.8, 70.4)
	Zinc deficiency [d]	31	21.9%	(8.6, 45.3)
	Hemoglobinopathies, sickle cell disorder	40	5.8%	(0.8, 31.1)
	Hemoglobinopathies, α-thalassemia	40	1.8%	(0.2, 13.7)
	Hemoglobinopathies, β-thalassemia	40	7.5%	(1.7, 28.3)
0-59 months	Stunting (i.e. HAZ < -2)	62	7.1%	(2.7, 17.1)
	Wasting (i.e. WHZ < -2)	62	0%	-
	Underweight (WAZ < -2)	62	1.1%	(0.1, 8.0)
	Overweight (i.e. WHZ > +2, ≤ +3)	62	3.1%	(1.1, 9.1)
	Obesity (i.e. WHZ > +3)	62	0.4%	(0.0, 2.9)
School-age children (6-12 years)				
	Anemia [e]	70	18.6%	(9.9, 32.1)
	Iron deficiency (SF<12 µg/l)	69	43.7%	(32.4, 55.7)
	Iron deficiency anemia [c]	70	15.7%	(9.3, 25.2)
	Vitamin A deficiency (RBP; ≤0.7 µmol/L)	69	8.8%	(2.8, 24.3)
	Vitamin D deficiency (<12 ng/mL)	68	44.2%	(30.9, 58.4)
	Vitamin D insufficiency (12.1-19.9 ng/mL)	68	39.3%	(28.1, 53.0)
	Zinc deficiency [d]	65	3.2%	(0.4, 22.2)
	Folate deficiency (<10 nmol/L)	68	0.6%	(0.1, 4.7)
	B_{12} deficiency (<150 pmol/L)	68	13.6%	(8.1, 21.9)
	Marginal B_{12} status (150-220 pmol/L)	68	29.7%	(17.1, 46.2)
	Stunting (i.e. HAZ < -2)	73	8.3%	(3.0, 21.3)
	Thinness (i.e. BMI-for-age z-score <-2)	72	0%	-
	Overweight (i.e. BMI-for-age Z > +2, ≤ +3)	72	8.4%	(3.3, 19.6)
	Obesity (i.e. BMI-for-age Z > +3)	72	5.2%	(1.3, 19.1)
Non-pregnant women (15-49 years)				
	Anemia (hb<110g/L)	46	29.7%	(10.3, 60.7)
	Iron deficiency (SF<15µg/l)	47	65.8%	(55.7, 74.6)
	Iron deficiency anemia [c]	46	25.0%	(8.4, 54.8)
	Vitamin A deficiency (RBP ≤0.7 µmol/L)	47	0%	-
	Vitamin D deficiency (<12 ng/mL)	45	58.5%	(31.4, 81.2)
	Vitamin D insufficiency (12.1-19.9 ng/mL)	45	30.3%	(15.2, 51.2)
	Folate deficiency (<10 nmol/L)	46	2.9%	(1.0, 8.0)

Target group	Indicator	N	% [a]	95% CI [b]
	B_{12} deficiency (<150 pmol/L)	46	8.8%	(1.8, 33.6)
	Marginal B_{12} status (150-220 pmol/L)	46	32.0%	(20.8, 45.7)
	Underweight (BMI≤18.5)	54	4.9%	(1.0, 21.1)
	Overweight (BMI≥25, <30)	54	23.7%	(13.0, 39.3)
	Obesity (BMI≥30)	54	37.8%	(25.8, 51.4)

Hb, Hemoglobin; RBP, retinol binding protein; sf, serum ferritin;

[a] Percentages and means are weighted for unequal probability of selection.

[b] CI=confidence interval calculated taking into account the complex sampling design.

[c] Iron deficiency anemia defined the combination of iron deficiency and anemia

[d] Zinc deficiency, defined as follows: pre-school children morning non-fasting: <65 µg/dL, afternoon non-fasting: <57 µg/dL; children 6-9.9 years: morning non-fasting: <65 µg/dL, afternoon non-fasting: <57 µg/dL; girls 10-12.9 years: morning non-fasting: <66 µg/dL, afternoon non-fasting: <59 µg/dL; boys 10-12.9 years: morning non-fasting: <70 µg/dL, afternoon non-fasting: <61 µg/dL;

[e] Anemia defined as hemoglobin < 115 g/L (children 5-11 y) and <120 g/L (children 12 y).

Note that in above table, no results on pregnant women are presented, since there were only 11 pregnant women from the non-camp Syrian households.

Appendix 4: Design effects of key outcomes of the JNMNS 2019

Table 8-5. Design effects of major outcomes of the JNMNS for the settled population [a], Jordan, 2019

Variable	Design effect
Pre-school children	
Low birth weight	2.64
Stunting	2.11
Wasting	1.69
Overweight	1.65
Obesity	1.52
Anemia	2.15
Iron deficiency	1.31
Vitamin D deficiency	1.46
Vitamin D insufficiency	1.93
Vitamin A deficiency	2.06
Zinc deficiency	2.86
School-children	
Stunting	4.33
Thinness	1.60
Overweight	2.68
Obesity	2.58
Anemia	3.82
Iron deficiency	3.50
Vitamin D deficiency	3.85
Vitamin D insufficiency	3.72
Vitamin A deficiency	3.08
Folate deficiency	1.77
Zinc deficiency	1.16
B12 deficiency	1.91
Marginal B12 status	2.66
Non-pregnant women	
Underweight	1.91
Overweight	1.80
Obesity	1.49
Anemia	1.87
Iron deficiency	2.42
Vitamin D deficiency	2.67
Vitamin D insufficiency	2.68
Vitamin A deficiency	1.70
B12 deficiency	1.73
Marginal B12 status	1.86
Folate deficiency	1.77
Pregnant women	
Took folic acid supplement in past 3 months	1.49
Took iron supplement in past 6 months	1.87
Anemia	1.64

[a] Settled population without Syrian refugees living in host community

Table 8-6. Design effects of major outcomes of the JNMNS for the Syrian refugee population living in refugee camps, Jordan, 2019

Variable	Design effect
Pre-school children	
Low birth weight	1.72
Stunting	1.70
Wasting	0.85
Overweight	1.03
Obesity	1.19
Anemia	1.39
Iron deficiency	1.10
Vitamin D deficiency	1.05
Vitamin D insufficiency	1.15
Vitamin A deficiency	0.84
Zinc deficiency	1.46
School-children	
Stunting	0.95
Thinness	0.70
Overweight	0.89
Obesity	1.20
Anemia	1.16
Iron deficiency	1.84
Vitamin D deficiency	1.11
Vitamin D insufficiency	0.84
Vitamin A deficiency	1.40
Folate deficiency	0.81
Zinc deficiency	1.78
B12 deficiency	1.43
Marginal B12 status	0.75
Non-pregnant women	
Underweight	1.30
Overweight	0.85
Obesity	0.96
Anemia	1.42
Iron deficiency	1.28
Vitamin D deficiency	0.98
Vitamin D insufficiency	0.93
Vitamin A deficiency	1.07
B12 deficiency	0.68
Marginal B12 status	1.47
Folate deficiency	0.87
Pregnant women	
Took folic acid supplement in past 3 months	1.02
Took iron supplement in past 6 months	1.42
Anemia	0.67

Appendix 5: Comparison of key outcomes between children 6-59 months old with and without blood specimen

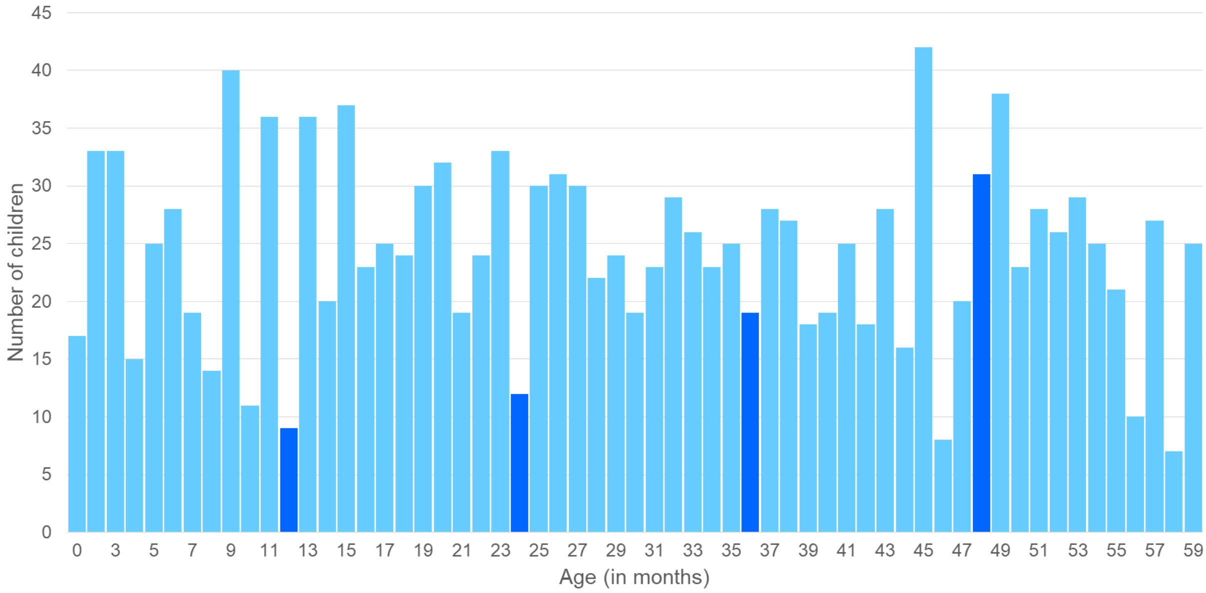
Table 8-7. Comparison of JNMNS pre-school children from the settled population with and without blood sample, Jordan, 2019

Variable	N	% with blood specimen	% without blood specimen	P value
Age (in months)				
6-11	77	33.4%	66.6%	0.013
12-23	156	48.9%	51.1%	
24-35	172	64.4%	35.6%	
36-47	150	58.8%	41.2%	
48-59	164	57.7%	42.3%	
Sex				
Male	399	48.1%	51.9%	0.879
Female	411	48.9%	51.1%	
Residence				
Urban	649	50.1%	49.9%	0.246
Rural	161	39.1%	60.9%	
Stratum				
Central	187	48.1%	51.9%	0.318
Northern	355	47.3%	52.7%	
Southern	268	55.2%	44.8%	
Wealth Quintile				
Lowest	221	50.0%	50.0%	0.063
Second	181	52.4%	47.6%	
Middle	181	39.8%	60.2%	
Fourth	143	60.4%	39.6%	
Highest	84	37.8%	62.2%	
Stunted				
Yes	45	53.2%	46.8%	0.807
No	705	50.5%	49.5%	
Overweight or obese				
Yes	74	34.4%	65.6%	0.032
No	673	52.8%	47.2%	

Appendix 6: Anthropometry quality summary

Pre-school children:

Age distribution (in months):



The age in months is quite evenly distributed without evidence of heaping at full years, as might be expected in a relatively developed country with a calendar-literate population and good documentation of births.

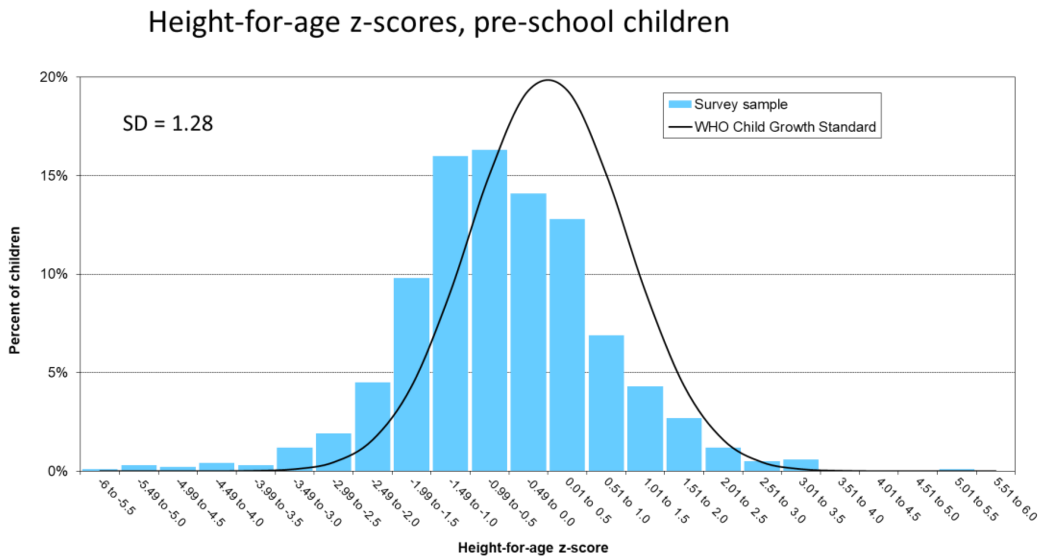
Further, the ratio of the number of children within ratio of the number of children 6-29 and the number of children 30-59 months is 0.878; the SMART methodology manual suggests the ratio should be around 0.85 (85).

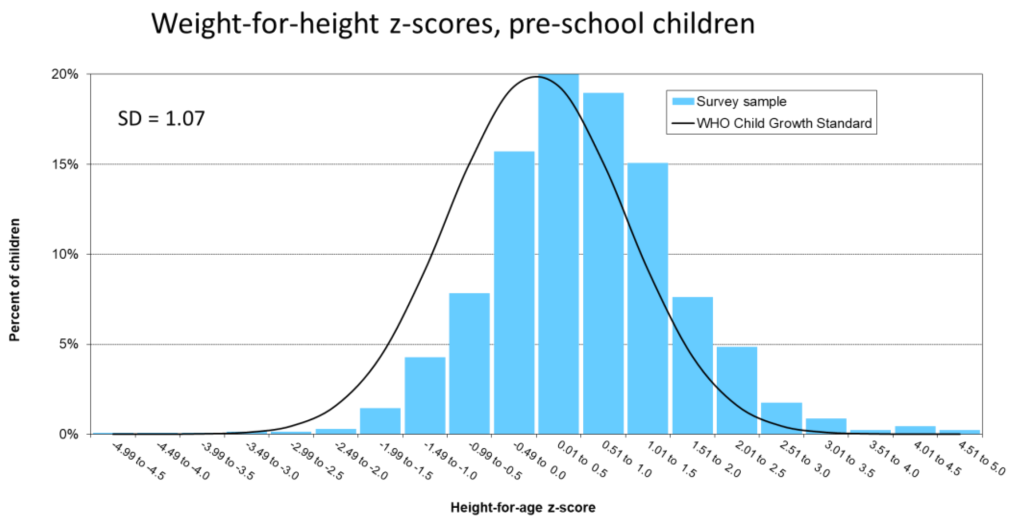
Sex distribution by age category:

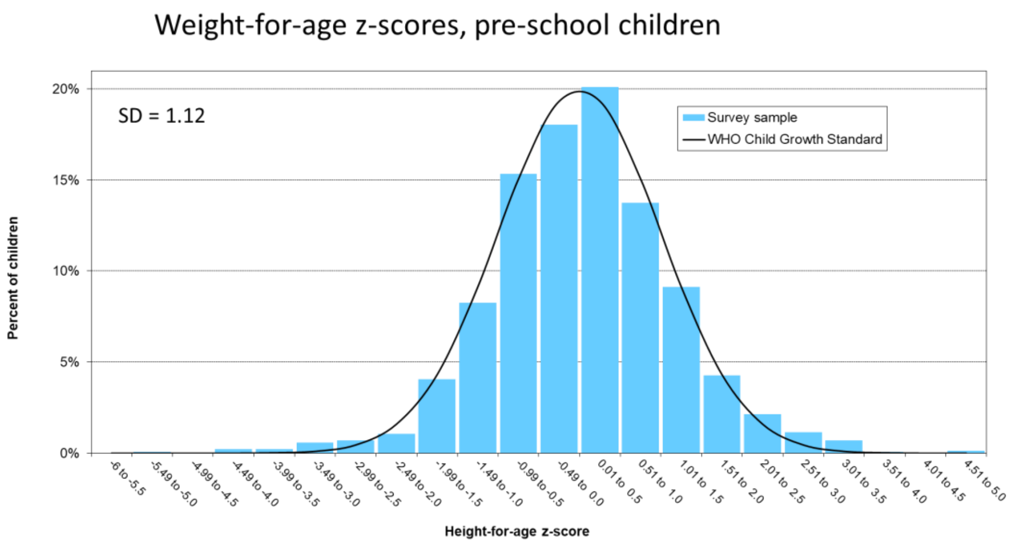
Variable	N	% Male	% Female	Sex ratio
TOTAL	1463	50.5%	49.5%	1.02
Age (in months)				
0-6	151	43.7%	56.3%	0.78
6-11	148	52.4%	47.6%	1.10
12-23	312	47.5%	52.5%	0.90
24-35	294	55.6%	44.4%	1.25
36-47	268	51.0%	49.0%	1.04
48-59	290	50.2%	49.8%	1.01

Although there are some differences in sex ratio within some age categories, the overall p-value is 0.579 indicating non-significant differences.

Histograms of z-scores:





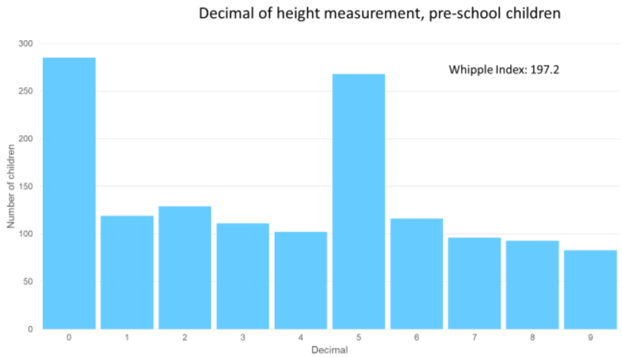


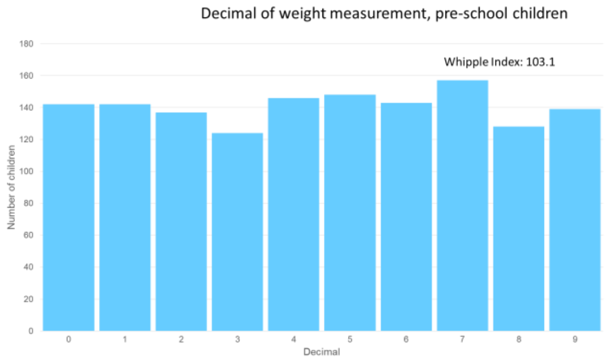
Flagged data:

Variable	N	% Flagged
No flag	1375	99.1%
HAZ flag	4	0.3%
WHZ flag	6	0.4%
HAZ & WHZ flag	2	0.1%
HAZ & WAZ flag	1	0.1%

As per the SMART methodology, a total of <2.5% of data being flagged is highly acceptable [85].

Digit preference:

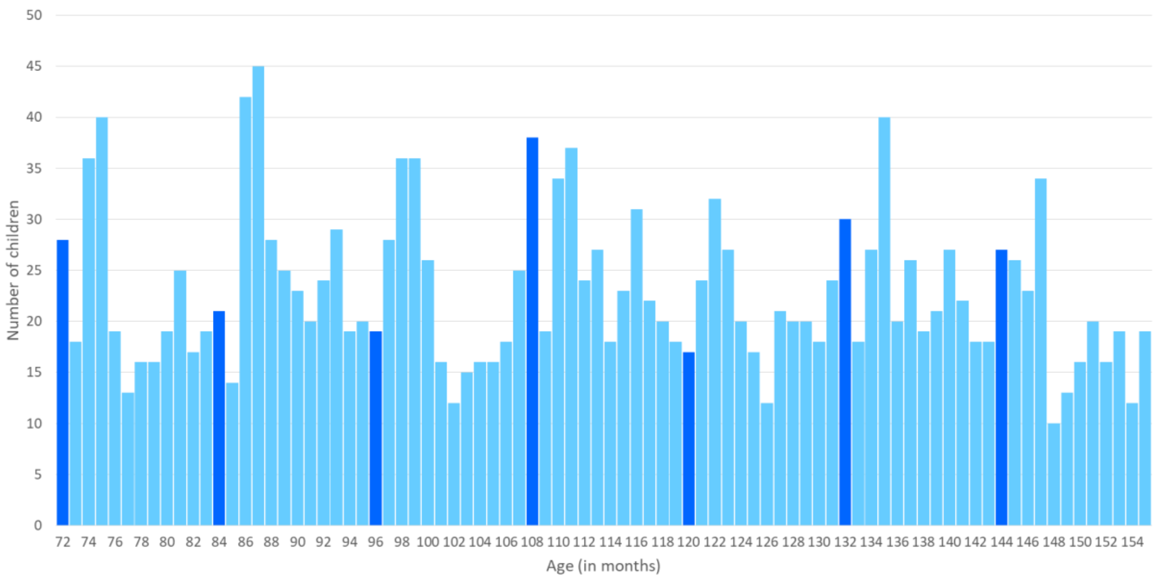




The height measurements show a clear and strong preference for the decimals .0 and .5, indicating that anthropometrists either rounded or truncated measurements. While this may decrease precision somewhat, height measurements which are inaccurate by only a few millimeters probably do not inject a substantial systematic bias.

<u>School-age children:</u>

Age distribution (in months):



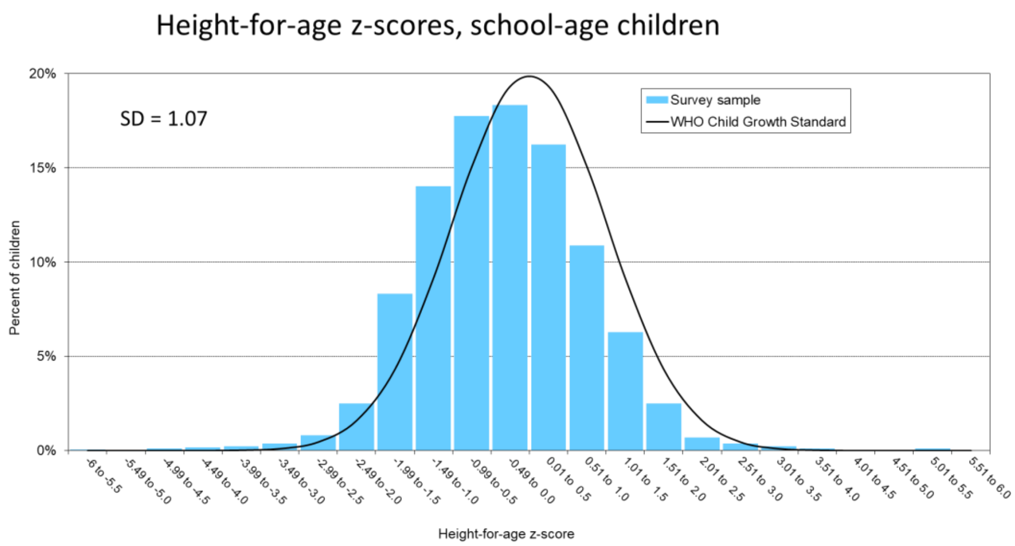
The age in months is quite evenly distributed without any heaping at full years, as might be expected in a relatively developed country with a calendar-literate population and good documentation of births.

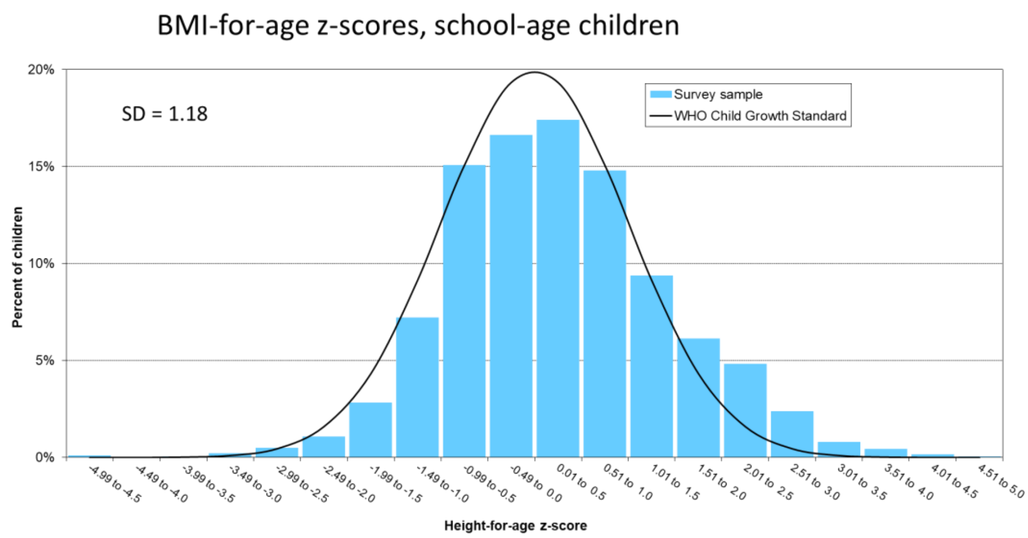
Sex distribution by age category:

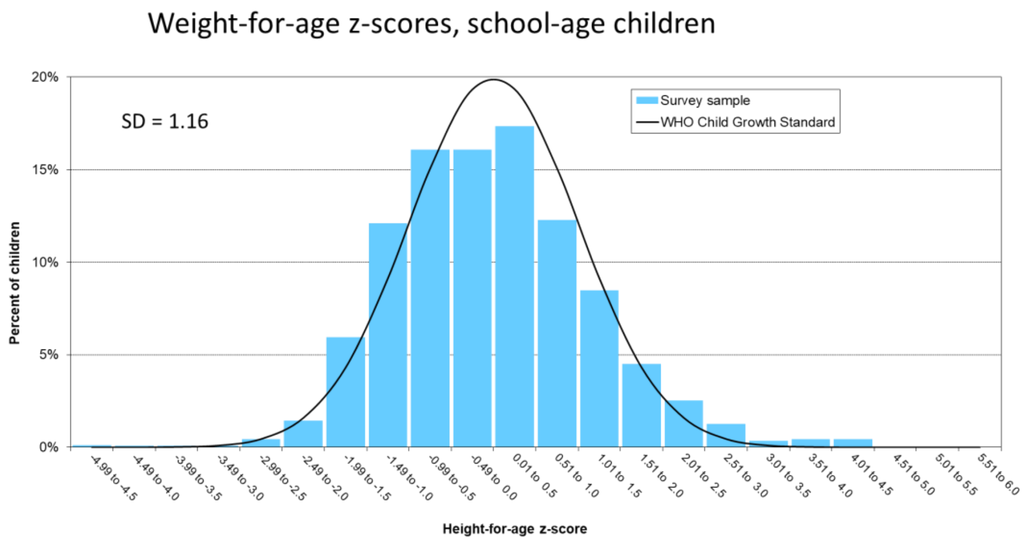
Variable	N	% Male	% Female	Sex ratio
TOTAL	1923	53.0%	47.0%	1.13
Age (in years)				
6-6.9	266	57.4%	42.6%	1.35
7-7.9	310	49.5%	50.5%	0.98
8-8.9	263	55.3%	44.7%	1.24
9-9.9	311	53.1%	46.9%	1.13
10-10.9	252	54.4%	45.6%	1.19
11-11.9	286	49.4%	50.6%	0.98
12	235	54.3%	45.7%	1.19

Although slightly more male school-age children were included in the survey, there are no statistically significant sex ratio differences by age group, with a p-value of 0.815.

Histograms of z-scores:





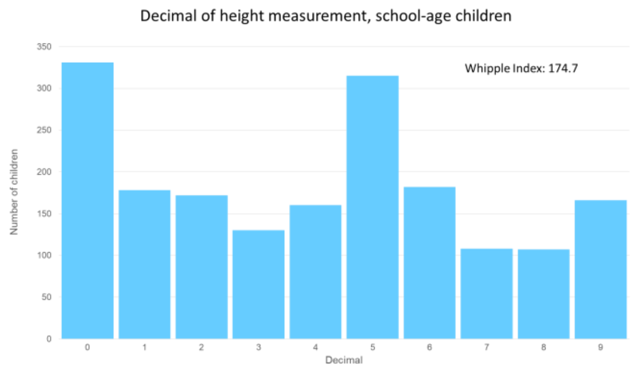


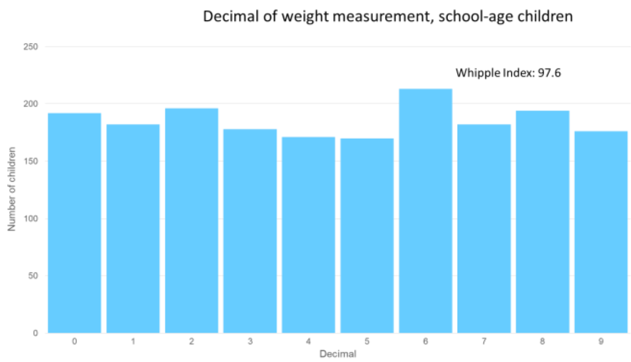
Flagged data:

Variable	N	% Flagged
Total	1923	--
HAZ flag	6	0.3%
WAZ flag	3	0.2%
BMI flag	8	0.4%

As with pre-school children, very few anthropometric measurements are flagged.

Digit preference:

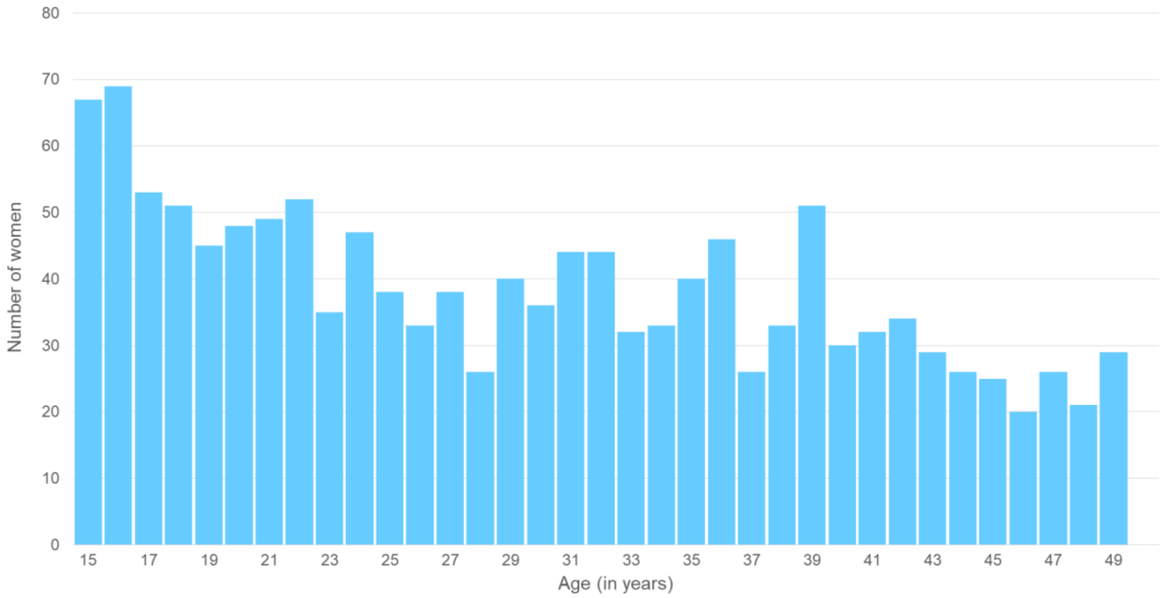




As in pre-school children, height measurements show a strong digit preference preference in school-age children.

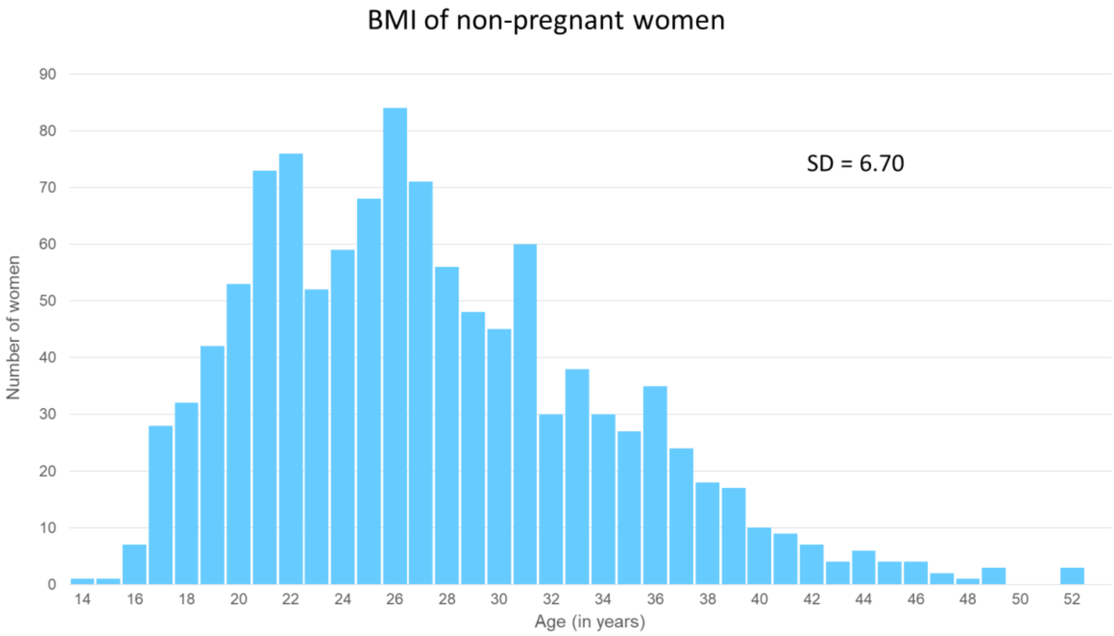
Non-pregnant women:

Age distribution (in years):

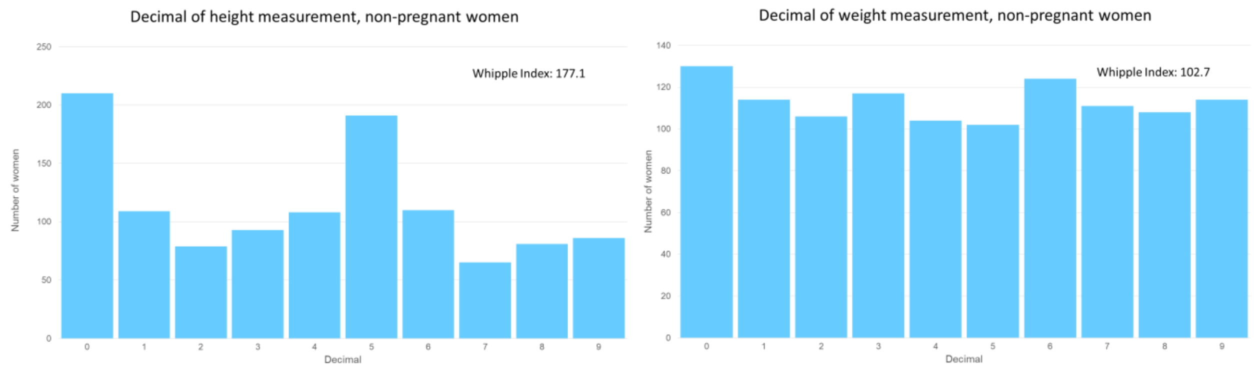


The survey sample included disproportionately younger women, but there is no heaping at decades or other specific points.

Histograms of BMI:



Digit preference:



The digit preference in height measurements is very similar to that in children.

Appendix 7: List of team members of the JNMNS 2019

Team #	Team leader	Medical doctor	Interviewers	Anthropometrists	Phlebotomists
1	Amal Khaled ibrahim Abu Shikha	Mahmod Ali Yacoub	Sarah mohammed Ali Ahmad Abu Ghazaleh	Areej Adnan Khalefih Al-Refaei	Alaa' Ghasan Taher Hindeih
			Yara Khaleel Ateih Al-Omari	Leen Ayman Mustafa Al-Khateeb	Noura Hmadan Awad Al-Raqab
2	Sundos Hussein Lutfi Al-Obeidi	Ashraf Jamil Adel	Rawan Bassam mohammed Shehab	Rand Saed Mahmoud Al-Saed	Nebal Wael Ahmad Jaber
			Dania Mazen Mahmoud Al-Odwan	Bushra Hesham Fayiz Abu Zaid	Maher Hatem mohammed Al-Saheb
3	Abd Al-Latif Musa Abd Abu Hajeb	Adel Salem Al-Rawahneh	Tala Maher Andouni Dahmas	Rantia Nayif Abd Al-Mahdi Al-Qutami	Yehia mohammed Yousef Abu Dalbouh
			Zaid Hani Naser Basioune	Israa Abdallah Ismaeil Al-Laham	Duaa Tawfeeq Radi Abu Naser
4	Yasmeen mohammed Jumaa Al-Shaikh	Basil Khaled Abu-Hdeeb	Talar Simone Balian	Lana Hasan Ghaleb Shukri	Duaa Ali Jaber Abu Kashef
			Hadeel Hazem Abd Al-Majeed Al-Hajjaj	Ghadeer Mustafa Tafa Ababneh	Laila Hussein Abd Al-Rahman Al-Harbi
5	Julie Musa Jameel Al-Hourani	Mohammad Ghazi Hattab	Tuqa Ghasan Abd AL-Mutlab Al-Daqes	Ala'a Mohammed Abduallah Subeih	Mu'tasem Mohammed Ahmad Al-Hussin
			Dania Nazeh Ahmad Ali	Ro'aa Bassam Dawod Al-Dawood	Suhad Mohammed Mahmoud Hawamdeh
6	Thana'a Younes Rasheed Al-jaraideh	Saed Adel Assaf	Osoul Ibrahim Mohammed Qaraqish	Sajeda Mohammed Hussin Al-Omari	Basheer Mohammed Basheer Al-Dababseh
			Maisam Hassan Mustafa Al-Turk	Maisa'a Munjed Najem Al-Alawneh	Roa'a Mohammed Ahmed Oleimat
7	Dana Adnan Abduallah Al-Omari	Abdallah Mzin Ma'touq	Bara'a Mohammed Saleh Al-Ajlouni	Dana Qutaibah Yousef Al-Samman	Nuha Saqer Nemir Al-Najajra
			Lubna Majed Abdelqader Mustafa		Nabeil Refaei Khaleif Hazaimeh
8	Sundos Mahmoud Eid Fleih	Suhaib Najib Abu Failat	Batool Jamal Tawfeeq Abu Shami	Mushera Dardah Faleih Ouadat	Saja Hashem Saed Hanandeh
		Ra'ed Nayef Al-Maluf	Umaima Mohammed Dawoud Zuqaile	Ahamad Ali Khaled Al-Sarmeeni	Sarah Ghaleb Saleh Al-Omar
9	Amani Rudwan Khalefih Al-Ma'aita	Rakan Ahmad Abu-Roman	Dua'a Adnan Daif-Allah Al-Hanandeh	Rana Mohammed Salem Mu'aeqel	Ahmad Ibrahim Abd Al-Tawalbeh
			Qusai Hamed Fadian Al-Bakeer	Remah Abd Al-Raheem Jaafar Al-Habashneh	Dalia Basem Mohammed Abd Al-Rahman
10	Safa' Fawaz Abd Al-Lateif Abu Al-Failat Barakat	Mohammad Nemer Al-Hawarat	Abd Al-Rahman Aref Ali Abu Shareiaa	Dana Mohammed Saed Mohammed Hasan Al-Rowais	Alaa' Asaad Taleb Al-Hanahen
			Bara'a Abduallah Issa Haikal	Ghadeer Khaled Mohammed Al-Saoub	Ahmad Bassam Awad Al-Lasasmeh
11	Sameiha Ghazi Mubarak Al-Thneibat	Salam Farhan Khraisat	Deema Shaher Abd Al-Razzaq Abu Hamour	Haneen Qasem Khalef Al-Tarawneh	Muhannad Marzouq Mudeeb Al-Moumani
			Mahmoud Haitham Taha Eliaan	Majd Razq Al-Haj Ali Al-Asafra	Farah Jamal Mohammed Jaber

Appendix 8: Sample size calculations

Table 8-8. Assumptions and results of sample size calculation, including conversion to number of households, and the precision obtained by the planned sample size of 2,600 households (stratum-specific estimates based on 600 households), by target group and nutrition indicator.

Target group and indicator	Estimated prevalence	Desired precision in each stratum (percentage points)	Assumed design effect	Assumed individual response	Number of persons to select in one stratum	Number of households to select in one stratum	Number of households to select in all four strata	% of HHs in which group recruited	Precision in 1 stratum with sample size of 600 HHs/stratum	Precision in survey with total sample size of 2600 HHs
Children										
Wasting	4%	±3.0	1.7	95%	258	518	2072	100%	±2.8	±1.3
Stunting	11%	±5.0	1.5	95%	936	470	1880	100%	±4.4	±2.1
Underweight	11%	±5.0	1.5	95%	234	470	1880	100%	±4.4	±2.1
Anemia	17%	±5.0	1.3	85%	326	654	2616	100%	±5.5	±2.6
Iron deficiency	14%	±5.0	1.5	85%	321	644	2576	100%	±5.5	±2.6
Vitamin A deficiency	18%	±5.0	1.5	85%	406	815	3260	100%	±6.1	±2.9
Zinc deficiency	25%	±10.0	1.5	85%	128	257	1028	100%	±6.9	±3.8
Vitamin D deficiency	20%	±5.0	1.7	85%	489	981	3924	100%	±6.7	±3.2
Non-pregnant women										
Chronic energy deficiency	5%	±5.0	1.5	95%	116	115	460	50%	3.1%	±1.5
Overweight & Obese	55%	±5.0	1.5	95%	601	593	2372	50%	7.0%	±3.4
Anemia	29%	±5.0	1.9	80%	755	745	2980	50%	7.9%	±3.8
Iron deficiency	35%	±7.0	2.0	80%	447	441	1764	50%	8.5%	±4.1
Vitamin A deficiency	5%	±5.0	1.4	80%	123	122	488	50%	3.2%	±1.5
Vitamin D deficiency	60%	±10.0	2.0	80%	230	227	908	50%	8.7%	±4.21
Folate deficiency	14%	±5.0	1.5	80%	339	335	1340	50%	5.3%	±2.5
B12 deficiency	11%	±5.0	1.5	80%	285	281	1124	50%	4.8%	±2.3
Pregnant women										
Anemia	29%	±7.0	1.5	70%	217	3576	14304	100%	±16.3	±8.1
School-age children										
Wasting	10%	±4.0	1.5	85%	382	541	2164	100%	±3.8	±1.8
Stunting	25%	±5.0	1.5	85%	509	721	2884	100%	±5.5	±2.6
Overweight/Obesity	25%	±7.0	1.5	85%	260	368	1472	100%	±5.5	±2.6

Target group and indicator	Estimated prevalence	Desired precision in each stratum (percentage points)	Assumed design effect	Assumed individual response	Number of persons to select in one stratum	Number of households to select in one stratum	Number of households to select in all four strata	% of HHs in which group recruited	Precision in 1 stratum with sample size of 600 HHs/stratum	Precision in survey with total sample size of 2600 HHs
Anemia	25%	±7.0	1.5	75%	294	417	1668	100%	±5.8	±2.8
Iron deficiency	20%	±5.0	1.5	75%	492	697	2788	100%	±5.4	±2.6
Vitamin A deficiency	30%	±7.0	1.5	75%	330	468	1872	100%	±6.2	±3.0
Zinc deficiency	30%	±7.0	1.5	75%	330	468	1872	100%	±6.2	±3.0
Vitamin D deficiency	50%	±10.0	1.5	75%	193	274	1096	100%	±6.7	±3.2
Folate deficiency	10%	±5.0	1.5	75%	277	393	1572	100%	±4.0	±1.9
B12 deficiency	10%	±5.0	1.5	75%	277	393	1572	100%	±4.0	±1.9

Table 8-9. Sample sizes for children, non-pregnant women, and pregnant women and their baseline vs. endpoint survey precision, assuming 85% household response rate and individual response rates from Table 4

Target group and indicator	Estimated Prevalence *	Estimated prevalence in 2019	Subjects with data in 1 stratum**	Subjects with data in 4 strata**	P-value for a difference in 1 stratum	P-value for a difference nationally
Children						
Wasting	4%†	1%	285	1232	**0.073**	**<0.001**
Stunting	11%†	7%	285	1232	**0.338**	**<0.01**
Overweight/Obesity	11%†	18.0%	285	1232	**0.103**	**<0.001**
Anemia	17%†	9.0%	229	992	**<0.05**	**<0.001**
Iron deficiency	14%†	6.5%	229	992	**0.057**	**<0.001**
Vitamin A deficiency	18%†	10.0%	229	992	**0.092**	**<0.001**
Zinc deficiency	25%	38.0%	229	992	**<0.05**	**<0.001**
Vitamin D deficiency	20%†	10.0%	229	992	**<0.05**	**<0.001**
Non-pregnant women ‡						
Chronic energy deficiency	5%	10.0%	290	1256	**0.124**	**<0.001**
Overweight & Obese	55%	61.0%	290	1256	**0.464**	**<0.05**
Anemia	29%†	17.0%	244	1056	**<0.05**	**<0.001**
Iron deficiency	35%†	24.0%	244	1056	**0.120**	**<0.001**
Vitamin A deficiency	5%†	2.5%	244	1056	**0.458**	**<0.05**
Vitamin D deficiency	60%†	46.0%	244	1056	**0.057**	**<0.001**
Folate deficiency	14%†	6.0%	244	1056	**<0.05**	**<0.001**
B12 deficiency	11%†	5.0%	244	1056	**0.095**	**<0.001**
Pregnant women						
Anemia	29%	20.0%	-	144	-	**0.212**

* Estimated prevalence and design effect were from most recently available data or, if data not available, a 50% deficiency prevalence was assumed;

** The number of subjects with data was obtained through known DHS data; average household size in Jordan is 5.1 persons and 12.6%, 25.9% and 5.5% of the population are children, non-pregnant women and pregnant women, respectively;

† Estimate from 2010 Jordan Micronutrient Survey;

‡ Non-pregnant women were selected from 50% of the households.

Appendix 9: JUST-IRB approval

جامعة العلوم والتكنولوجيا الأردنية
Jordan University of Science and Technology

مستشفى الملك المؤسس عبدالله الجامعي
King Abdullah University Hospital

لجنة أخلاقيات البحث على الإنسان
Institutional Review Board

Ref.: 77/118/2018, date 31.10.2018

Date: 1 / 11 / 2018

Ministry of Health/ Jordan

In reference to the scientific research which is presented by **Dr. Fabian Rohner**, entitled:

Jordan National Micronutrient and Nutrition survey 2018/19 – JNMNS

We would like to inform you that the above research proposal has granted IRB approval, under the following conditions:

1. Commitment to the Scientific Research Policy at Jordan University of Science and Technology and King Abdullah University Hospital.
2. Maintaining data confidentiality and using it only for scientific purposes.
3. Provide us with the final executive study report including copy of participants' legally authorized representative consent form, and keep another copy with the researcher.
4. This approval will be canceled if the principle investigator doesn't provide IRB with the final report about the results of the research after one year.

Sincerely,

Prof. Yousef Al-Gaud

Chairman of the Institutional Review Board

Tel.: 962-2-7200610 Fax: 962-2-7095777 P.O. Box: 630001 Irbid 22110 Jordan Email: irb@kauh.jo

Appendix 10: Participant Information Sheet and Consent Form

English versions:

Participant information sheet:
http://groundworkhealth.org/wp-content/uploads/2020/02/8_EN_Participant_information_sheet_JNMNS.pdf
Consent form:
http://groundworkhealth.org/wp-content/uploads/2020/02/9_EN_Consent_form_JNMNS.pdf

Arabic versions:

Participant information sheet:
http://groundworkhealth.org/wp-content/uploads/2020/02/8_AR_Participant_Information_Sheet_JNMNS.pdf
Consent form:
http://groundworkhealth.org/wp-content/uploads/2020/02/9_AR_Consent_form_JNMNS.pdf

Appendix 11: Referral Sheet

English versions:

Referral sheet:
http://groundworkhealth.org/wp-content/uploads/2020/02/10_EN_Referral_form_JNMNS.pdf

Arabic versions:

Referral sheet:
http://groundworkhealth.org/wp-content/uploads/2020/02/10_AR_Referral_Sheet_JNMNS.pdf

Appendix 12: Questionnaires

PDF versions of all questionnaires and survey tools can be download from GroundWork's website using the URL hyperlinks provided below:

English versions:

Household questionnaire:
http://groundworkhealth.org/wp-content/uploads/2020/02/1_EN_Household_questionnaire_JNMNS.pdf
Pre-school child questionnaire:
http://groundworkhealth.org/wp-content/uploads/2020/02/2_EN_PSC_questionnaire_JNMNS.pdf
Pre-school child biological form:
http://groundworkhealth.org/wp-content/uploads/2020/02/3_EN_PSC_bioform_JNMNS.pdf
School-age child questionnaire:
http://groundworkhealth.org/wp-content/uploads/2020/02/4_EN_SAC_questionnaire_JNMNS.pdf
School-age child biological form:
http://groundworkhealth.org/wp-content/uploads/2020/02/5_EN_SAC_bioform_JNMNS.pdf
Woman questionnaire:
http://groundworkhealth.org/wp-content/uploads/2020/02/6_EN_Women_questionnaire_JNMNS.pdf
Woman biological form:
http://groundworkhealth.org/wp-content/uploads/2020/02/7_EN_Women_bioform_JNMNS.pdf

Arabic versions:

Household questionnaire:
http://groundworkhealth.org/wp-content/uploads/2020/02/1_AR_Household_questionnaire_JNMNS.pdf
Pre-school child questionnaire:
http://groundworkhealth.org/wp-content/uploads/2020/02/2_AR_PSC_questionnaire_JNMNS.pdf
Pre-school child biological form:
http://groundworkhealth.org/wp-content/uploads/2020/02/3_AR_PSC_bioform_JNMNS.pdf
School-age child questionnaire:
http://groundworkhealth.org/wp-content/uploads/2020/02/4_AR_SAC_questionnaire_JNMNS.pdf
School-age child biological form:
http://groundworkhealth.org/wp-content/uploads/2020/02/5_AR_SAC_bioform_JNMNS-1.pdf
Woman questionnaire:
http://groundworkhealth.org/wp-content/uploads/2020/02/6_AR_Women_questionnaire_JNMNS.pdf
Woman biological form:
http://groundworkhealth.org/wp-content/uploads/2020/02/7_AR_Women_bioform_JNMNS.pdf

UNICEF Jordan Country Office

The Hashemite Kingdom of Jordan
Ministry of Health

WFP Jordan Country Office