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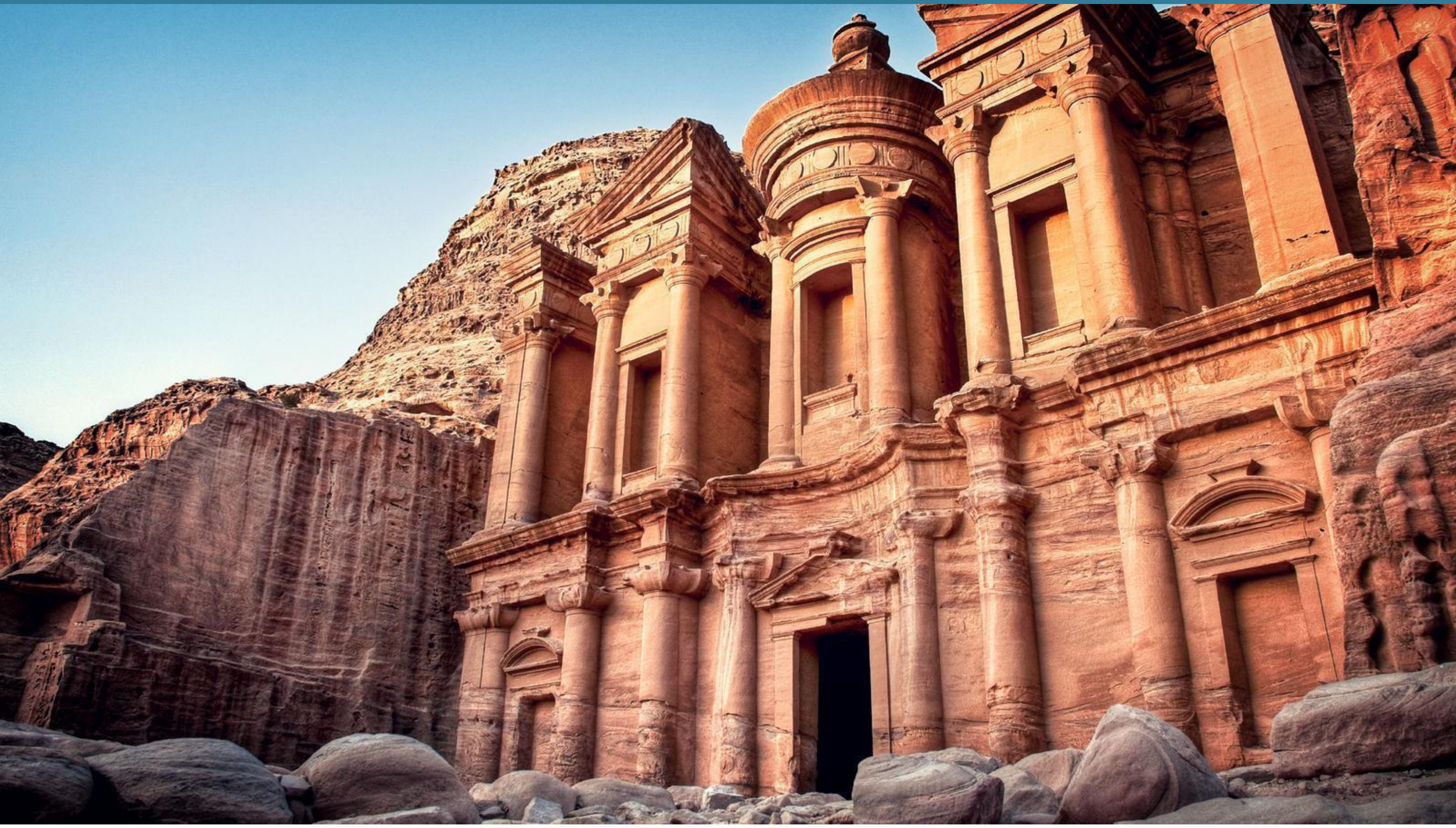

Trends Analysis Report on Infant and Young Child Feeding Practices in the Hashemite Kingdom of Jordan, 1990-2017

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Acronyms and Abbreviations

ASF	Animal Source Food
BMS	Breastmilk Substitute
BMI	Body Mass Index
CBF	Continued Breastfeeding
CF	Complementary Feeding
DHS	Demographic and Health Survey
DGLV	Dark Green Leafy Vegetables
EBF	Exclusive Breastfeeding
EMR	East Mediterranean Region
HIES	Household Income and Expenditure Survey
IBFAN	International Baby Food Action Network
IYCF	Infant and Young Child Feeding
JPFHS	Jordan Population and Family and Health Survey
MAD	Minimum Acceptable Diet
MDD	Minimum Dietary Diversity
MENA	Middle East and North Africa
MMF	Minimum Meal Frequency
UNICEF	United Nations International Children's Fund
USD	United States Dollar
WHA	World Health Assembly
WHO	World Health Organization

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Executive Summary

Exclusive breastfeeding is ranked as the top preventative child survival intervention globally, while appropriate timely complementary feeding ranks third; implementing these alongside timely and appropriate IYCF (infant and young child feeding practices) can prevent up to 1.4 million deaths annually.[1] In Jordan, low rates of exclusive breastfeeding and poor complementary feeding are significant public health concerns, as are rapidly rising rates of overweight and obesity among both adult women and children. Through an intensive literature review, we found a gap in evidence on complementary feeding and complementary feeding practices in Jordan. There is little information on what, when, and how a mother chooses the first foods and in particular given the low rates of appropriate feeding practices (e.g. minimum meal frequency- MMF, minimum dietary diversity-MDD and minimum acceptable diet-MAD), the relationship of consumption of unhealthy foods (e.g., sugar sweetened beverages, fried snacks and sweets) versus consumption of micronutrient rich foods and foods groups (e.g. dark green leafy vegetables, vitamin A rich fruits and vegetables, animal source foods including dairy, meat, fish, poultry and eggs and legumes, nuts and seeds).

Utilizing six multi-year Demographic and Health Surveys (DHS) between 1990-2017, we assessed the trends and changes in breastfeeding and complementary feeding practices in Jordan. The objective of the study was to assess these trends and determine factors associated with optimal versus sub-optimal practices of breastfeeding (BF), exclusive breastfeeding (EBF) and complementary feeding indicators such as MMF, MDD and MAD and consumption of breastmilk substitutes, ultra-processed foods such as juices and sugar sweetened beverages versus consumption of micronutrient rich foods and food groups. The analysis included a total of 14,874 infants and young children across all survey years with 11,099 children aged 6-23 months and 3725 infants under 6 months of age and involved a trends analysis and an assessment of factors associated with the different IYCF practices as well as those associated with the consumption of different food groups. Descriptive and inferential statistical analyses were conducted to assess trends over time and determine differences by survey year, location (governorates, urban/rural population), education level of the mother and the wealth of the household.

In Jordan, while the rate of early initiation of breastfeeding has improved over time (1990 to 2017) with two-thirds of newborns being put to the breast within the first hour of life, as of 2017, 3 out of four children still do not receive the protective benefits of exclusive breastfeeding, a number that has not changed for three decades. Similarly, the median duration of exclusive breastfeeding has not changed in three decades. Furthermore, there is an increased reliance on breastmilk substitutes. With respect to complementary feeding practices in infants and young children 6-23 months of age, the percentage achieving MMF has drastically reduced over time with less than half of the infants and young children aged 9-11 and 18-23 months being fed the minimum number of meals for their age. MAD has also progressively declined over the years with only 1 in every six children receiving a minimum acceptable diet. Similarly, consumption of micronutrient rich foods, eggs, meat, fish, and poultry has declined considerably over time. On the other hand, consumption of infant formula and sugar sweetened beverages has increased over time in Jordan.

When we examine factors associated with consumption of breastmilk substitutes and sugar sweetened beverages, controlling for survey year, we find infants under 6 months of age in wealthier households and infants in urban areas were significantly more likely to be introduced to formula prior to 6 months of age. In infants aged 6-23 months, MAD, MDD and MMF and consumption of micronutrient rich foods and food groups were positively associated with wealth status and the education levels of the mother. Infants 6-23 months with more educated mothers and those living in wealthier households were also more likely to receive infant formula, juices, and baby foods.

In summary, we find many IYCF indicators have substantially declined over time in Jordan. Our findings indicate the importance of supporting policies and programs to support IYCF practices starting from supporting breastfeeding and appropriate complementary feeding practices.

Background

1.1 Introduction

When, What and How children are fed from birth to age 2 has a profound impact on the rest of a child's life.

Appropriate and optimum nutrition during the first 2 years of life can directly affect the survival, health, and development of children to their full potential.[2] Inadequate and poor nutrition during this period has been associated with irreversible damage to physical and cognitive development, with an increased risk of obesity, hypertension, and diabetes later on in life.[3,4,5] Globally, nearly 150 million children under the age of 5 are stunted, 45 million are wasted, and an estimated 40 million children are overweight or obese.[6] Estimates suggest 830,000 newborn deaths could be prevented every year if all infants were breastfed in the first hour of life.[7] Similarly, 600,000 under-5 deaths could be averted annually with optimal complementary feeding.[8]

Breastfeeding saves lives and promotes optimal health in both mothers and their infants

Optimum food and infant and young child feeding (IYCF) practices during the first 1000 days, from conception to a child's second birthday can directly affect the survival, health, and nutritional status of children.[9] The World Health Organization (WHO) and UNICEF Global Strategy for Infant and Young Child Feeding outlines early initiation of breastfeeding (provision of mother's breastmilk to infants within one hour of birth)[10], exclusive breastfeeding (only breastmilk from birth until 6 months) and continued breastfeeding (until two years of age) as three key recommended practices for breastfeeding. Breastfeeding confers numerous direct, medium- and long-term health benefits to both mother and child.

Breastfeeding is safe, since it requires no preparation, and is available even in environment with poor sanitation and unsafe drinking water.[11] Early initiation of breastfeeding (provision of mother's breastmilk to infants within one hour of birth)[10] is a key practice that keeps the infant warm, builds immune function to prevent neonatal mortality due to sepsis, pneumonia, and diarrhea, improves child survival, promotes bonding, boosts mother's milk supply, and facilitates sustained breastfeeding.[12,13,14,15] . Mothers transmit elements of their microbiota and microbiome to their children, and breastmilk helps program the healthy development of infant's gut microbiome for life[16] though its unique complex chain of sugars. There is growing evidence that breastfeeding is associated with reduced childhood morbidity and mortality,[17,1814,15] and improved cognitive development and performance.[19] It offers protective effects against childhood and adult overweight, obesity, and diabetes[20,21,22]. Breastfeeding mothers have been shown to have a reduced risk of breast and ovarian carcinoma,[23,24] obesity, and type 2 diabetes.[20,24] A prospective study has found significant protective effect of breastfeeding on late childhood overweight and obesity.

Similarly, another systematic review found a consistent association of breastfeeding with reduction of later overweight and obesity in childhood and adulthood.[25] Further, studies have shown breastfed children gain less weight than children who are fed infant formula.[26,27] At the same time, complementary feeding such as semi- and solid foods and liquids other than breastmilk or infant formula should not be introduced before 17 weeks and not later than 26 weeks with early introduction of complementary foods associated with childhood adiposity.[28]

Given that, obesity in children currently poses a global health challenge and is associated with health risks such as Type II diabetes mellitus, dyslipidemia, hypertension, and atherosclerosis, it is critical to support appropriate breastfeeding and complementary feeding for optimal child growth and development.[29]

Only few infants globally benefit from optimum breastfeeding practices

Despite the benefits of early initiation and exclusive breastfeeding, breastfeeding rates in low- and middle-income countries (LMICs) as well as high income countries (HICs) fall short of the international recommendations,[30,31] with global rates remaining below 40% for the past 20 years.[7] Less than 42% of newborns are put to the breast within the first hour of birth, even in countries with high breastfeeding initiation rates.[32] A recent study assessing the prevalence of early initiation of breastfeeding in LMICs and HICs found large data gaps with only half of the LMICs and 22% HICs recording data on early initiation.[33] Only 41% of infants less than 6 months of age are exclusively breastfed, far short of the 2030 global target of 70%.[34] This is further compounded by the promotion and marketing of commercially-available breastmilk substitutes (BMS) resulting in the early cessation of breastfeeding.[35,36] The International Code of Marketing of BMS, adopted by the World Health Assembly (WHA) in 1981, prohibits all forms of promotion and advertising of BMS, including advertising, gifts to healthcare professionals and distribution of free samples.[37] While progress has been made, only few countries have legal measures in place to discourage marketing of BMS. As of 2020, of the 194 Member States, only 25 countries had legal measures which were substantially aligned with the "Code" and 58 countries had no legal measures at all.[38] On the contrary, infant formula (0–6 months) sales increased globally from 7.1 kg per infant in 2005 to 11.0 kg per infant in 2017, representing a 54.9% increase.[39] In 2018, BMS market size was valued at over USD 60 billion and is expected to grow to USD 119 billion by 2025.[40]

Complementary feeding – When, What, and How

Similarly, complementary feeding is defined as the feeding period when breastmilk is no longer sufficient to meet the nutritional requirements of infants, and therefore other foods and liquids are required along with breastmilk. [41,33] This is a critical period to address the growing gaps between the daily energy and nutrient requirement of infants and young children aged 6-23 months. Four recommended complementary feeding practices indicators, including i) Minimum meal frequency (MMF), defined as children who are receiving solid, semi-solid, or soft foods the minimum number of times or more during the previous day; ii) Minimum dietary diversity (MDD), defined as children who received foods from more than or equal to four (out of seven) food groups during the previous day; iii) Minimum acceptable diet (MAD), a composite indicator of MMF and MDD; iv) introduction of solid, semi-solid or soft foods, defined as infants 6-8 months of age who received solid, semi-solid or soft foods during the previous day, were first published in 2008,[42] and updated more recently in 2021[43] by the World Health Organization and UNICEF to monitor appropriate feeding practices in children 6-23 months. Providing safe and hygienic meals frequently throughout the day ensures adequate energy and nutrients to fuel their children's growth and development. Appropriate and timely introduction of complementary foods (as tracked by these metrics) ensures that children are consuming nutrient -dense diets, thereby reducing the risk of poor growth (both linear and ponderal), ensuring micronutrient adequacy, and preventing childhood illnesses, thus promoting to promote optimal physical and cognitive growth and development.[44,45]

Few infants and young children receive a diverse and nutritious diet

However, in several parts of the world, complementary feeding continues to be a challenge to good nutrition. Complementary foods are often lacking in diverse and adequate nutritional quality, introduced too early or too late, in sub-optimal amounts, or not frequently enough.[46] More than 44% of children aged 6 – 23 months are not fed fruits or vegetables and 59% are not fed eggs, dairy, fish or meat.[47] Only half of the children aged 6–23 months meet MMF, while 29% meet MDD, and only 15% receive a MAD.[48,39] Similarly, another study found only 64.5% of infants between 6–8 months of age are fed solid, semisolid, or soft foods and rates of MMF and MDD were both low at 52% and 29% respectively. [49] Timing of introduction of complementary foods was problematic across all regions with consumption of solid foods before the recommended 6 months of age. As with diet diversity, only 28% children consumed any legumes, nuts, or seeds, consumption of fruits and vegetables, and animal sourced foods (flesh foods, eggs, and dairy) was low across all regions in the world.[49] Concurrently, consumption of unhealthy and highly processed snack foods is increasingly prevalent during this nutritionally vital complementary feeding period and has shown to displace breastmilk and other suitable, nutrient-rich, home-prepared, and locally available foods.[35,50] Relatedly, during the period 2005 – 2017, sales of total per capita volumes of packaged foods rose from 67.7 kg per capita to 76.9 kg, with significant growth in growing economies.[39]

1.2 Determinants of optimal breastfeeding and complementary feeding practices: What does the evidence tell us?

Despite significant global attention, promotion, and advocacy to support exclusive breastfeeding through 6 months of age, only 41% of infants less than 6 months of age are exclusively breastfed, far short of the 2030 global target of 70%.[34] The predictors and determinants of exclusive breastfeeding practices include place of residence, maternal age and education, early initiation of breastfeeding, knowledge about exclusive breastfeeding, perceived availability of breastmilk, infant age, place of residence, place and type of delivery, and income.[51,52,53,54,55,56]

Numerous factors and barriers have been associated with early initiation of breastfeeding. A systematic review from Asia found lack of education, lack of decision making powers, lack of maternal health services such as antenatal appointments, skilled birth attendance and postnatal check-up, traditional feeding practices such as offering prelacteal feeds, misperceptions regarding colostrum, and deliveries outside health facilities as major barriers associated with early initiation.[57] Other studies from across the world have identified similar predictors for early initiation – prenatal guidance on breastfeeding, mode of delivery, full-term pregnancy, maternal education, birth order, household wealth, and place of residence.[58,59,60,61,62,63]

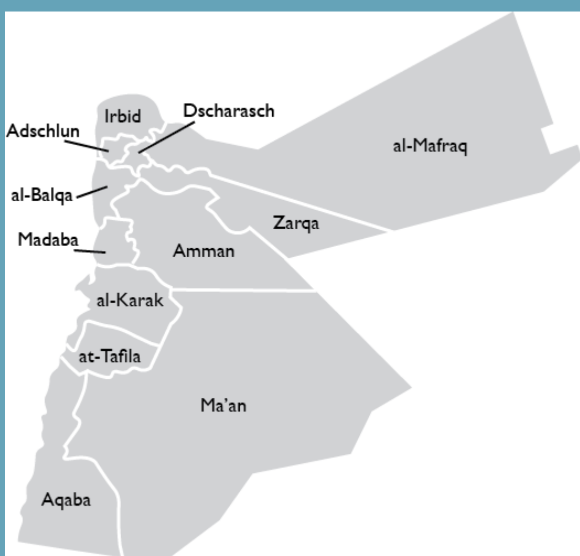
While the challenges associated with complementary feeding practices are context-specific, they are characterized with untimely introduction of complementary foods (too early or too late), improper and non-responsive feeding frequency, unsafe and unhygienic preparation, and poor feeding methods.[64] Furthermore, low-quality foods are often of inappropriate consistency (too thick or too thin), not nutritionally dense (lacking in essential and adequate vitamins and minerals, proteins and fatty acids) and lack variety.[65,41,66] The age of the child at time of introduction, birth weight, birth order, household income, access to healthcare services, maternal education, and place of delivery are some of the common determinants of CF practices.[67,68,69,70,71,72]

Globalization and urbanization are driving unprecedented changes in the profile of nutrition with increasing coexistence of multiple forms of malnutrition.[73] Diets that are already lacking in essential nutrients are being further modified due to increasing access to convenience and ultra-processed foods. This is evident in the increased consumption of sugar-sweetened beverages and snack foods not just among the adult population but also among infants and young children. In a study in South Africa, 42% of infants aged 6 – 12 months were consuming savory snacks every day.[74] In Mexico, more than 50% of infants under 6 months consumed fruit juices and 99% of 12-month old infants consumed juice 3 to 4 times a week.[75] A cross-sectional survey in Cambodia also found 55% of children 6 – 23 months consumed commercially produced snack foods.[76] Similarly, another study assessing consumption patterns among children 6–23 months of age in four Asian and African urban contexts, with a particular focus on use of commercially produced foods and beverages, found consumption of snack foods ranging from 23% in Dar es Salaam, Tanzania to 74% in Kathmandu, Nepal, and sugar sweetened beverages ranging from 16% in Kathmandu, Nepal to 32% in Phnom Penh, Cambodia.[77] A recent assessment of Demographic and Health Surveys (DHS) data on intake of sugary snack foods across 18 countries found that in one-third of countries, more than 20% of all infants 6 – 8 months consumed sugary snacks, and this intake increased with age. The most eaten snack foods were crisps, plain or sweet biscuits, and sponge cake. Sugary snack food consumption was more common than intake of more nutritious foods such as eggs or vitamin A-rich fruits or fortified infant cereals.[50] This is supported by several studies that have found increased consumption of commercially available beverages and snacks can lead to early cessation of BF and unsuitable introduction of complementary foods, displacing established traditional dietary patterns.[78,79,80]

With current trends, unless accelerated progress occurs, the World Health Assembly (WHA) Global Nutrition Target of "increasing the rate of exclusive breastfeeding in the first six months up to at least 50%" by 2025 will not be achieved.[81] Unfortunately, early cessation of exclusive breastfeeding in favor of commercially available BMS, untimely introduction of liquids such as water and juices, and unnecessary supplementation is far too common.[82] Comparably, far too few children are benefiting from minimum complementary feeding practices, with nearly a third of infants 4-5 months old having been already introduced to solid food, and 20% of 10-11 month old children having not yet received optimal solid food.[83]

1.3 Infant and young child feeding practices in Jordan

Figure 1: The Hashemite Kingdom of Jordan



Little is known about complementary feeding practices

The Hashemite Kingdom of Jordan, with its rapid social, economic, dietary, and demographic shifts, faces the dual burden of undernutrition and overnutrition. This dual burden is linked to rapidly rising rates of overweight and obesity among adults, particularly women of reproductive age and children.[84] The Global Nutrition Report indicates that Jordan is "off course" to meet the global nutrition targets for maternal, infant and young child nutrition.[85] An estimated 14% of infants in Jordan are born with low birth weight, and this rate is the highest in the Middle East and North Africa (MENA) region.[86] On the other hand, Jordan has made progress in achieving its target rates for stunting and wasting. Among the MENA region, the 2012 data shows that Jordan has the lowest rates of stunting and wasting, only behind Kuwait and Tunisia (nearly 8% and 2.4%, for children under 5, respectively).[87] At the same time, a report that used Demographic and Health Surveys (DHS) data from 2003 to 2016 found 4% of 6 – 59 month-old children in Jordan were overweight.[88] Only 43% of women in Jordan have normal body mass index (BMI), while 54% women are overweight or obese.[89]

According to the 2017-2018 Jordan Population and Family and Health Survey (JPFHS), 67% children were breastfed within one hour of birth. However, contrary to the recommendations, 43%

of breastfeeding children also received a prelacteal feed. Regional differences exist, with 71% early initiation of breastfeeding in the North, and 66% and 57% in Central and South regions of Jordan.[89] Although most mothers breastfeed their infants soon after delivery, EBF is an uncommon practice because of the early introduction of solid food.[90] Despite the compelling evidence on the benefits of EBF, over the last 20 years, the rates of increase in prevalence of EBF has been slow, with 12% in 1997 and only 26% in 2017.[89,91]

Little is known about breastfeeding and its barriers that women experience in the Middle East, with most studies being cross-sectional in nature.[92,93,94] A study conducted in Northern Jordan found only 40.7% of healthy infants were exclusively breastfed for the first 3 months of life, and 78.7% introduced breastmilk substitutes in the first 4 months of life along with early introduction of water and herbs.[95] With respect to complementary feeding and feeding practices, data from the most recent DHS report in Jordan highlights only 23% of breastfed infants 6 – 8 months met the MDD requirements, 35% achieved MMF, and only 12% achieved a minimum acceptable diet (MAD). Overall, only 28% of infants in Jordan aged 6-23 months met the standards for a minimum acceptable diet.[101] We found no studies that have examined complementary feeding practices in Jordan or ascertained the role of ultra-processed foods in displacing nutrient-dense foods, particularly during this period of the life cycle. Thus, there are significant gaps in knowledge around EBF and IYCF practices in Jordan. Identifying the trends over time and factors associated with sub-optimal versus optimal practices is needed to support actions to address these challenges.

1.4 Study objectives

The objective of this study was to assess the trends and changes in breastfeeding and complementary feeding practices in Jordan over time and determine factors associated with optimal versus sub-optimal practices of BF, EBF and IYCF indicators such as MMF, MDD and MAD. Specifically, the study aimed to:

i) Describe IYCF practices among infants and young children aged 0-6 months and 6-23 months by location, household socio-economic status and maternal education levels

ii) Assess the trends in introduction and consumption of breastmilk substitutes in infants under 6 months of age by location, household socio-economic status, and maternal education levels

iii) Assess the trends in complementary feeding practices (e.g., MMF, MDD, MAD), continued use of breastmilk substitutes, introduction of micronutrient rich food groups versus ultra-processed foods such as sugar-sweetened beverages in Jordanian infants and young children aged 6-23 months by location, household socio-economic status, and maternal education levels

iv) Examine the factors associated with poor EBF, BF and other IYCF practices among infants and young children 0-6 months and 6-23 months of age.

Data and Methods

1.5 Data

All data used in this analysis were obtained from the Demographic and Health Surveys (DHS) in Jordan.[106] DHS are nationally representative household surveys that provide data on a wide range of monitoring and impact evaluation indicators in the areas of population, health, and nutrition.[106] DHS collects information on households, children under 5 years of age, and men and women between the age of 15-49 years.[106] For this study, we downloaded all the available DHS surveys starting from 1990 to 2017 (n=6 surveys).[106] Location characteristics (governorate and urban/rural), child's age, child's anthropometry, mother's education, and wealth index variables originated in the household questionnaire, while the infant dietary recall variables originated in the woman's questionnaire.

1.6 Design and sample size

The sample design of a DHS is representative at the national, regional, and geographic location or residence (rural/urban). The survey has a stratified two-stage cluster design whereby the first stage involves selection of enumeration areas (EAs) drawn from census files, and in the second stage, in each EA selected, a sample of households is drawn from an updated list of households. **Table 1** below shows the distribution of the sample sizes of children under 24 months across six rounds of DHS.

Table 1: Sample size across DHS survey years (1990-2017/18)

Survey Year	Children under 6 months	Children under 24 months	Children 6-23 months
1990	657	1685	1028
1997	449	2264	1765
2002	380	2225	1845
2007	540	2081	1541
2012	568	2561	1993
2017-18	1131	4058	2927
Total	**3725**	**14874**	**11099**

1.7 Statistical analysis

Data from all six surveys were merged into a single database and reviewed for consistency across surveys. Differences in types of questions asked and/or types of foods tracked were found in this process. The study analyst reviewed all the differences and developed new standardized variables as needed. Descriptive statistics and proportions were used to describe relevant demographic and diet characteristics. The survey data were pooled to conduct multivariate logistic regression analyses. The primary outcome variables in this study included the prevalence of exclusive breastfeeding, consumption of specific foods and specific food groups in the past 24 hours, and meeting the MDD, MMF, and MAD indicators. The definitions are provided below:

i) **Exclusive breastfeeding**: This is measured as children who were currently breastfeeding and who did not receive any water, liquid, or foods in the past 24 hours.
ii) **Consumption of breastmilk substitutes**: This is measured as consumption of milk, infant formula, and infant foods. Consumption of milk included fresh, powdered, or tinned animal milk.
iii) Data on **dietary intake** was collected using qualitative 24-hour recalls, in which the mother of the child responded "yes" or "no" when asked if the child consumed specific foods in the past 24 hours. **Beverages** that are likely to be sweetened with sugar include juice, tea, and sugar water. Data on **consumption of staple grains and starchy foods** were gathered after 1990. **Micronutrient-rich foods** included legumes, nuts and seeds, fruits and vegetables, and animal source foods (ASFs).
iv) **Minimum dietary diversity (MDD)** is defined as children who consumed 5 or more of the 8 food groups and were considered to have met the minimum dietary diversity requirement. The 8 food groups included in this indicator are: (1) breastmilk; (2) grains, roots, and tubers; (3) legumes and nuts; (4) dairy products; (5) meat, flesh, fish, poultry, and organ meats; (6) eggs; (7) vitamin A-rich fruits and vegetables; and (8) other fruits and vegetables.
v) **Minimum meal frequency (MMF)** is defined as the number of times a child receives meals, snacks, or milk feeds in the previous 24 hours, where the minimum threshold for adequate meal frequency depends on the child's age and breastfeeding status. Breastfed infants 6-8 months have a minimum of 2 meals or snacks and breastfed children 9-23 months of age have a minimum of 3 meals or snacks. Children 6-23 months of age who are not breastfed have a minimum of 4 meals, snacks, and milk feeds, where one must be solid or semi-solid food.
vi) **Minimal acceptable diet (MAD)** is defined as the proportion of breastfed children 6-23 months of age who had at least the minimum dietary diversity and the minimum meal frequency during the previous day. Children at 6-23 months must meet both MMF and MDD requirements to meet the MAD.

The independent/predictor variables included were year of the DHS survey, geographic location/governorates, child's age, mother's education attainment, and household wealth index.

This allowed us to assess not only change over time (i.e. trends), but also assess differences in outcome variables by geographic location and the association with age of the child, the education of the mother, and the socio-economic status as reflected by the household wealth index.

A variable for DHS year was created as a categorical variable indicating which year the data point originated. Geographic location included the governorate in which the child lived as well as if they live in an urban or rural location. Child's age in months was calculated as the difference between the child's birth date and the interview date. An age squared term was also calculated by squaring the child's age in months, which was used in models to address non-linear relationships between the child's age and consumption of food groups.

A categorical variable for mother's education was created from the number of years of education the mother received. Data were categorized into 6 groups for analysis: (1) none (0 years); (2) primary incomplete (1-5 years); (3) primary complete (6 years); (4) secondary incomplete (7-11 years); (5) secondary complete (12 years); and (6) higher (13+ years).

The wealth quintile variables created by DHS were used for all models and were not manipulated. Wealth indices were created from a principal component analysis with data on household assets, services, and amenities, and represents a household's wealth relative to all households included in the survey. Households were then split into 5 groups based on their wealth index, relative to the other households in the survey. The 5 quintiles indicate households with (1) lowest, (2) second, (3) middle, (4) fourth, and (5) highest wealth.

Descriptive statistics, including mean ± standard errors (SD), frequency distributions, and proportions were used to describe relevant demographic and diet characteristics. All analyses were conducted using Stata version 15.1 software (StataCorp, College Station, TX, USA).

Logistic regression models were used to assess trends across the different outcome variables including having met the MDD, MMF, MAD as well as in consuming each food group and meeting IYCF-MDD, IYCF-MMF, and IYCF-MAD over the six DHS surveys. A total of 25 pooled regression models were run for the following variables.

Bi-variate models were computed on children by age group: under 6 months of age and 6-23 months of age due to dietary differences in age groups. All models were run on children 6-23 months of age, while only models predicting consumption of breastmilk substitutes (infant formula and milk), juice, tea, and sugar water were conducted on children under 6 months of age. After that, multivariate models including survey year, the age of the child, governorate, urban/rural residence, household wealth, and mother's education attainment were computed on the same model specifications.

Due to occasional changes in the dietary recall tool, data that were available for as many DHS surveys as possible were included in each model. Below we outline data by model type:

1. **Juice consumption and infant formula or milk consumption**: Data from all DHS surveys were used.
2. **Tea consumption**: data from 1990, 1997, 2002, and 2007 were used
3. **Sugar water**: Data from 1990, 1997, and 2002 were used in the models
4. **Infant/baby food consumption**: Data were used from 2007, 2012, and 2017-18
5. **DGLV, other vitamin A-rich fruits and vegetables, other fruits, and vegetables consumption:** Data were used from 2002, 2007, 2012, and 2017-18
6. **Any ASF consumption models**: Data were used from 1997, 2002, 2007, 2012, and 2017-18
7. **Specific ASF consumption (Egg consumption and meat, fish, or poultry):** Data were used from 2007, 2012, and 2017-18
8. **Specific ASF consumption (Dairy**): Data were used from 2002, 2007, 2012, and 2017-18
9. **MDD models**: Data were used from 2002, 2012, and 2017-18
10. **MMF models**: Data were used from 2007, 2012, and 2017-18
11. **MAD models**: Data were used from 2012 and 2017-18

Further details on data and methods used to standardize data for this analysis are presented **Appendix 1**.

Trends IYCF practices in infants under 6 months of age

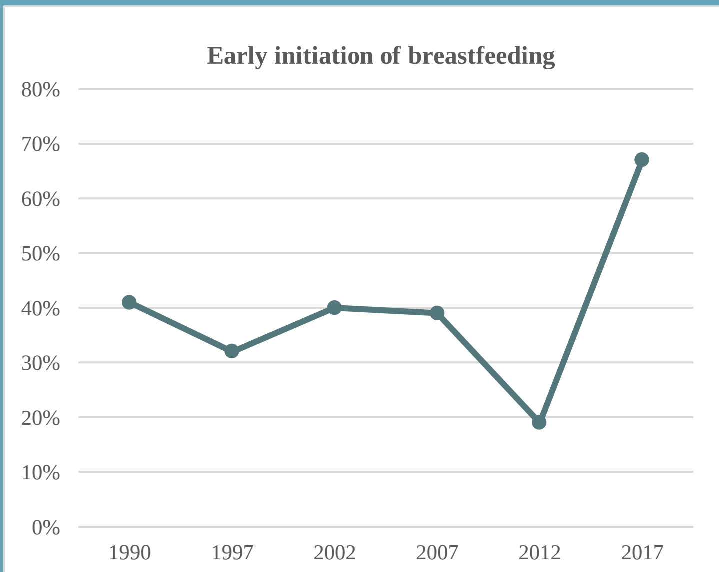
1.8 Introduction

This section presents the trends in infant and young child feeding (IYCF) practices specifically in infants under 6 months of age. This includes an assessment of trends in early initiation of breastfeeding, exclusive breastfeeding in infants under 6 months, median duration of exclusive breastfeeding, and any introduction/consumption of foods and beverages in the past 24 hours. In addition, descriptive anthropometric indicators including length-for-age (LAZ), weight-for-age (WAZ), and weight-for-length (WLZ) Z-scores computed using the WHO child growth standards are presented.[107] Stunted children were defined as those having LAZ<-2 and wasted children were defined as those having WLZ<-2. Underweight was defined as WAZ<-2, overweight as WLZ>2 and obese as WLZ>3.

1.9 Early initiation of breastfeeding

In 2017, two-third of the newborns are being put to breast within the first hour of life, an improvement since the 1990s

Figure 2: Early initiation of breastfeeding

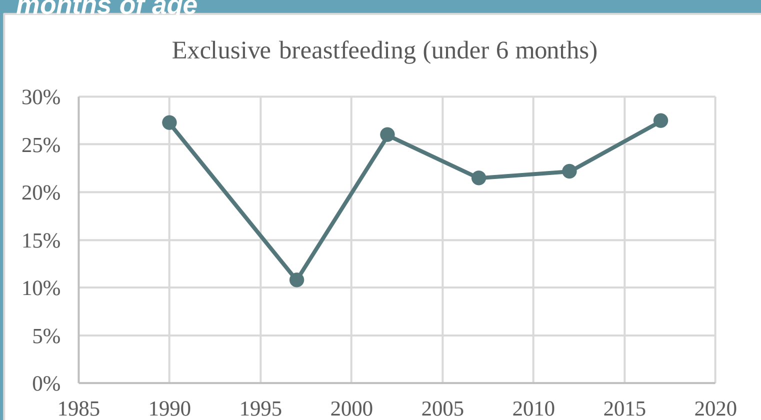


Early initiation of breastfeeding is defined as provision of mother's breastmilk to infants within one hour of birth. **Figure 2** shows the trend in early initiation of breastfeeding between 1990-2017. The rates of early initiation of breastfeeding, which was 41% in 1990, decreased to 32% in 1997. Between 1997 and 2002, the rates increased to 40% and remained the same until 2007. The rates were lowest at 19% in 2012, which then peaked to 67% in 2017. The DHS data did not allow determination of the reason for the improvement.

1.10 Exclusive breastfeeding (EBF) in infants under 6 months

Three out of four children under 6 months failed to receive the protective benefits of exclusive breastfeeding in the last three decades

Figure 3: Exclusive breastfeeding in infants under 6 months of age



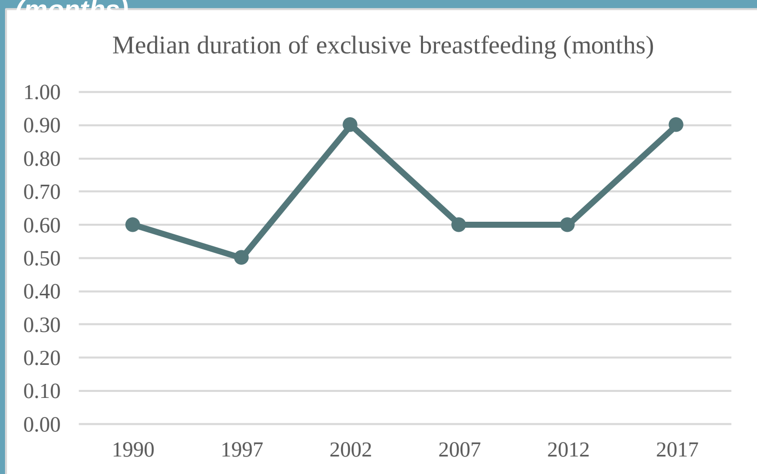
Exclusive breastfeeding (EBF) is defined as infants who are currently breastfeeding and who did not receive any water, liquids, or foods in the past 24 hours. **Figure 3** shows the national level trends in EBF rates in infants under 6 months between 1990-2017. Jordan has consistently seen lower rates of EBF since the first DHS survey in 1990. The EBF rates decreased from 27% in 1990 to 11% in 1997. The rates increased to mere 27% in 2002, then decreased in 2007 (22%). After 2007, the rates have increased, yet marginally, from 22% to 26% in 2017.

1.11 Median duration of exclusive breastfeeding in infants under 6 months

Median duration of exclusive breastfeeding in Jordan is less than a month and this has not changed in three decades

According to WHO, infants should be exclusively breastfed for the first six months of life to achieve optimal growth, development, and health. This is calculated as the median duration (in months) of exclusive breastfeeding. **Figure 4** depicts the trend in median duration of exclusive breastfeeding, which has remained below one month since 1990-2017.

Figure 4: Median duration of exclusive breastfeeding (months)



Figures 2, 3, and **4** suggest that although mothers have been introducing breastmilk soon after delivery, exclusive breastfeeding rates and its median duration have stayed low in the last three decades.

1.12 Trends in the consumption of breastmilk substitutes (BMS) in infants under 6 months

In 2017, the percentage of infants introduced to commercial infant formula prior to 6 months of age was twice as high as the percentage introduced in 1990

We then assessed the types of foods and beverages introduced to infants including breastmilk substitutes including commercial infant formula and non-breast milks (dairy) including fresh, powdered, or tinned animal milk. Consumption of milk or formula was defined as children who consumed fresh, powdered, or tinned milk and/or commercial infant formula in the past 24 hours. Commercial infant formula is one of the most common BMS introduced to infants under 6 months in Jordan. **Figure 5** shows the trend in infant formula and milk consumption where rates of infant formula consumption have dramatically and steadily increased from 17% in 1990 to 51% in 2007. While there was a sharp decline to 5% in 2012, it increased to 50% in 2017. Like infant formula, dairy milk is a commonly introduced breastmilk alternative in infants under 6 months and is found to be consumed at much higher levels in 2012 than the prior years with a drop in 2017. **Figure 5** depicts the rates of dairy milk consumption in infants under 6 months which was historically low at 6% in 2002. Consumption progressively increased in 2007 (32%) and 2012 (59%). In 2017, however, the rates plummeted to merely 9%, like the rates in 2002.

Figure 5: Formula and milk consumption in infants under 6

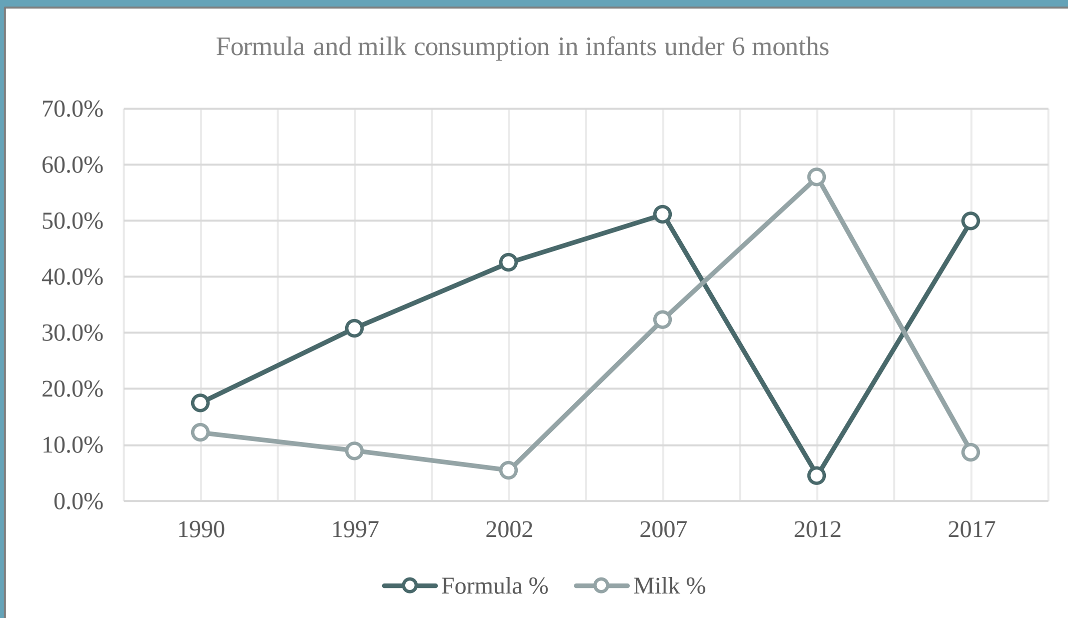


Figure 6: Odds ratio for formula and milk consumption by infants under 6 months of age by

We assessed the significance of these trends using multivariate logistic regression analysis. Forest plots in **Figures 6** presents the findings of this analysis. The complete regression models are presented in **Table 4 in Appendix 2**. Introduction of infant formula prior to 6 months of age has significantly increased from 1990 to 2017, where infants were 2.3 times more likely to consume in 1997 (OR: 2.30, 95% CI: 1.72-3.08), 3.6 times more likely in 2002 (OR: 3.60, 95%

CI: 2.65-4.87), 5.2 times more likely in 2007 (OR: 5.20, 95% CI: 3.91-6.91), and 4.7 times more likely in 2017-18 (OR: 4.74, 95% CI: 3.66-6.13), compared to 1990.

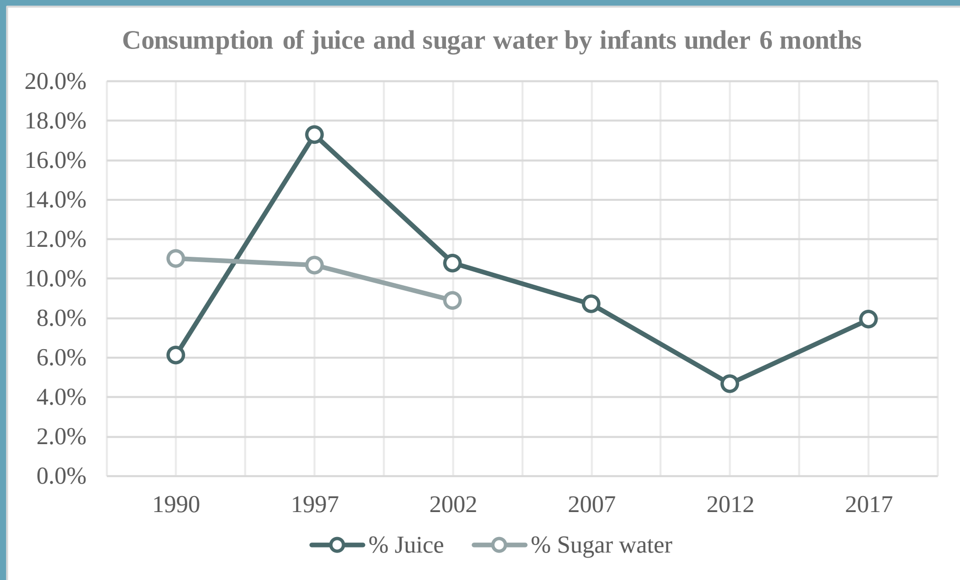
Compared to 1990, infants were less likely to consume cow, goat, or other dairy milk in 2002 and 2017-18 (OR: 0.38, 95% CI: 0.22-0.65; OR: 0.65, 95% CI: 0.46-0.92, respectively) and more likely to consume in 2007 and 2012 (OR: 3.50, 95% CI: 2.53-4.85; OR: 10.69, 95% CI: 7.78-14.68, respectively). Interestingly, since 2012, whole milk consumption has decreased, formula consumption increased at a similar magnitude.

1.13 Trends in the consumption of sugar sweetened beverages by infants under 6 months of age

We then assessed trends in the early introduction of beverages and micronutrient rich foods to infants under the age of 6 months. Beverages that are enumerated in the DHS include **juices, sugar water and tea**. **Figure 7** depicts trends in juice and sugar water respectively. While the rate of juice consumption was highest in 1997 (17 %), it dropped in 2012 (5%) with an increase to 8 % in 2017. On the other hand, sugar water consumption has gradually decreased from 11 % in 1990 to 8.9 % in 2002**.** Similarly, tea consumption in infants under 6 months has declined from 11 % in 1990 to less than 2 % in 2007 (data not shown).

Juice consumption was high in 1997 compared to 1990 with infants 3 times more likely to consume juice (OR: 2.98, 95% CI: 1.94-4.57), although that trend was not sustained in the later DHS survey years (**Table 4, Appendix 2**). Tea consumption decreased drastically, with an approximate 90% decrease in the odds of consuming tea in 2002 and 2007 (OR: 0.10, 95% CI: 0.04-0.26; OR: 0.09, 95% CI: 0.04-0.21, respectively). With no current data, it is not possible to ascertain if tea consumption (likely a significant source of sugar in the diet) continues to remain low.

Figure 7: Consumption of juice and sugar water by infants under 6 months of age by survey year

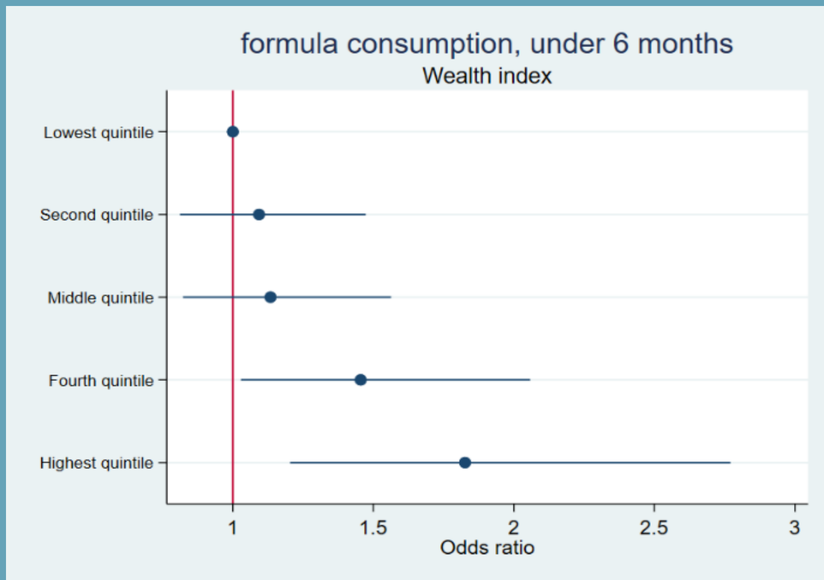


*Data on sugar water consumption was only available for 1990, 1997 and 2002 DHS survey years

1.14 Factors associated with the consumption of breastmilk substitutes and sugar-sweetened beverages in infants under 6 months of age

When we examine factors associated with consumption of breastmilk substitutes and sugar-sweetened beverages (controlling for survey year), we find that infants living in households with fourth wealth quintiles were 1.3 times more likely to be given infant formula (OR: 1.30, 95% CI:1.17-1.44) compared to the lowest wealth quintile, controlling for survey year (**Figure 8**). On the other hand, household wealth was not associated with the consumption of cow, goat, or other dairy milk, but infants living in urban locations were 1.3 times more likely to be given cow, goat or other dairy milk (OR: 1.35, 95% CI: 1.03-1.76) compared to those living in rural locations controlling for survey year. There were no significant patterns emerging either by governorate or by mother's educational attainment across all the models (**Table 4, Appendix 2**).

Figure 8: Odds ratio of formula consumption by infants under 6 months of age by wealth quintiles



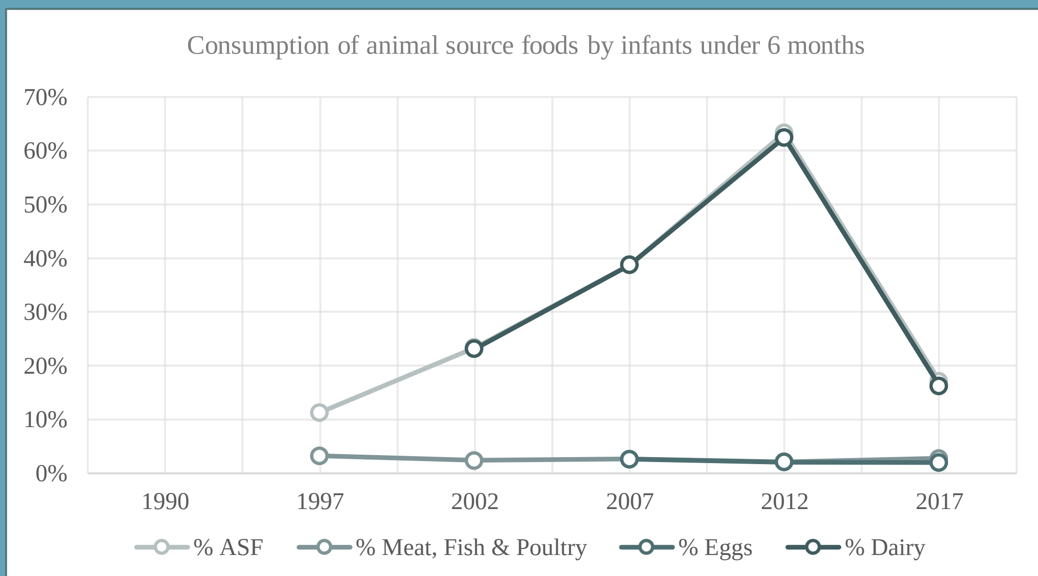
1.15 Trends in the consumption of micronutrient rich foods

Micronutrient rich foods include **dark green leafy vegetables**, **vitamin A rich fruits and vegetables** (e.g., apricots, palm nuts, yellow melon, pumpkin, carrots, red/yellow yams, and red sweet potato), **other fruits and vegetables**, **animal source foods (ASFs)** that include (1) dairy products (milk, cheese, yogurt, and other milk products), (2) eggs, and (3) meat, fish, poultry, and organ meats, and **legumes** (beans, peas, and lentils). Overall, consumption of dark green leafy vegetables and vitamin A rich fruits and vegetables has been consistently low throughout the survey years in Jordan. Consumption of dark green leafy vegetables was less than 1% as was consumption of vitamin A rich fruits and vegetables, which was highest (3%) in 2002 and 2017. Consumption of other fruits and vegetables has decreased from 2002 (8%) to 2017 (2%) (data not shown).

As shown in **Figure 9, Panel 1,** ASFs consumption increased between 1997 (11%) to 2012 (63%), and then saw a sharp decline to 17% in 2017. Consumption of ASFs such as meat, poultry, and fish was low in 1997 (3%) and has stayed the same in 2017 (**Figure 9 Panel 2),** as was the case with egg consumption **(Figure 9 Panel 3).** Consumption of dairy products saw a large increase from 23% in 2002 to 63% in 2012, after which the rates plummeted to 16% in 2017 **(Figure 9 Panel 4**). Consumption of legumes in infants under 6 months remained low and dropped from 4% in 2002 to 1% in 2007 and stayed the same in 2017 (data not shown).

Logistic regression models assessing trends over the years are presented in **Table 5** in Appendix 2. Consumption of fruits and vegetables in infants less than 6 months of age was not common and no significant trends were observed. A decrease was observed in legume consumption by infants under 6 months of age, where infants were 67% less likely to consume in 2007 (OR: 0.33, 95% CI: 0.12-0.93), 74% less likely in 2012 (OR: 0.26, 95% CI: 0.09-0.77), and 69% less likely in 2017-18 (OR: 0.31, 95% CI: 0.13-0.78), compared to 2002. Dairy was the only ASF group with a significant association in infants across DHS survey years, driven by milk consumption. Infants were 2.4 times more likely to consume dairy in 2007 (OR: 2.43, 95% CI: 1.74-3.38), 7.2 times more likely in 2012 (OR: 7.21, 95% CI: 5.18-10.04), but 33% less likely in 2017-18 (OR: 0.67, 95% CI: 0.49-0.93), compared to 2002.

Figure 9: Consumption of animal source foods by infants under 6 months of age by



*Data on consumption ASFs, and meat, fish and poultry consumption available from 1997 to 2017
*Data on eggs consumption was only available for 2007, 2012, and 2017
*Data on dairy consumption was only available from 2002 to 2017

1.16 Factors associated with consumption of micronutrient rich food in infants under 6 months of age

Controlling for the survey year, no significant differences were observed in the consumption of total ASFs, as well as specific ASFs and other foods including meat/fish/poultry, eggs or legumes based on maternal education or wealth of the household. There were few differences by location in the consumption of overall ASFs, where children in Karak were 1.7 times more likely to consume ASFs compared to those in Amman (OR:1.69 95% CI: 1.057-2.73). Similarly, children in Karak were 1.9 times more likely to consume dairy compared to children in Amman (OR:1.89 95% CI: 1.16-3.10) (see **Appendix 2 Table 5**). Finally, while dairy consumption did not differ by maternal education, children in wealthier households were also more likely to consume dairy (OR: 1.21, 95% CI: 1.07-1.37).

Trends in IYCF outcomes in children 6-23 months

This section presents trends in infant and young child feeding (IYCF) outcomes in children aged 6-23 months. This includes standard indicators such as minimum meal frequency (MMF), minimum diet diversity (MDD), minimum acceptable diet (MAD) and various food groups consumed by infants 6-23 months. Since children between 6-23 months are likely to get introduced to a variety of food groups at different ages (in months), the outcomes are presented for overall (6-23 months) age group as well as disaggregated age group (in months) for children at 6-8 months, 9-11 months, 12-17 months, and 18-23 months.

1.17 Minimum meal frequency (MMF)

The percentage of infants and young children achieving MMF has drastically reduced over time, with less than half of infants and young children aged 18-23 months being fed the minimum number of meals for their age as of 2017/2018.

Minimum meal frequency (MMF) is the number of times a child receives meals, snacks, or milk feeds in the previous 24 hours. As shown in **Figure 10**, the percentage of children aged 6-23 months that met the MMF increased from 60% in 2002 to 69% in 2012, after which, it declined to 45% in 2017. When disaggregated by age groups, between 2002-2017, a rapid decline in MMF was observed in the 18-23 months age group, from 82% to 45%. While MMF in infants between 9-11 months was the lowest (44%) in 2002, it improved to 67% in 2012, and then declined to its lowest at 42% in 2017 (**Figure 10**). Compared to 2002, children were almost 1.5 times more likely to meet the MMF in 2012 (OR: 1.47, 95% CI: 1.25-1.72), but were about 50% less likely in 2017-18 (OR: 0.51, 95% CI: 0.43-0.59) (**Figure 11**).

Figure 10: Percentage of 6-23 months who met minimum meal frequency (M

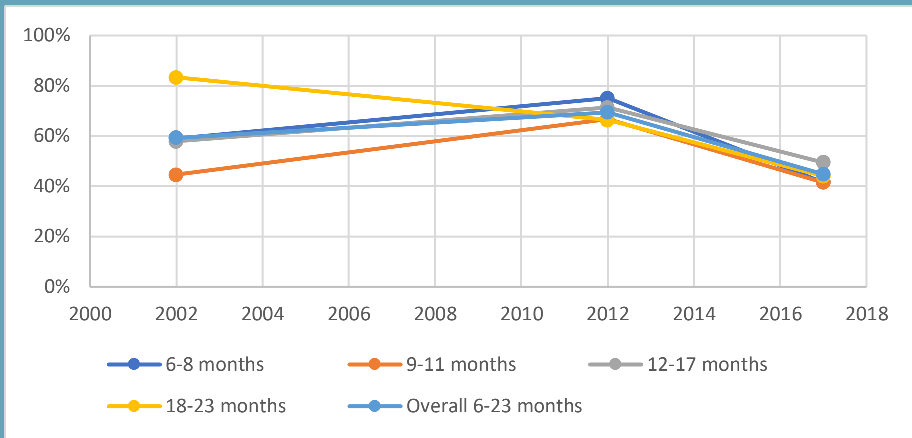
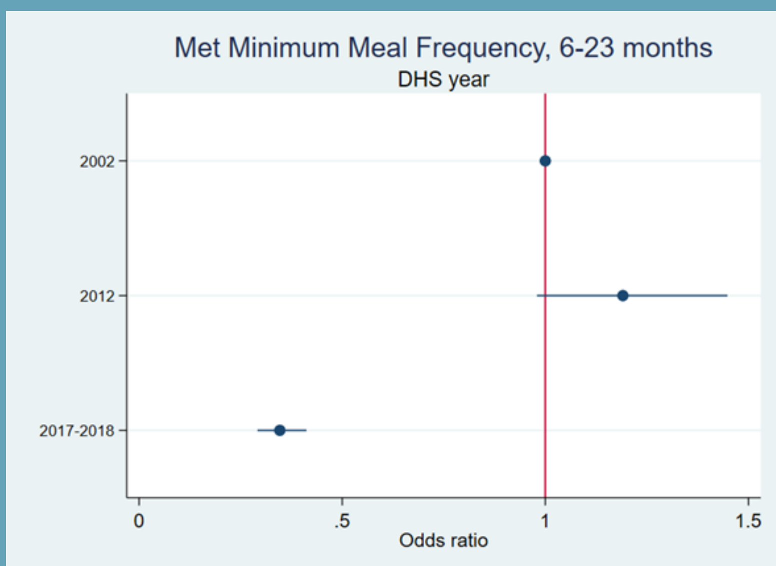


Figure 11: Odds of achieving MMF by infants and young children aged 6-23 months by DHS survey year



1.18 Minimum dietary diversity (MDD)

MDD has declined over years, where only 1 out of 3 children met MDD in 2017, and is lowest among youngest children, for whom it is most critical

Children between 6-23 months who consumed 5 or more of the 8 food groups are considered to have met the minimum dietary diversity requirement. The eight food groups included in this indicator are breastmilk; (2) grains, roots, and tubers; (3) legumes and nuts; (4) dairy products; (5) meat, fish, poultry, and organ meats; (6) eggs; (7) vitamin A-rich fruits and vegetables; and (8) other fruits and vegetables. The MDD in **Figure 12** for overall children 6-23 months declined by half between 2007 (63%) and 2012 (32%), and then further dropped to 29% in 2017. As children grow older, MDD does increase; however, overall, there is a declining trend across all age groups.

The odds of meeting the MDD indicator decreased after 2007. Children were 76% less likely to consume a diverse diet in 2012 (OR: 0.24, 95% CI: 0.22-0.27) and almost 80% less likely in 2017-18 (OR: 0.21, 95% CI: 0.19-0.24), compared to 2007 (**Figure 13**).

Figure 12: Percentage of 6-23 months who met minimum dietary diversity (MDD) (2007, 2012 and 2017)

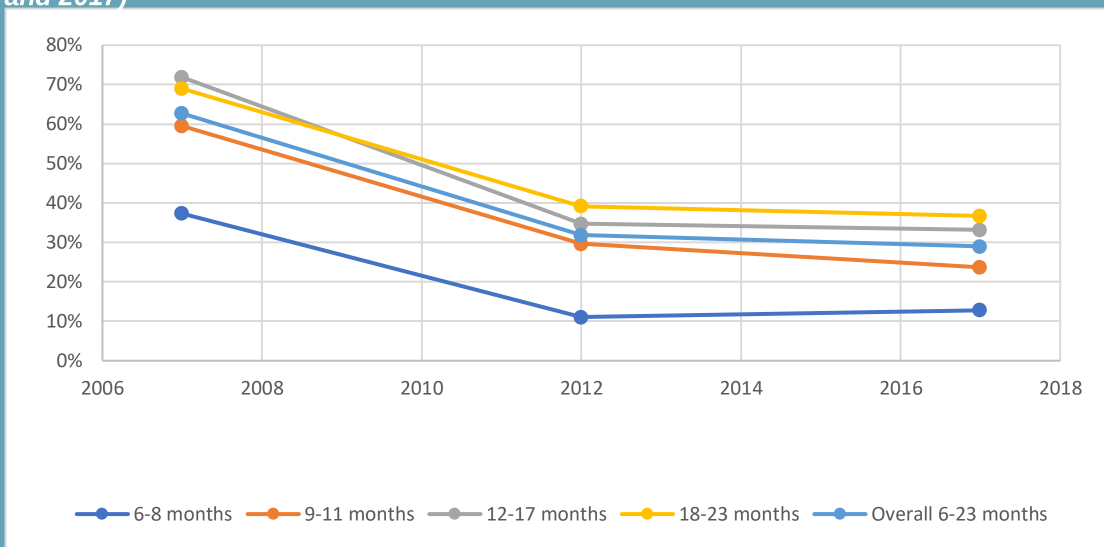
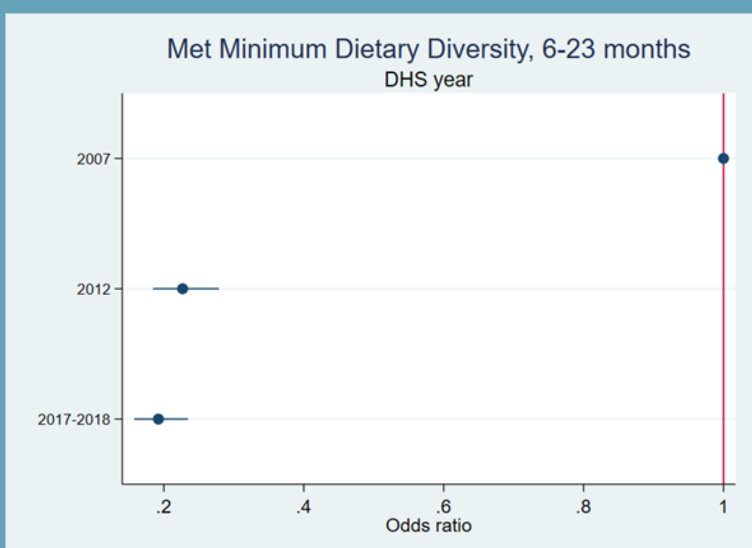


Figure 13: Odds of achieving MDD in infants 6-23 months by survey year (2007, 2012, 2017)



1.19 Minimum acceptable diet (MAD)

Minimal acceptable diet has progressively declined over the years, where only 1 in every 6 children received a minimal acceptable diet. MAD is also lowest among the youngest age group (6-8 months), for whom it is most critical

MAD is defined as the proportion of breastfed children 6-23 months of age who had at least the minimum dietary diversity and the minimum meal frequency during the previous day. Children at 6-23 months must meet both MMF and MDD requirements to meet the MAD. As shown in **Figure 14**, Jordan has consistently seen a lower trend in MAD (<25%) in children aged 6-23 months since 2012. In a span of 5 years (from 2012 to 2017), MAD remarkably declined to 15%. MAD was lowest in 6-8 months with only about 11% meeting the MAD in 2012, that further declined to 7% in 2017. Similarly, only about 25% of children aged 9-11 months met MAD, which further declined to 12% in 2017. While the rates of MAD among 12-17 months and 18-23 months aged was relatively higher (29%) in 2012, the rates declined to 18% in 2017. Compared to 2002, children were about 50% less likely to meet MAD in 2017-18 (OR: 0.51, 95% CI: 0.44-0.59) (**Figure 15**).

Figure 14: Percentage of infants aged 6-23 months achieving a minimal acceptable diet by survey year

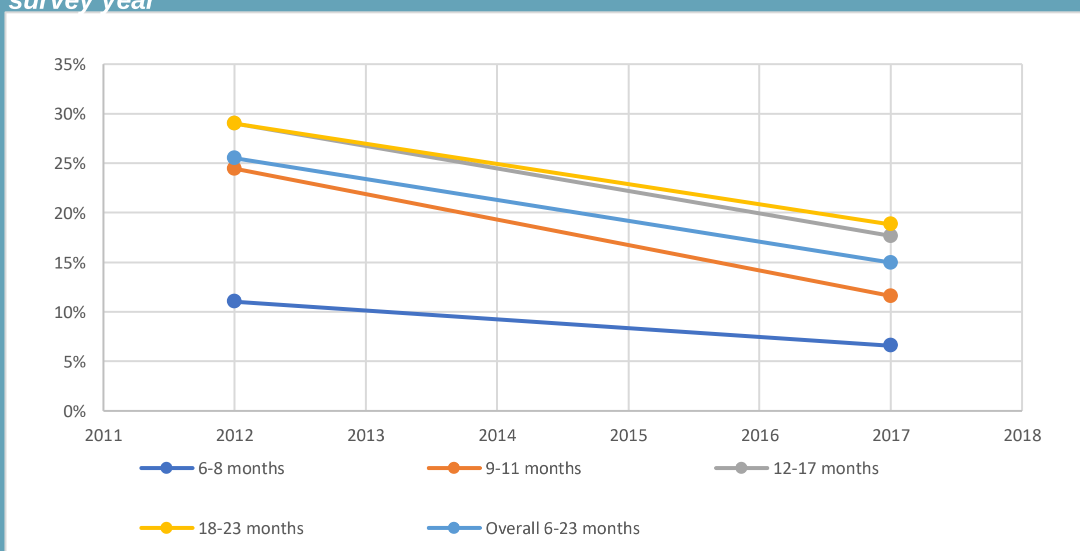
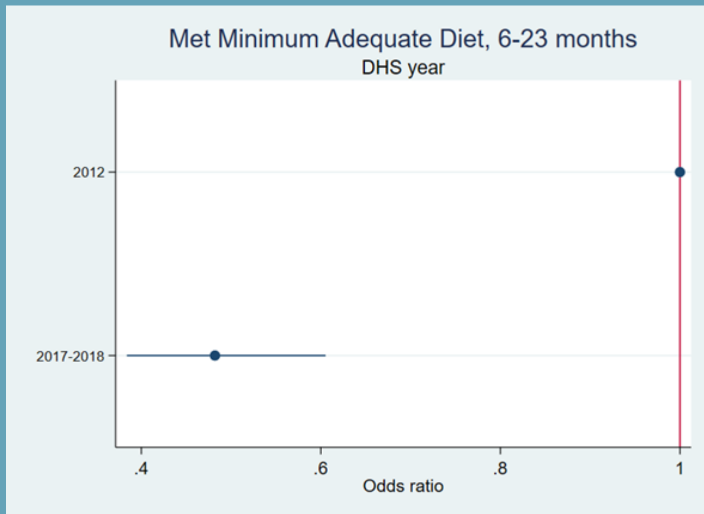


Figure 15: Odds of achieving a minimal acceptable diet by infants aged 6-23 months by survey year



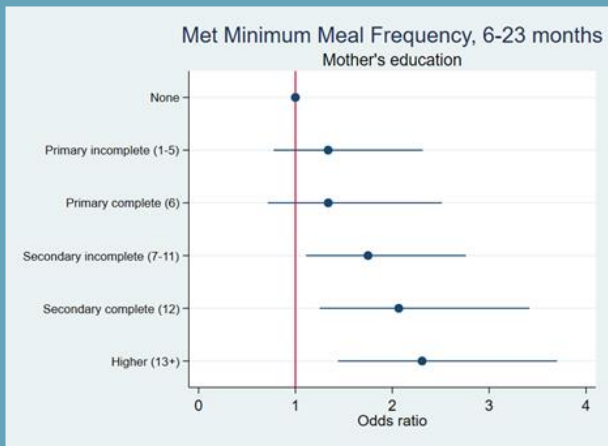
1.20 Factors associated with achieving MMF, MDD, and MAD in children 6-23 months of age

Controlling for survey year, education, and wealth were found to be positively associated with meeting the MDD, where children with more educated mothers and from wealthier households were more likely to meet the MDD (**Figure 16 Panels 1-6**). Like MDD, children with more educated mothers and in wealthier households were more likely to meet the MMF, however the relationship was slightly less strong for MMF. Children were much more likely to meet the MAD with higher educated mothers, and household wealth was also positively associated.

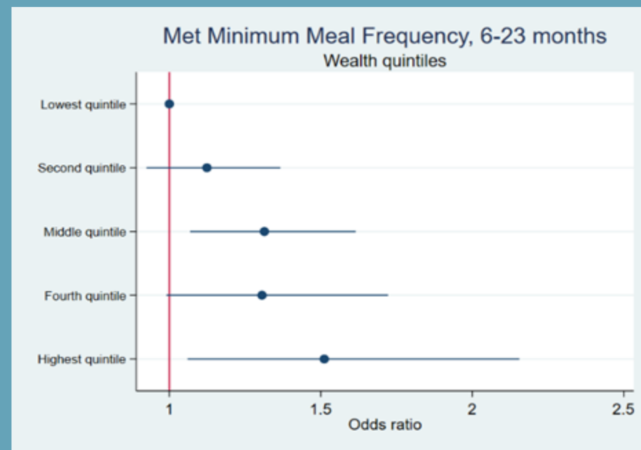
At the governorate level, children in Karak were 26% less likely (OR: 0.74, 95% CI: 0.56-0.98), and in Mafraq were 22% less likely (OR: 0.78, 95% CI: 0.62-0.98) to meet MDD, compared to Amman (which served as the reference). With respect to MMF, children in Zarqa were 1.2 times more likely (OR: 1.20, 95% CI: 1.02-1.41), and children in Jerash were 1.5 times more likely to meet MMF (OR: 0.78, 95% CI: 0.62-0.98), compared to Amman. Finally, with respect to MAD, children in Irbid were 25% less likely to meet MAD (OR: 0.75, 95% CI: 0.62-0.92), and children in Mafraq were about 33% less likely (OR: 0.67, 95% CI: 0.48-0.94) to meet MAD compared to children from Amman (**Table 6, Appendix 2**)

Figure 16: Odds of achieving the MMF, MDD and MAD by mother's education and wealth index controlling for survey year

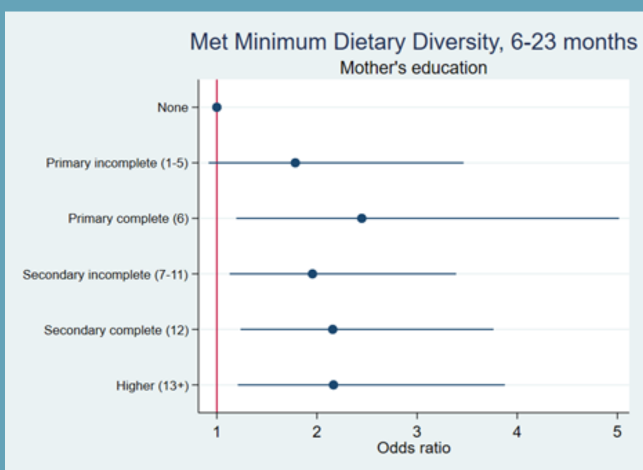
Panel 1: MMF by mother's education



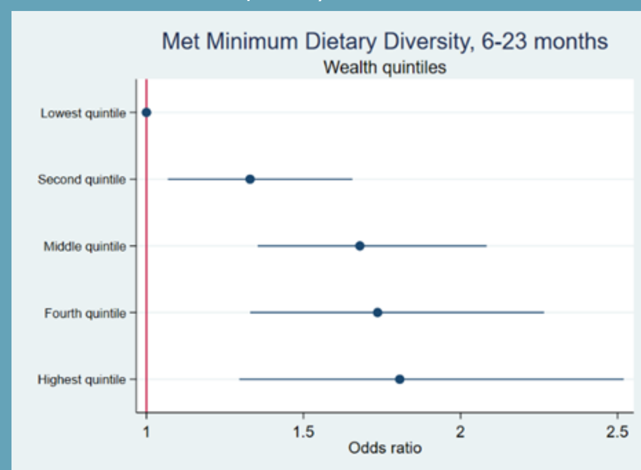
Panel 2: MMF by wealth index



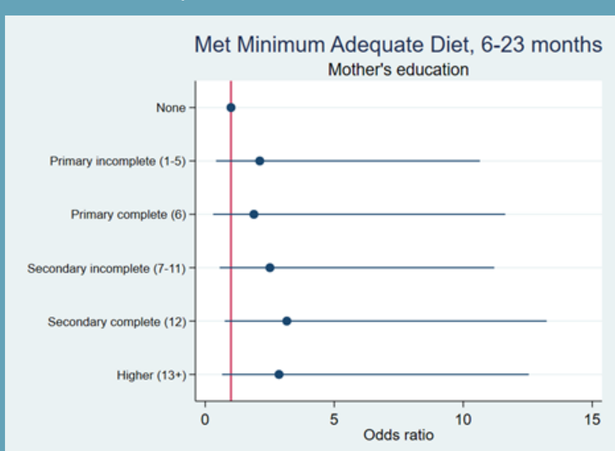
Panel 3: MDD consumption by mother's education



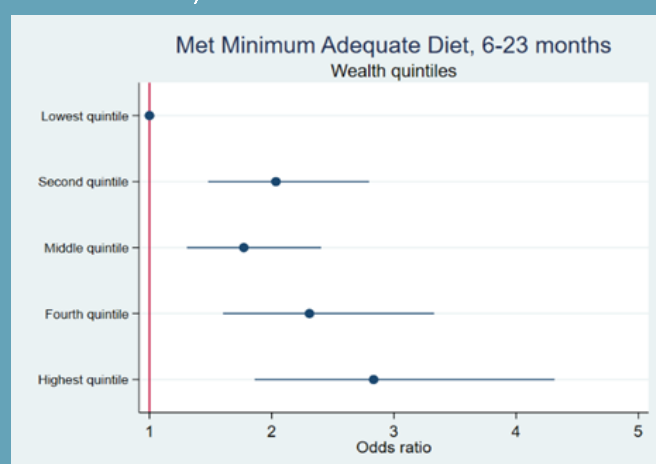
Panel 4: MDD consumption by wealth index



Panel 5: MAD by mother's education



Panel 6: MAD by wealth index



1.21 Trends in consumption of breastmilk substitutes by infants aged 6-23 months

Consumption of infant formula has increased over time and is higher in younger infants (under 12 months), while cow, goat, and other dairy milk consumption has reduced over time

The consumption of breastmilk substitutes, including infant formula and milk, increased in children 6-23 months of age throughout the DHS survey years. As shown in **Figure 17**, between 1990-2002, consumption of infant formula in children 6-23 months was low (13%). Since 2002, there has been an increase in the consumption of infant formula in 2007 (41%), followed by a sharp decline to 10% in 2012 followed by an increase to 47%, depicting a similar trend as that of the under 6 months (**Figure 17**). The highest rates of formula consumption were seen in children aged 9-11 months (63%) and 6-8 months (62.3%), respectively, followed by infants under 6 months (50%). Formula consumption is higher in younger children. Infants in this age group were 40% less likely to consume formula in 1997 and 2012 (OR: 0.62, 95% CI: 0.48-0.79; OR: 0.61, 95% CI: 0.48-0.79, respectively), while they were 4.5 times more likely to consume it in 2007 (OR: 4.52, 95% CI: 3.61-5.65) and 5.7 times more likely in 2017-18 (OR: 5.74, 95% CI: 4.63-7.10), compared to 1990 (**Figure 18**).

Milk consumption in all children 6-23 months was the lowest in 1990 (27%), which increased to 58% in 1997, dropped to 48% in 2002, and increased again in 2007 (60%) and 2012 (68.7%) **(Figure 20**). By 2017, the rates decreased to 41%. Milk consumption has been consistently higher in children aged 12 months and older, while children aged 6-8 months consistently had the lowest rates (20%). This observed trend in milk consumption is inverse to the trends seen in consumption of infant formula consumption in children aged less than 12 months (**Figures 19, 20**). Infants were 3.1 times more likely to consume milk in 1997 (OR: 3.09, 95% CI: 2.58-3.70), 1.9 times more likely in 2002 (OR: 1.89, 95% CI: 1.57-2.27), 3.0 times more likely in 2007 (OR: 3.04, 95% CI: 2.51-3.68), 4.3 times more likely in 2012 (OR: 4.32, 95% CI: 3.58-5.20), and 1.3 times more likely in 2017-18 (OR: 1.32, 95% CI: 1.11-1.58), compared to 1990 (**Figure 20**).

Figure 17: Consumption of infant formula in children 6-23 months by survey year

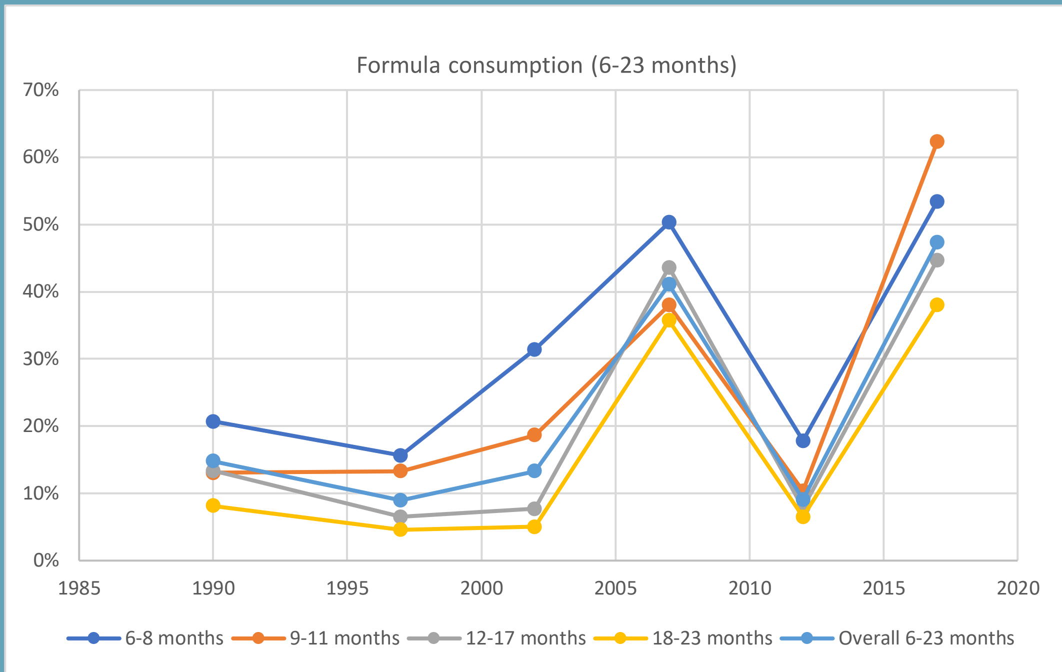


Figure 18: Odds ratio of formula consumption by infants aged 6-23 months by DHS Survey year

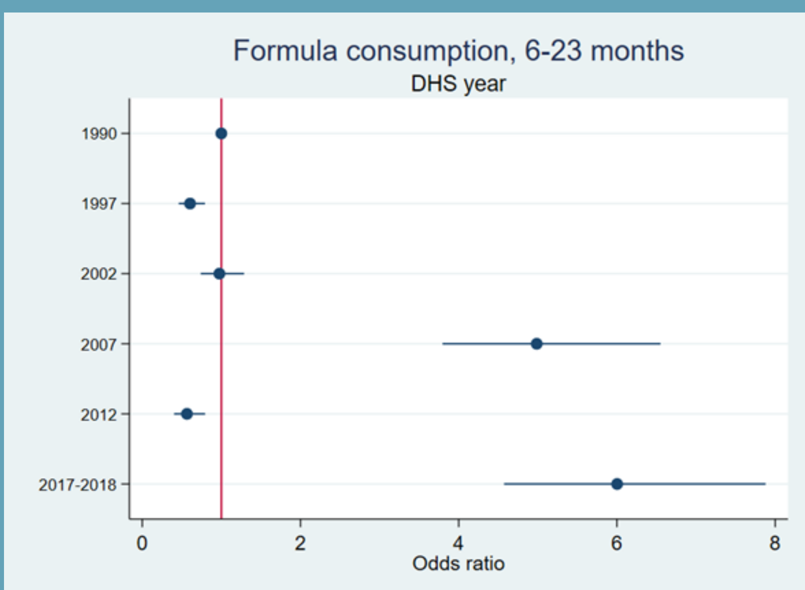


Figure 19: Percentage of milk consumption in 6-23months

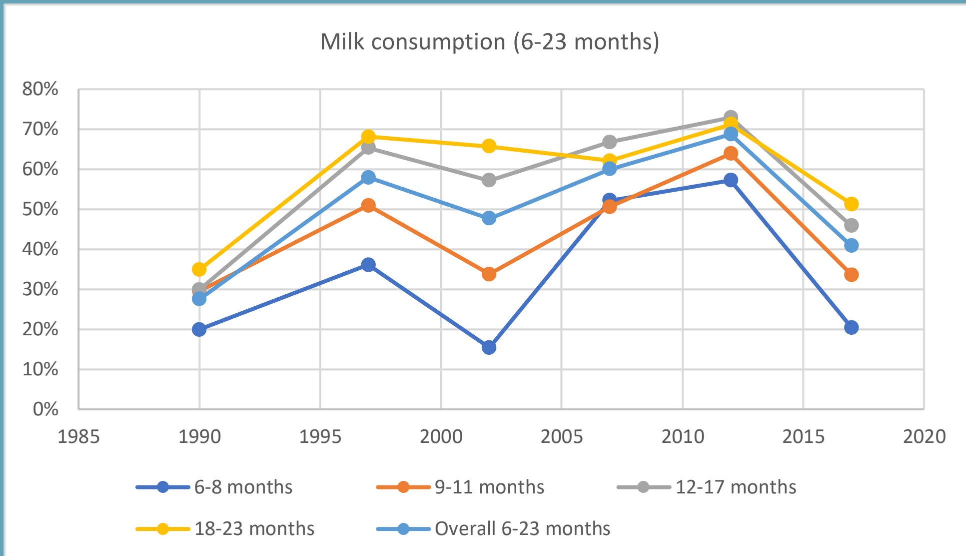
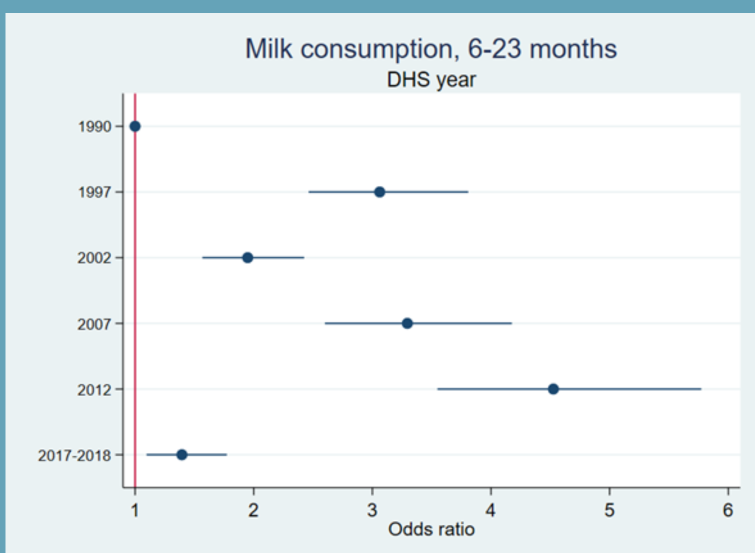


Figure 20: Odds ratio of milk consumption by infants 6-23 months by DHS survey year



1.22 Trends in consumption of juices and sugar-sweetened beverages by infants aged 6-23 months

There has been a significant increase in the consumption of juice from 1990 to 2017. Currently, 1 in 2 children above 12 months and older consume sugar-sweetened beverages

Figure 21 shows the consumption of juice, sugar water, and tea in children aged 6-23 months. Juice consumption increased rapidly from 1990 (22%) to 1997 (65%) but dropped to 47% in 2002. Since 2002, the rates have marginally increased to 53% in 2017. Highest rates of juice consumption were seen in children over 12 months, while lowest rates were seen in children aged 6-8 months. A sharp increase in juice consumption in children aged 9-11 months was observed between 2012 (36%) and 2017 (53%) (**Figure 21**). Compared to 1990, children in 1997 were 6.4 times more likely to consume juice (OR: 6.36, 95% CI: 5.26-7.69), 2.8 times more likely in 2002 (OR: 2.79, 95% CI: 2.31-3.37), 3.4 times more likely in 2007 (OR: 3.40, 95% CI: 2.80-4.14), 2.7 times more likely in 2012 (OR: 2.73, 95% CI: 2.25-3.30), and 3.4 times more likely in 2017-18 (OR: 3.41, 95% CI: 2.84-4.11) (**Figure 22**). Similarly, tea consumption in children aged 6-23 months increased from 1990 (13%) to 2002 (35%), after which there was a marginal decrease to 32% in 2007. A higher percentage of children aged 12 months and above consume tea compared to those under 12 months (**Figure 23**). Children were 2.5 times more likely to consume tea in 1997 (OR: 2.48, 95% CI: 1.96-3.13), 3 times more likely in 2002 (OR: 3.02, 95% CI: 2.40-3.82), and 2.6 times more likely in 2007 (OR: 2.60, 95% CI: 2.04-3.31), compared to 1990 (**Figure 24**).

Until 1997, sugar water consumption was below 5% in children aged 6-23 months. The rates then progressively increased to 16% in 2002 (data not shown). Giving sugar water was about 60% less likely in 1997 (OR: 0.41, 95% CI: 0.26-0.64), but was 3.4 times more likely in 2002 (OR: 3.37, 95% CI: 2.35-4.83), compared to 1990.

Figure 21: Rates of juice consumption for children 6-23 months

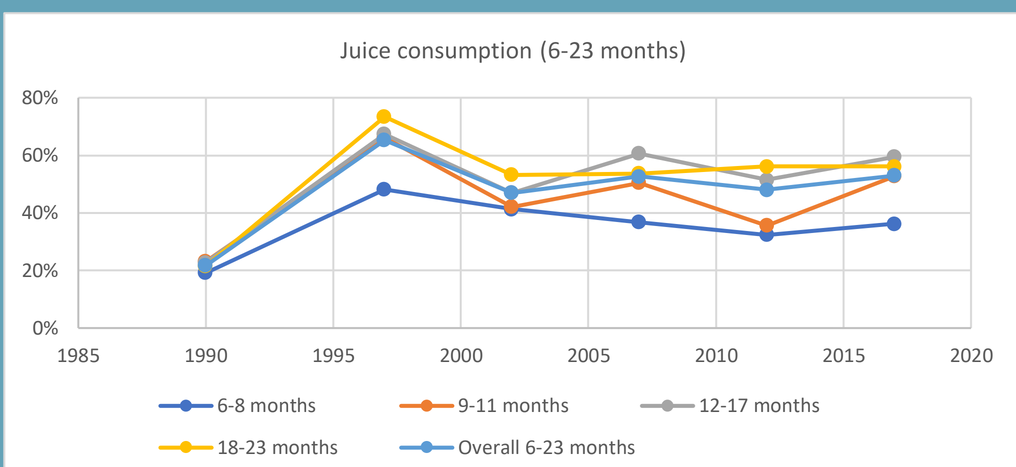


Figure 22: Odds of consuming juice by infants aged 6-23 months by DHS Survey year

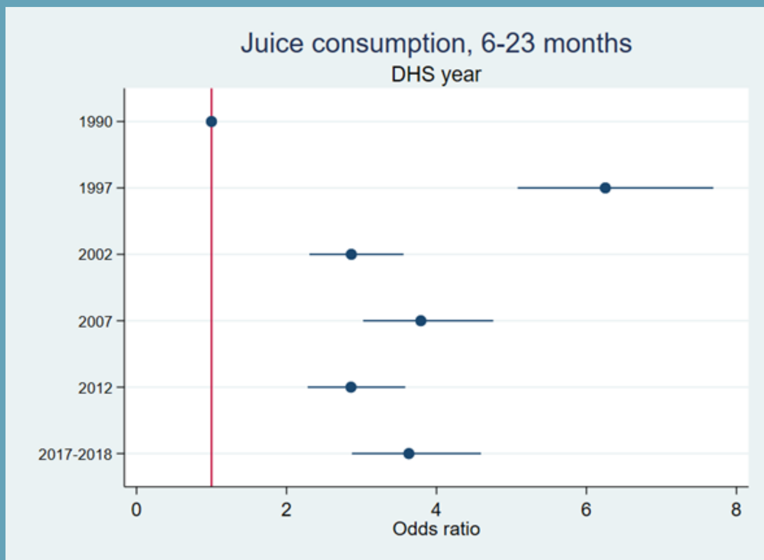


Figure 23: Consumption of tea by infants aged 6-23 months by DHS survey year

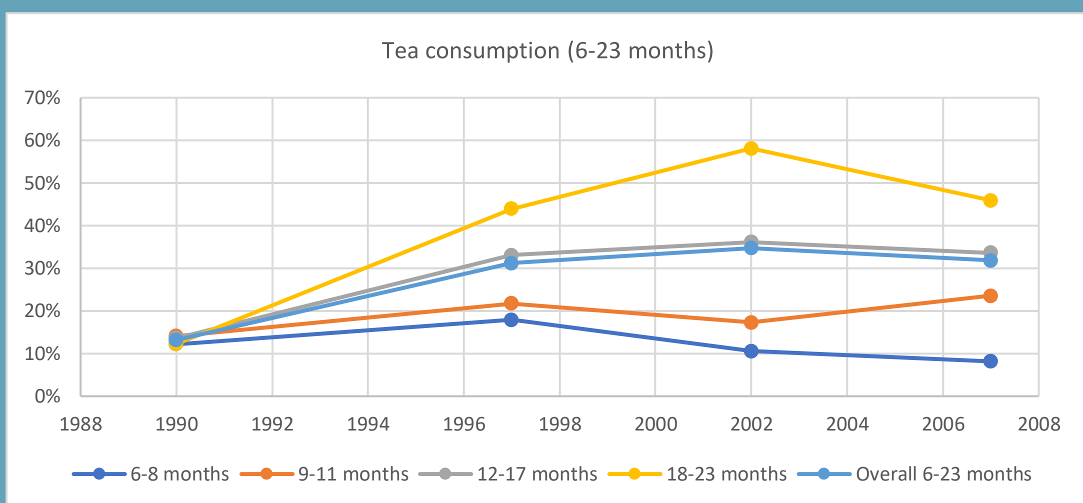
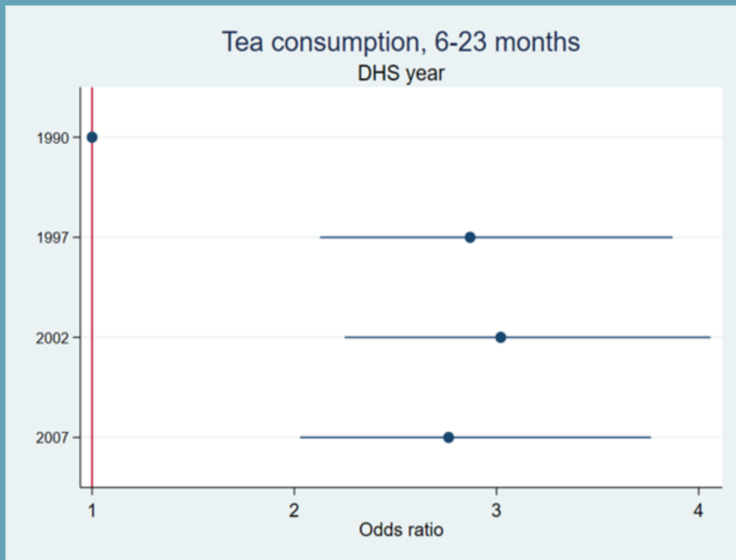


Figure 24: Odds of consuming tea by infants aged 6-23 months by survey year



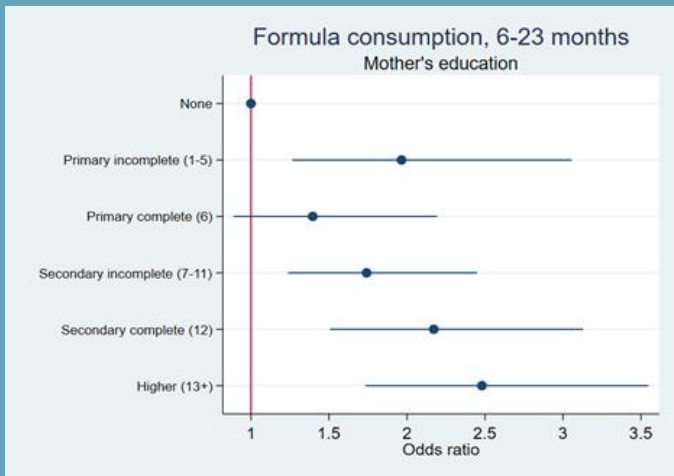
1.23 Factors associated with consumption of breastmilk substitutes and beverages in children 6-23 months of age

Children with more educated mothers and those living in wealthier households were more likely to receive infant formula and milk (**Figure 25, Panels 1-4**). Highly educated mothers were more likely to give baby food to their children: mothers who completed secondary school (12 years) were 5 times more likely to give baby food (OR: 5.07, 95% CI: 1.08-23.70) and mothers who had higher than secondary school education (13+ years) were 7 times more likely (OR: 7.23, 95% CI: 1.55-33.67), compared to mothers with no formal education (**Table 7, Appendix 2**). Additionally, children in wealthier households were more likely to consume baby food. Juice consumption was found to be positively associated with mother's education, and children in wealthier households were more likely to consume juice (**Figure 25, Panels 5 and 6**). Tea consumption was not associated with mother's education, however, was found to be negatively associated with household wealth (OR: 0.90, 95% CI: 0.83-0.97) (**Table 7, Appendix 2**).

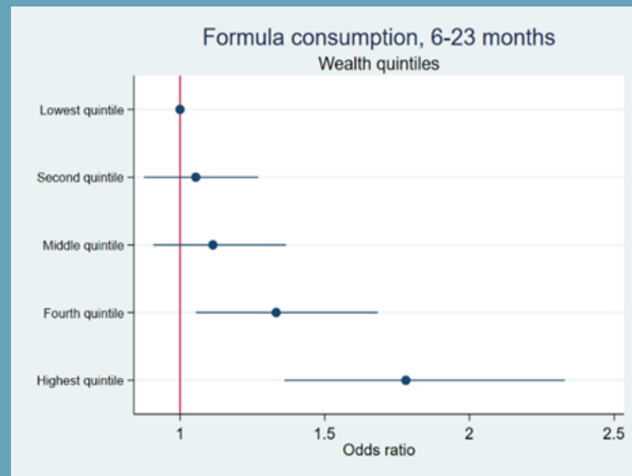
Children in Aqaba were 1.5 times more likely to consume juice (OR: 1.52, 95% CI: 1.12-2.08), and 83% less likely to consume sugar water (OR: 0.17, 95% CI: 0.03-0.90), and 47% less likely to consume infant formula (OR:0.53, 95% CI: 0.35, 0.80), compared to Amman. Similarly, children in Zarqa were 27% less likely to consume infant formula (OR:0.73, 95% CI: 0.62, 0.85), and 43% less likely to consume baby foods (OR: 0.57, 95% CI: 0.44-0.75), compared to Amman. Similarly, children in Karak were 41% less likely to consume baby foods (OR:0.59, 95% CI: 0.36-0.96), compared to Amman. Children in Balqa were 1.2 time more likely to consume dairy milk (OR:1.21, 95% CI: 1.01-1.45), while children in Mafraq were 1.3 times more likely to consume dairy milk (OR:1.32, 95% CI: 1.08-1.61), compared to Amman (**Table 7, Appendix 2**).

Figure 25: Odds of consuming breastmilk substitutes and juice by mothers' education level and household wealth index (controlling for survey year)

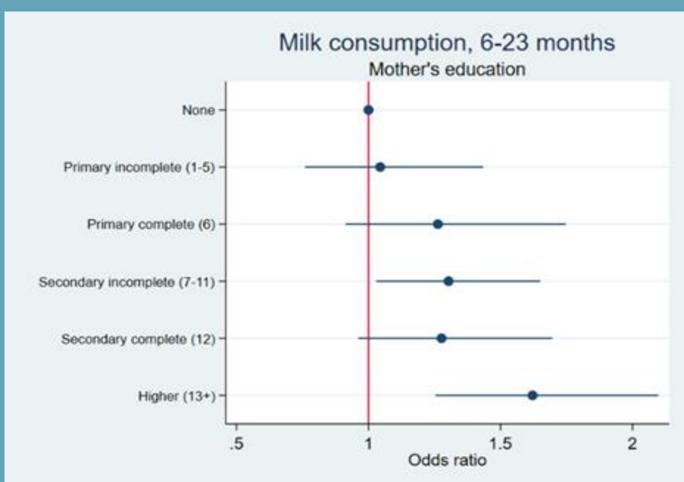
Panel 1: Odds of formula consumption by mother's education



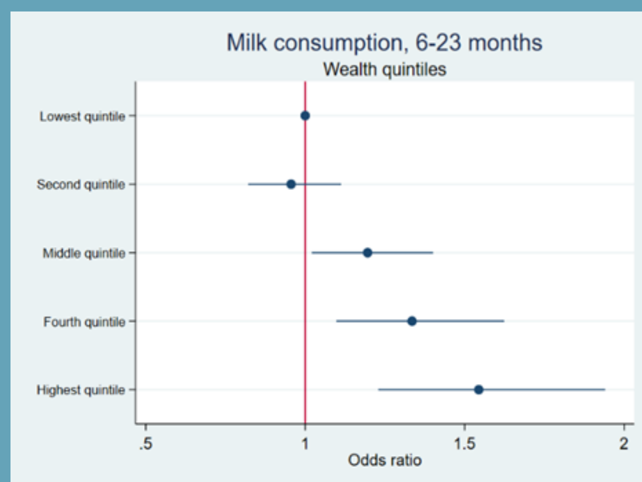
Panel 2: Odds of formula consumption by wealth index



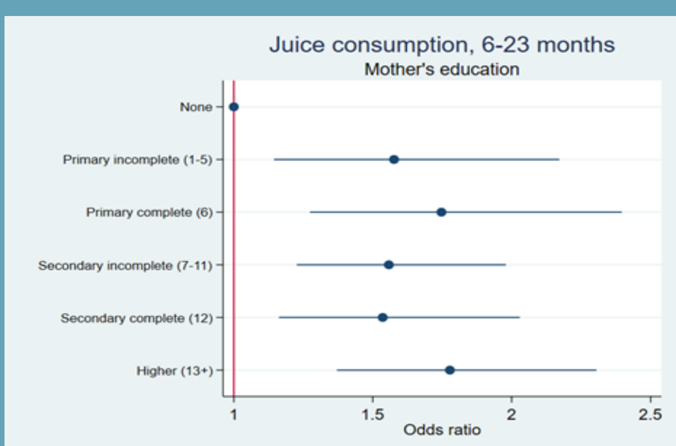
Panel 3: Odds of milk consumption by mother's education



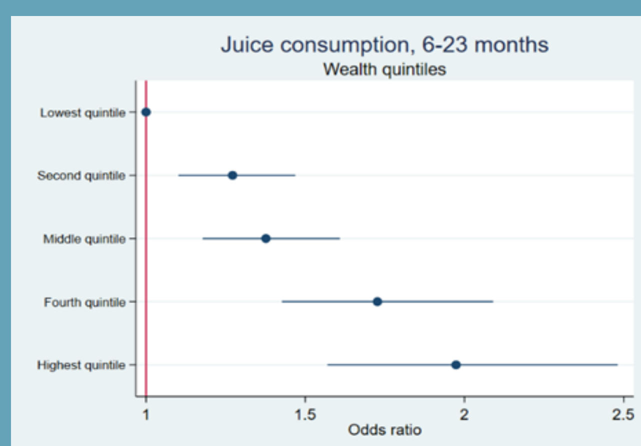
Panel 4: Odds of milk consumption by wealth index



Panel 5: Odds of juice consumption by mother's education



Panel 6: Odds of juice consumption by wealth index



1.24 Trends in consumption of micronutrient rich food groups: Plant foods

Irrespective of survey year, only 1 in 6 children aged 6-23 months consumed dark green leafy vegetables, and consumption of fruits and vegetables are lowest in younger children

Consumption of dark green leafy vegetables in children aged 6-23 months was low (15%). It increased from 2002 (13%) to 2007 (19%) and dropped in 2012 (11%). By 2017, the consumption increased to 15%. Consumption is lowest in children less than 12 months (data not shown). Compared to 2002, children were about 1.5 times more likely to consume DGLV in 2007 (OR: 1.52, 95% CI: 1.25-1.85), followed by a 23% decrease in odds in 2012 (OR: 0.77, 95% CI: 0.63-0.95) (**Table 8, Appendix 2**). Consumption of Vitamin A rich fruits and vegetables increased from 2002 (32%) to 2007 (47%) (**Figure 26**). However, by 2012, there was a sharp decrease to 19% followed by an increase to 25% in 2017. This is reflected in the odds ratio, with infants and young children 1.84 times more likely to consume vitamin A-rich fruits and vegetables in 2007 (OR: 1.84, 95% CI: 1.59-2.14), but 65% less likely to consume in 2012 (OR: 0.44, 95% CI: 0.38-0.52) and 35% less likely to consume in 2017-18 (OR: 0.67, 95% CI: 0.59-0.78), compared to 2002 (**Figure 27**). A downward trend in consumption was observed from 2007 (63%) to 2017 (43%) for other fruits and vegetables. It was lowest for younger children aged 6-8 months **(Figure 28**). Consumption of dark green leafy vegetables, vitamin-A rich fruits and vegetables and other fruits and vegetables have been consistently low in children aged 6-23 months.

Figure 26: Consumption of vitamin A rich fruits and vegetables by infants 6-23 months of age by survey year

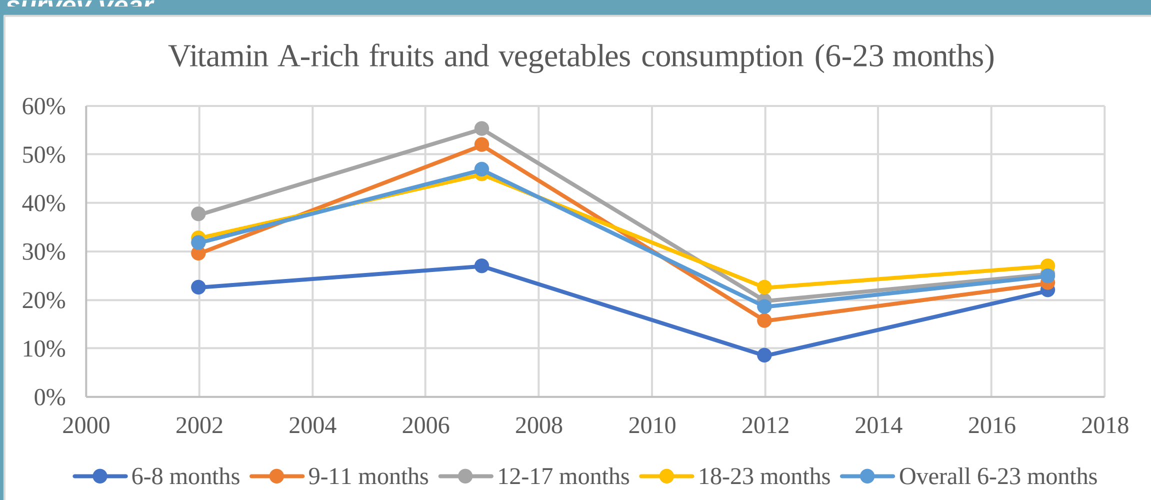


Figure 27: Odds of consuming Vitamin A rich fruits and vegetables by infants aged 6-23 months by DHS year

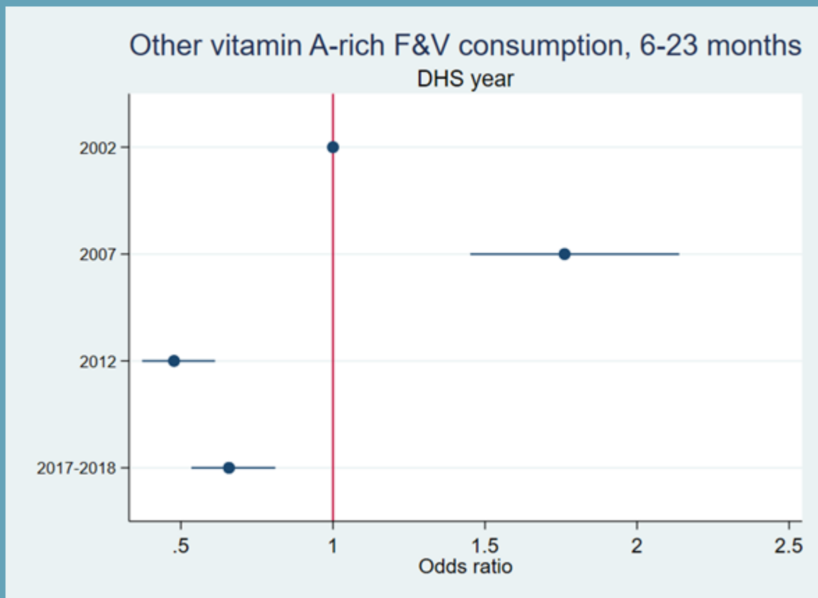
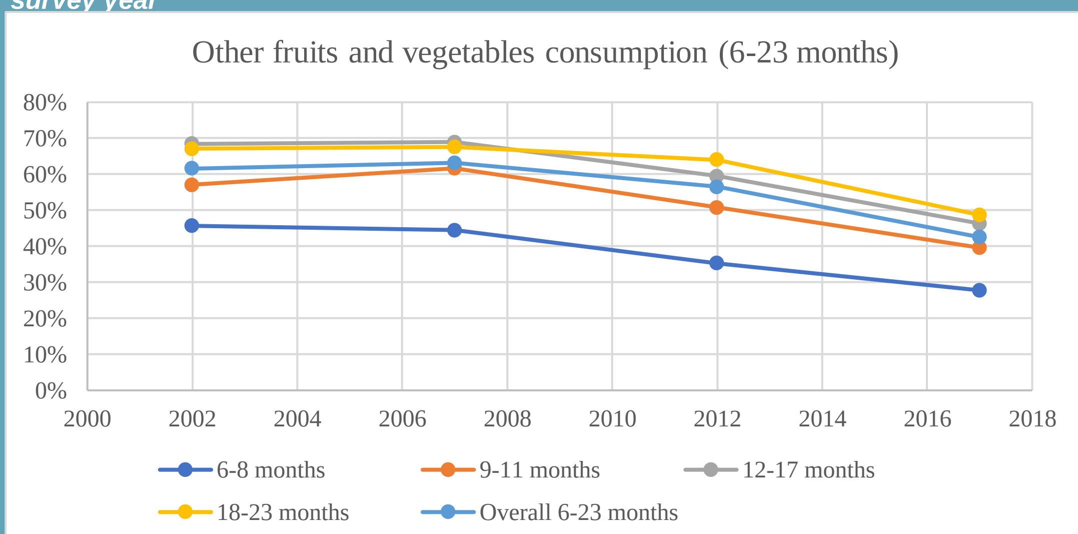


Figure 28: Consumption of other fruits and vegetables by infants aged 6-23 months by survey year



1.25 Trends in consumption of micronutrient rich food groups: Animal sourced foods and legumes

4 out of 5 children aged 6-23 months consume ASFs, and while consumption is higher there has been an overall decline in the consumption of eggs, meat, fish, and poultry over time

There was an increasing trend in consumption of ASFs between 1997 (81%) and 2012 (94%), after which it declined to 82% in 2017. Egg consumption decreased between 2007 (62%) and 2017 (42%) (**Figure 29)** with children 70% less likely to consume eggs in 2012 (OR: 0.31, 95% CI: 0.27-0.36) and 57% less likely in 2017-18 (OR: 0.43, 95% CI: 0.37-0.49) (**Figure 30**). Consumption of meat, poultry, and fish decreased between 1997 (64%) and 2017 (54%) (**Figure 31**). Compared to 1997, consumption of meat, poultry, or fish was almost 30% less likely in 2002 (OR: 0.71, 95% CI: 0.62-0.83), 20% less likely in 2007 (OR: 0.80, 95% CI: 0.69-0.94), 38% less likely in 2012 (OR: 0.62, 95% CI: 0.54-0.72), and almost 45% less likely in 2017-18 (OR: 0.56, 95% CI: 0.49-0.58) (**Figure 32**). Dairy consumption, including milk, yogurt, cheese, and other dairy products, fluctuated across DHS survey years. Consumption of dairy products was high, between 2002 (87%) and 2012 (90%) though there was a drop in consumption to 77% in 2017 (data not shown). The decrease in consumption of dairy products was highest in children aged 6-8 months, (from 88 to 62%). Compared to 2002, children were 30% more likely to consume dairy in 2012 (OR: 1.31, 95% CI: 1.07-1.62) but were 50% less likely to consume dairy in 2017-18 (OR: 0.49, 95% CI: 0.41-0.58). The positive association in 2012 is likely due to the significant increase in milk consumption that year.

Consumption of legumes in children aged 6-23 months was highest in 2002 (29%), which then declined in 2007 (27%) and 2012 (13%). Although the rates increased to 14% in 2017, the overall consumption of micronutrient rich legumes have historically been at a lower end. Compared to 2002, children were 65% less likely to consume protein rich legumes in 2012 (OR: 0.35, 95% CI: 0.29-0.41) and 60% less likely in 2017-18 (OR: 0.41, 95% CI: 0.35-0.48) (Data not shown).

Figure 29: Consumption of eggs by infants aged 6-23 months by

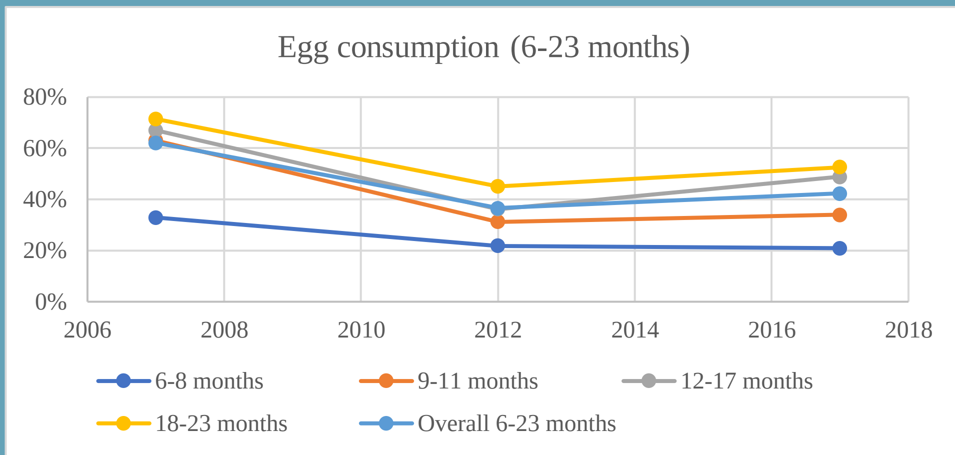


Figure 30: Odds of consuming eggs by infants aged 6-23 months by

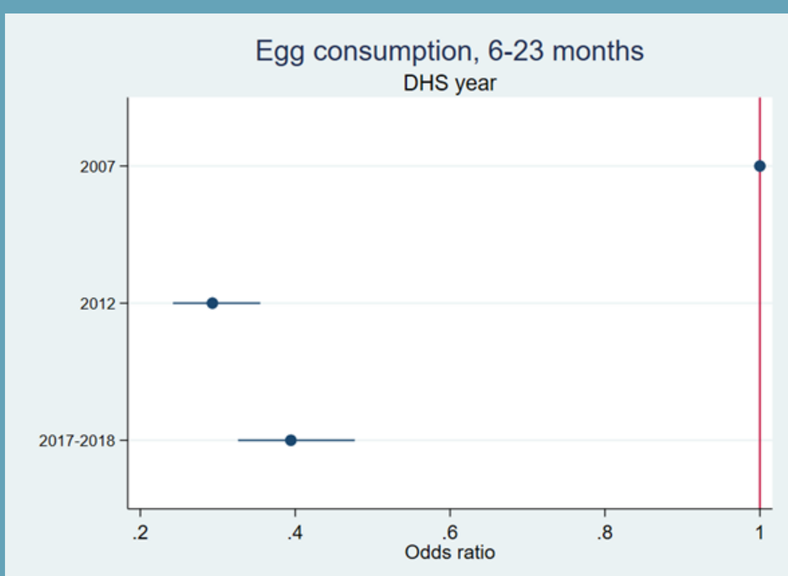


Figure 31: Consumption of meat, fish, and poultry by infants aged 6-23 months by survey year

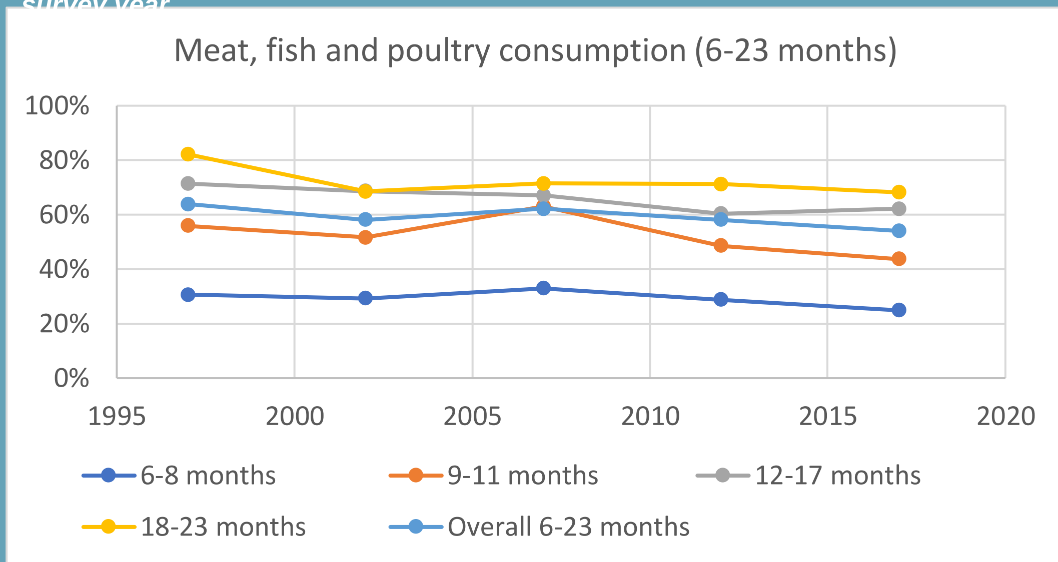
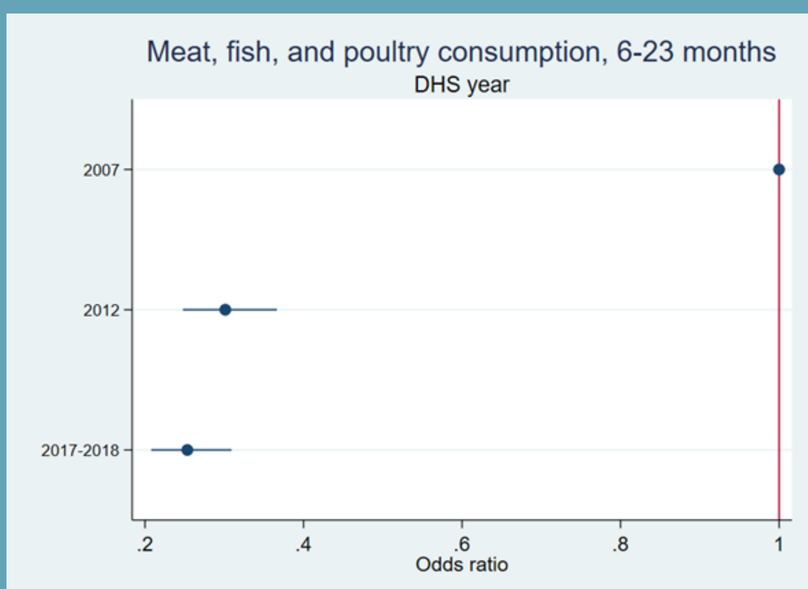


Figure 32: Odds of consuming meat, fish and poultry by infants aged 6-23 months by survey year



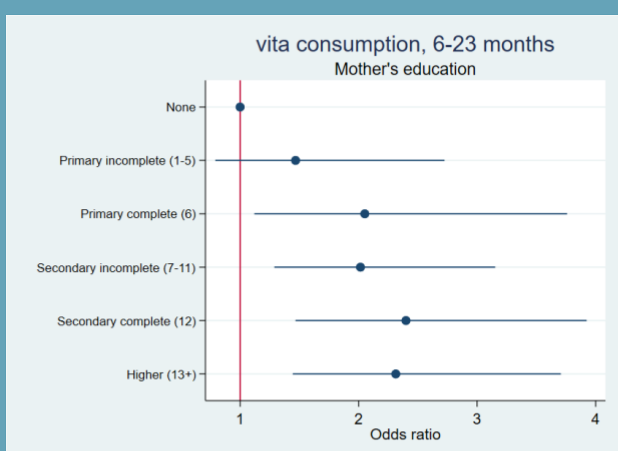
1.26 Factors associated with the consumption of micronutrient rich food groups in children 6-23 months of age

Mother's education and household wealth were found to be positively associated with vitamin A-rich fruit and vegetable consumption (**Figure 33, Panel 1 and 2**). Egg consumption was somewhat associated with higher maternal education, and children in wealthier households were more likely to consume eggs (OR: 1.10, 95% CI: 1.02-1.18) (**Table 8, Appendix 2**). Children with more educated mothers and those living in the wealthier quintiles were more likely to consume meat, poultry, or fish (**Figure 33, Panel 3 and 4**). There was no association between dairy consumption and mother's education, however children in wealthier households were found to be more likely to consume (OR: 1.23, 95% CI: 1.13-1.34). Children living in wealthier households were more likely to consume legumes (OR: 1.14, 95% CI: 1.06-1.23) (**Table 8, Appendix 2**).

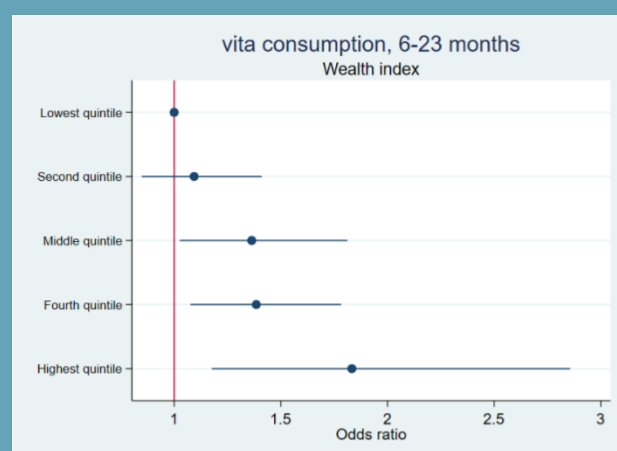
At the governorate level, children in Balqa were about 1.4 times more likely to consume DGLV (OR: 1.34, 95% CI: 1.02-1.76), compared to Amman. Children in Balqa were 26% less likely (OR: 0.74, 95% CI: 0.59-0.93), while children in Zarqa were 46% less likely to consume vitamin A rich fruits and vegetables (OR: 0.59, 95% CI: 0.47-0.66), compared to Amman. At the governorate level, compared to Amman, children in Zarqa were 1.27 times more likely to consume legumes (OR: 1.27, 95% CI: 0.1.07-1.52). At the governorate level, compared to Amman, children in Zarqa were about 22% less likely to consume eggs (OR: 0.78, 95% CI: 0.65-0.92) (**Table 8, Appendix 2**).

Figure 33: Odds of infants aged 6-23 months consuming vitamin A rich fruits, meat, fish, and poultry by mother's education and wealth index controlling for survey year

Panel 1: Odds of consuming Vitamin A rich fruits and vegetables by mother's

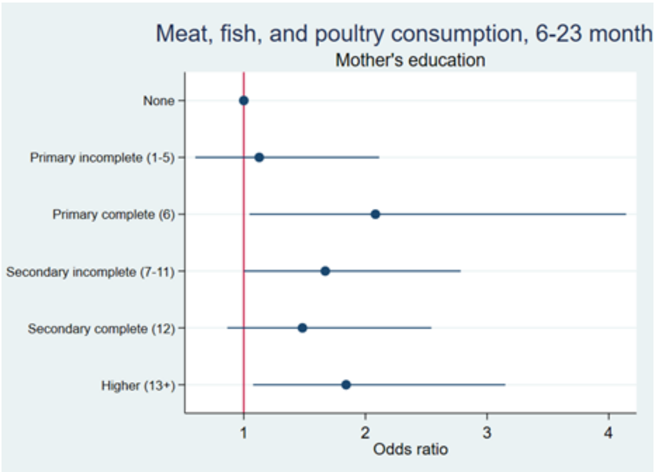


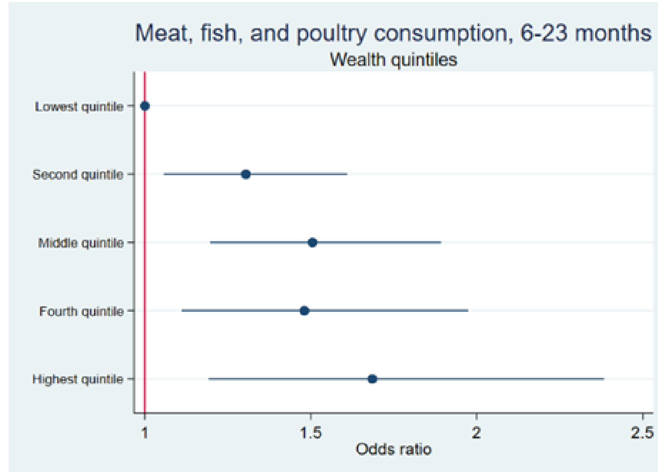
Panel 2: Odds of consuming Vitamin A rich fruits and vegetables by wealth index



Panel 3: Odds of consuming meat, fish and poultry by mother's education

Panel 4: Odds of consuming meat, fish, and poultry by wealth index





Discussion

The need to improve maternal, infant, and young child health and nutrition is critical within the context of the Government of Jordan's priorities in supporting optimal health and wellbeing of women and children, achieving the World Health Assembly targets, and preventing the risk of non-communicable diseases among pregnant women and young children as reflected in the national strategy and plan of action against diabetes, hypertension, dyslipidemia, and obesity. A 2018 USAID landscape analysis re-emphasizes the need to enhance scientific and programmatic actions to breastmilk, breastfeeding, and complementary feeding practices by improving knowledge and awareness of exclusive breastfeeding among the Jordanian population as well as health care professionals.[108]

Through an intensive literature review, we found a gap in the evidence on complementary feeding and complementary feeding practices in Jordan. While there is emerging evidence on the issues related to early initiation of breastfeeding, exclusive and continued breastfeeding and the barriers associated with them, there was little information on what, when and how a mother chooses the first foods and consumption of breastmilk substitutes and sugar-sweetened beverages versus consumption of micronutrient rich foods and food groups.

This study utilized six DHS surveys conducted in the Kingdom since 1990 through 2017. The objective of the study was to assess the trends and changes in infant and young child feeding over time relative to the estimates observed in the DHS 2017-2018. The infant and young child feeding practices that we focused on included both breastfeeding and complementary feeding practices in Jordan. We examined factors associated with optimal versus sub-optimal practices of BF, EBF and complementary feeding indicators such as MMF, MDD and MAD, consumption of breastmilk substitutes, sugar-sweetened beverages and micronutrient rich foods and food groups. The analysis included a total of 14,874 infants and young children across all survey years with 11,099 children aged 6-23 months and 3725 infants under 6 months of age (aggregate across all survey years). The analysis utilized two approaches, one where we conducted in-depth descriptive and inferential statistical analyses to assess trends over time and the second where we pooled data and assessed differences by survey year, location (governorates, urban/rural population), education level of the mother, and the wealth of the household. Our interest was to understand changes over time and to assess factors that were time invariant to have a better understanding of the findings of the 2017-2018 DHS.

In infants under 6 months of age, we examined trends over time in the indicators of exclusive breastfeeding, early initiation of breastfeeding, and median duration of breastfeeding along with consumption of breastmilk substitutes. We also examined if foods and what foods were introduced earlier than 6 months of age and their determinants. In infants and young children 6-23 months of age, we assessed trends over time in the indicators of minimum dietary diversity (MDD), minimum meal frequency (MMF) and minimum acceptable diet (MAD). In addition, we examined the trends in consumption of breastmilk substitutes, sugar-sweetened beverages and micronutrient rich food foods and food groups. Finally, across both groups, controlling for survey year, we assessed if differences existed by location (governorate, urban/rural), by the education of the mother and wealth of the household.

We found that while the rate of early initiation of breastfeeding has improved over time with two-thirds of newborns being put to the breast within the first hour of life, 3 out of four infants under 6 months of age still do not receive the protective benefits of exclusive breastfeeding, a number that has not changed for three decades. Similarly, the median duration of exclusive breastfeeding has not changed in three decades. In 2017, the percentage of infants introduced to commercial infant formula was twice as high as the percentage in 1990 with infants almost five times more likely to be introduced to infant formula prior to 6 months in 2017 compared to 1990. We found juice and tea consumption had decreased over time in infants under 6 months of age; however, the data are collected only through 2002.

With respect to complementary feeding practices in infants and young children 6-23 months of age, we find that the percentage achieving MMF has drastically reduced over time with less than half of the infants and young children aged 18-23 months being fed the minimum number of meals for their age. This decline was also observed in infants aged 9-11 months. Compared to 2002, in 2017, infants and young children aged 6-23 months were 50% less likely to achieve MMF. MDD has declined over the years with only one in every third child meeting the requirement, the lowest percentage was observed in the youngest age group (6-8 months). Compared to 2007 (the first survey year where we can compute MDD), children in 2017 were 80% less likely to have achieved their MDD. MAD has also progressively declined over the years with only one in every sixth child receiving a minimum acceptable diet. Like MDD, the rate was lowest in the youngest age group (6-8 months).

When examining consumption of breastmilk substitutes and sugar-sweetened beverages, consumption of infant formula has increased over time and is higher in younger children (under 12 months of age). Infants aged 6-23 months in 2017 were almost 6 times more likely to consume infant formula compared to infants in 1990. We also found a substantial and significant increase in consumption of juices from 1990 to 2017. Over 50% of infants and young children 6-23 months of age had consumed a juice beverage in 2017. They were over 3 times more likely to consume a juice beverage compared to infants in 1990.

In 2017, only one in every six children aged 6-23 months consumed a dark green leafy vegetable. Vitamin A rich fruits and vegetable consumption has also declined, with infants in 2017, 35% less likely to consume a vitamin A rich fruit and vegetable compared to infants in 1990. Consumption of other fruits and vegetables was low particularly in younger children. With respect to animal sourced foods and legumes, four out of five children aged 6-23 months do consume ASFs; however, this is driven by dairy consumption. There has been a significant overall decline in consumption of eggs, meat, fish, and poultry over time.

Controlling for the survey year, we find infants under 6 months of age in wealthier households were 1.3 times more likely to be introduced to infant formula than those from poorer households. Additionally, infants in urban areas were significantly more likely to be introduced to formula prior to 6 months of age. Contrary to this finding, micronutrient rich food groups including dark green leafy vegetables, vitamin A rich fruits and vegetables, legumes, animal sourced foods (other than dairy) were not commonly introduced.

In infants 6-23 months of age, MAD, MDD and MMF were positively associated with wealth status and maternal education levels. With respect to governorates, controlling for survey year, wealth and education, children in Karak and Mafraq were less likely to meet MDD (compared to Amman) while children in Zarqa and Jerash were more likely to meet the MMF (compared to Amman). Finally, children in Irbid and Mafraq were significantly less likely to meet MAD compared to Amman. Like infants under 6 months, infants 6-23 months with more educated mothers and those living in wealthier households were more likely to receive infant formula, juices, and baby foods.

Tea consumption was not associated with mother's education and was negatively associated with household wealth. There were differences in consumption practices by the governorate. With respect to micronutrient rich foods, infants and young children from wealthier households were more likely to consume these over those that belonged to poorer households. Mother's education was associated with the consumption of some of the micronutrient rich foods and food groups but not all. These IYCF practices in early life are reflected in anthropometric indicators of the same infants. While we do not present the data on anthropometry, in an assessment over time, we found steady rates of overweight between 20-30% in infants under 6 months of age and about 15-20 % of infants and young children aged 6-23 months across survey years. We also note that about 10-20% of infants under 6 months and about 5-15 % of infants and young children aged 6-23 months classified as obese across survey years.

Available studies suggest that low EBF rates are common to most countries in Middle East region.[99] In Jordan, other studies have documented that 37% of infants less than 6 months of age consume milk other than breastmilk.[90] Results from other studies also indicate supplementation with infant formula ranging from 30% - 55% and an unclear understanding among mothers about the definition of exclusive breastfeeding.[92,93,94] Although Jordan adopted the provisions of the International Code of Marketing of Breastmilk Substitutes[38] in 2015, a report by International Baby Foods Action Network (IBFAN) showed that implementation of the "Code" was weak, compliance was not monitored, and violations were not reported to the concerned agencies.[90] A similar pattern was observed in a 2020 report by the WHO that revealed provisions related to the scope of the "Code," informational and educational materials, monitoring and enforcement of the laws, engagement with health workers and systems, and labeling instructions were poorly covered.[38] According to an analytical study from the Eastern Mediterranean Region (EMR), there was less than 15% change in EBF trends in Jordan from 2015 to 2019 in relation to the strength of the score for provisions in national laws.[100] Several studies in Jordan have indicated the importance of strengthening the administrative environment to create Baby Friendly Hospitals and enforce the Ten Steps to Successful Breastfeeding as the cornerstone in improving the rates of exclusive breastfeeding.[92,93,94,98]

Furthermore, while we find studies emerging around the role of breastfeeding in supporting women's and infant's health, there are significant barriers towards supporting exclusive breastfeeding. We found one study that explored knowledge, attitudes and practice (KAPs) among working mothers in the South found 31% mothers stopped breastfeeding earlier than recommended due to poor workplace policies, such as the lack of a designated area for breastfeeding, inadequate maternity leave, and embarrassment to feed in public due to cultural preferences.[96] Similarly, a study in the North Jordan cited an unsupportive work environment, employment, lack of maternity leave, type of delivery and public feeding as the predominant reasons for early BF cessation.[92] Further, the lack of Baby Friendly hospitals and qualified trained lactation consultants lead to an environment that does not support early initiation and EBF practices.[92,93] Some deterrents of early cessation of EBFs and early introduction of formula feeding include mothers' perception that breastmilk is not sufficient source of nutrition for their infants, short interpregnancy intervals, and maternal infant admission to the hospital,[93,97] while others include poor practice of skin-to-skin care, rooming in, and limited lactation support at the facility level within the Jordanian health system.[93,98] We found little research examining the effect of potential policy and programmatic actions to support overcoming these barriers/deterrents of early cessation of EBF and continued BF.

With respect to complementary feeding and feeding practices, other than the DHS 2017[101], we found no studies that have examined complementary feeding practices in Jordan or ascertained the role of ultra-processed foods in displacing nutrient -dense foods particularly during this period of the life cycle. It is also important to note that there are limited studies on complementary feeding in the MENA region. A scoping review to identify gaps and opportunities in nutrition research to curb the escalating burden of non-communicable diseases (NCDs) in Arab countries found less than 10% of research focused on pregnant women, infants, and children.[102] The modest evidence from the region suggests poor IYCF practices, with mixed bottle and breastfeeding being introduced as early as the first month of life coupled with premature introduction of CF.[103] A study that evaluated CF practices and diets among children 6 – 23 months in the MENA region found suboptimal feeding practices and poor compliance with the recommendations affect more than half of the infants and young children in all the countries.[104] Another review that evaluated nutritional status and dietary intakes in four EMR countries found a decreasing secular trend in the prevalence of stunting and an increasing trend in overweight and obesity. At the same time, micronutrient deficiencies exist across the region. For example, prevalence of iron deficiency and vitamin A deficiency was reported in 32% and 18% of Jordanian children under five years of age respectively. This was coupled with low protein intake and high fat intake.[105]

Thus, there is a significant paucity in data and evidence around the underlying factors that drive poor complementary feeding in infants and young children in Jordan. This is an area that has significant need for research. Little is also known about the long-term effects of poor feeding practices in early life. Given the increasing prevalence of NCDs, this is an area that requires investigation.

There are some limitations to our findings. Firstly, while we were able to assess consumption of baby foods, juices, tea, sugar water and other beverages, we could do this only for select survey years. Furthermore, we were not able to assess other ultra-processed food consumption (e.g., candy, cookies, sweets, fried snacks, and foods) as these are not collected in a disaggregated fashion within the DHS diet questionnaire. Also, we did not have data on nationality for all the surveys and hence were unable to control for nationality across the regression models. Nationality data were collected only in 2007, 2012 and 2017/2018 surveys. Finally, we are relying on secondary survey data that has been collected across different time periods. While we standardized all the computations, there might have been differences in data collection across survey years that may not be reconciled in this analysis.

In conclusion, we find that while there have been improvements in some of the indicators particularly supportive of early initiation of breastfeeding, other IYCF indicators have substantially declined. We found an increasing presence of infant formula and juices across the early period of life along with a decreasing quality of the diet and complementary feeding practices starting at 6 months of age as measured by MMF, MDD and MAD. There has been a decline in consumption of specific food groups with fewer infants and young children (6-23 months) receiving high quality micronutrient rich foods and food groups such as dark green leafy vegetables, Vitamin A rich fruits and vegetables and animal sourced foods other than milk. Education and wealth were important factors in ensuring a healthier diet though wealth of a household was also positively associated with displacement of breastfeeding as measured through the consumption of breastmilk substitutes, particularly infant formula.

Recommendations

Our findings indicate the importance of supporting policies and programs to support IYCF practices starting from exclusive breastfeeding, continued breastfeeding to appropriate complementary feeding. While early initiation of breastfeeding has improved in recent years, it is still below the universal coverage recommendations. Given the high usage of health services for prenatal care and the high rate of facility-based delivery, there is a need to evaluate health facility bottlenecks in optimally supporting and promoting early initiation of breastfeeding, exclusive breastfeeding up to 6 months, and continued breastfeeding through 2 years of age. In Jordan, EBF rates have been low over three decades, as has the median duration of breastfeeding.

Our literature and the findings of our secondary analysis also highlight research needs within the space of nutrition and diets of pregnant and lactating women and their infants aged 6-23 months. Some illustrative research priorities include the need for generating nationally representative data on dietary intakes of pregnant and lactating women; optimal dietary patterns for pregnant and lactating women to support actions on addressing the increasing rates of overweight and obesity while combating micronutrient deficiencies and suboptimal food consumption; research to generate evidence on effectiveness and impact of breastfeeding interventions and policy actions to support adherence to exclusive breastfeeding through 6 months of age, impact of interventions targeting healthy diets for infants and young children; determinants of maternal feeding practices and information on what, when, why and how a mother chooses the first foods for the newborn; the impact of regulating the marketing of breastmilk substitutes on adherence to breastfeeding practices; assessing the relationship of optimal or suboptimal IYCF practices, consumption of ultra-processed foods and sugar-sweetened beverages, and consumption of nutrient dense foods; interventions utilizing an integrated multi sectoral approach to support healthy diets for both women and children and research to assess barriers and opportunities to build capacity, collaboration, and commitment of health care professionals to support optimal MIYCN.

With respect to complementary feeding practices, MMF, MDD and MAD have declined over time. While mother's education and household wealth were significantly associated with better IYCF practice, they were also indicative of a higher consumption of infant formula. Programs, therefore, need to emphasize appropriate infant and young child feeding practices and support mothers with appropriate nutrition education and counseling. Given the high usage of infant formula, there is a critical need to understand and evaluate adherence to the Code for marketing breastmilk substitutes. Finally, while there is access to micronutrient rich foods, the consumption of diverse, micronutrient food groups have declined over the years. Introduction to the ultra-processed foods in the child's diet may be a reason for this declining trend. However, DHS surveys do not collect data that allow for a comprehensive assessment of ultra-processed foods. More information and data on diet and expenditure data on ultra-processed foods in Jordan are required to assess the impact of these foods on achieving a healthy diet in this particularly important period of the life cycle. Finally, based on the findings of this analysis, there is an urgent need for concerted policy advocacy and action at national, sub-national and local levels for strategies and programs to support optimal IYCF in Jordan.

Suggested Citation:

Shibani Ghosh, Robin Shrestha, Kamal Kasturi, Katherine Appel, Patrick Webb (November 2021). *Trends Analysis Report on Infant and Young Child Feeding Practices in the Hashemite Kingdom of Jordan, 1990-2017*. Jordan Nutrition Innovation Lab

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Appendix 1: Data and Methods

a. Measurement of Key Variables: Definitions

i) Exclusive breastfeeding was defined as children who are currently breastfeeding and who did not receive any water, liquids, or foods in the past 24 hours.

ii) Consumption of milk or formula was defined as children who consumed fresh, powdered, or tinned milk and/or infant formula in the past 24 hours.

iii) Consumption of juice, tea, and sugar water was defined as children who consumed that beverage in the past 24 hours.

iv) Consumption of dark green leafy vegetables (DGLV) was defined as children who consumed DGLV in the past 24 hours.

v) Consumption of other vitamin A-rich fruits and vegetables was defined as children who consumed vitamin-A rich fruits and/or vitamin A-rich vegetables, other than DGLV, in the past 24 hours.

vi) Consumption of ASFs was defined as children who consumed meat, fish, poultry, eggs, and/or dairy products in the past 24 hours.

vii) Minimum dietary diversity (IYCF-MDD) was defined as children who consumed 5 or more of the 8 food groups in the past 24 hours: (1) breastmilk; (2) grains, roots, and tubers; (3) legumes and nuts; (4) dairy products; (5) meat, fish, poultry, and organ meats; (6) eggs; (7) vitamin A-rich fruits and vegetables; and (8) other fruits and vegetables.

viii) Minimum Meal Frequency (IYCF-MMF) was defined as children who received the minimum number of meals and milk feeds in the past 24 hours. Breastfed infants 6-8 months had a minimum of 2 meals or snacks, and breastfed children 9-23 months of age had a minimum of 3 meals or snacks. Children 6-23 months of age who were not breastfed had a minimum of 4 meals, snacks, and milk feeds, where one must have been a solid, semi-solid, or soft food.

ix) Minimum acceptable diet (IYCF-MAD) was defined as children who met all requirements for both IYCF-MDD and IYCF-MMF.

x) Governorate was defined as (11) Amman, (12) Balqa, (13) Zarqa, (14) Madaba, (21) Irbid, (22) Mafraq, (23) Ajloun, (24) Jerash, (31) Karak, (32) Tafilah, (33) Ma'an, and (34) Aqaba. Urban location was defined as (0) rural and (1) urban. Child's age was defined as the number of months between the child's birth and the interview date.

xi) Mother's education was defined as: (1) none (0 years); (2) primary incomplete (1-5 years); (3) primary complete (6 years); (4) secondary incomplete (7-11 years); (5) secondary complete (12 years); and (6) higher (13+ years). Wealth quintiles were defined as (1) lowest, (2) second, (3) middle, (4) fourth, and (5) highest wealth.

Appendix 1 Table 1 below provides the variable names extracted for the analyses.

Table 2: Extracted Variables by survey year

		DHS Survey year					
Topic/Variable		**1990**	**1997**	**2002**	**2007**	**2012**	**2017-18**
Governorate		shgovern	shgovern	sgovern	shgovern	shgov	hv024
Urban/rural		v102	v102	v102	v102	v102	v102
Child's age		v008, b3	v008, b3	v008, b3	v008, b3	v008, b3	v008, b3
Mother's education		v133	v133	v133	v133	v133	v133
Wealth index		wlthindf, wlthind5	wlthindf, wlthind5	wlthindf, wlthind5	hv271, hv270	hv271, hv270	hv271, hv270
Currently breastfeeding		v404	v404	v404	v404	v404	v404
Number of times given milk				v469h		v469e	v469e
Number of times given formula				v469f		v469f	v469f
Number of times ate solid, semi-solid, or soft foods			m39	m39	m39	m39	m39
Child was given:							
Breast-milk substitutes	Infant formula	v411a	v411a	v469f	v411a	v411a	v411a
	Milk	v411, v412	v411, v412	v469h	v411	v411	v411
Sugar-sweetened beverages	Juice	v410	v410	v469c	v410	v410	v410
	Tea	v410a	v410a, v413a	v469d	v410a		
	Sugar water	v409a	v409a	v469b			
Grains, roots, and tubers	Baby food				v412b	v412a	v412a
	Grains		v414e	v469q	v412b, v414e	v412a, v414e	v412a, v414e
	Roots and tubers		v414f	v469r	v414f	v414f	v414f

Legumes, nuts, and seeds	Legumes, nuts, or seeds						v414o
	Legumes			v469w	v414o	v414o	
	Nuts and seeds			v469xx	v414a	v414t	
Fruits and vegetables	Fruits		v414b				
	Vegetables		v414a				
	Vitamin A-rich fruits			v469z	v414k	v414k	v414k
	Vitamin A-rich vegetables			v469m	v414i	v414i	v414i
	Dark green leafy vegetables			v469n	v414j	v414j	v414j
	Other fruits or vegetables			v469u	v414l	v414l	v414l
Animal source foods	Cheese, yogurt, and other dairy products (excluding milk)			v469x	v414p		
	Cheese					v414p	v414p
	Yogurt					v414v	v414v
	Eggs				v414g	v414g	v414g
	Eggs, fish, or poultry		v414g				

	Meat		v414h				
	Meat or poultry				v414h	v414h	v414h
	Meat, poultry, fish, or eggs			v469v			
	Fish				v414n	v414n	v414n
	Organ meats					v414m	v414m

b. Dependent variables

The primary outcome measures were exclusive breastfeeding, consumption of foods and food groups in the past 24 hours, and meeting the IYCF-MDD, IYCF-MMF, and IYCF-MAD indicators.

Exclusive breastfeeding was calculated as children who were currently breastfeeding (v404) and who did not receive any water, liquid, or foods in the past 24 hours.

Consumption of breastmilk substitutes of milk, infant formula, and baby food were created as binary variables. Consumption of milk included fresh, powdered, or tinned animal milk.
Variables for fresh milk (v412) and powdered or tinned milk (v411) were combined for the 1990 and 1997 data to create a single variable with a "yes" response for a child who had fresh and/or powdered or tinned milk, and a "no" response for a child who did not have either kind of milk. Fresh, powdered, and tinned milk were combined in a single question in the remaining years. The variable from 2002 (v469h) was manipulated as described previously, and variables from 2007, 2012, and 2017-18 were not manipulated (v411). A single variable for infant formula was included in the data and was not manipulated for 1990, 1997, 2007, 2012, and 2017-18 (v411a). A binary variable for data from 2002 was created as described previously (v469f). Using the binary milk and formula variables, we created a single variable for children who consumed milk or infant formula, where "yes" corresponds to a child who consumed milk and/or infant formula, and "no" corresponds to a child who consumed neither milk nor infant formula. Baby food was only included in the dietary recall in 2012 and 2017-18 and was asked as a single variable. The baby food consumption variable was not manipulated (v412a).

Data on **dietary intake** was collected using qualitative 24-hour recalls, in which the mother of the child responded "yes" or "no" when asked if the child consumed specific foods in the past 24 hours. In 2002, the mother was asked how many times the child consumed specific foods in the last 24 hours, and responses were categorized into "no" (0 times) and "yes" (1-7+ times). Dietary recall data were analyzed as individual foods and aggregated food groups.

Beverages that are likely to be sweetened with sugar were examined, including juice, tea, and sugar water. A single variable for juice was included in the data and was not manipulated for 1990, 1997, 2007, 2012, and 2017-18 (v410). A binary variable for data from 2002 was created as described previously (v469c). Consumption of tea was included in the dietary recall until 2007. A single variable for tea was included in 1990 and 2007 and was not manipulated (v410a). In 1997, consumption of herbal tea (v410a) and anise tea (v413a) were recorded. Data were combined to create a single variable was created with a "yes" response for a child who had herbal and/or anise tea, and a "no" response for a child who did not have either kind of tea. A binary tea variable for 2002 was created as described previously (v469d). Sugar water was only included in surveys from 1990, 1997, and 2002. A single variable for sugar water was included in 1990 and 1997 and was not manipulated (v409a). A binary variable for sugar water was created as previous described for 2002 data (v469b).

Data on **consumption of staple grains and starchy foods** were gathered after 1990. A single variable for porridge or baby food was included in 2007, 2012, and 2017-18 (v412b in 2007 and v412a in 2012 and 2017-18) and was not manipulated. Consumption of foods made from grains (bread, pasta, rice, maize, etc.) was included as a single variable in 1997, 2002, 2007, 2012, and 2017-18. Data from 1997 (v414e) was not manipulated and data from 2002 (v469q) was converted to a binary variable as previously described.

Data from 2007, 2012, and 2017-18 (v414e for all years) were combined with baby food to create an overall grain variable, since baby food is made from grains, where "yes" indicates that a child consumed any food made from grains and "no" indicates that a child did not consume any food made from grains.

A single variable for consumption of white roots and tubers was collected and only data from 2002 were manipulated (v414f in 1997, 2007, 2012, and 2017-18 and v469r in 2002). Further, a single variable for consuming any grain or root/tuber was created by combining the grain variable and roots or tubers variable, where "yes" indicates that the child consumed foods made from grains and/or roots or tubers and "no" indicates that the child did not consume any food made from grains, roots, or tubers.

Micronutrient-rich foods were also examined, including legumes, nuts and seeds, fruits and vegetables, and animal source foods (ASFs). Data on consumption of legumes, nuts, and seeds was not collected before 2002. A single variable for legumes (beans, peas, and lentils) was included in 2002, 2007, and 2012 (v469w in 2002 and v414o in 2007 and 2012), as well as a single variable for nuts and seeds (v469xx, v414a, and v414t, respectively), so these variables were combined to create a single variable for consuming legumes or nuts and seeds. Variables from 2002 were further manipulated as described previously. In 2017-18, lentils, nuts, and seeds were combined in one question (v414o) and was not manipulated.

Dietary recall of fruits and vegetables was collected in all years except 1990 and was collected on specific types of fruits and vegetables for all years except 1997. In 1997, the variables for consuming fruits (v414b) and consuming vegetables (v414a) were combined to create a single variable, where "yes" indicates that the child consumed fruits and/or vegetables and "no" indicates that the child consumed neither fruits nor vegetables.

Dietary recall of dark green leafy vegetables (DGLVs) was recorded in a single variable in 2002, 2007, 2012, and 2017-18. Variables from 2007, 2012, and 2017-18 were not manipulated (v414j) and the variable from 2002 (v469n) was converted into a binary variable as described before.

Consumption of vitamin A-rich fruits (e.g., apricots, palm nuts, and yellow melon) and other vitamin A-rich vegetables (e.g., pumpkin, carrots, red/yellow yams, and red sweet potato, but not including DGLV) were collected in 2002, 2007, 2012, and 2017-18 in two separate variables, which were combined to create a single "other vitamin A-rich fruits and vegetables" variable. For the 2002 data, the vitamin A-rich fruits (v469z) and other vitamin A-rich vegetables (v469m) variables were converted into binary variables as described previously and then combined. For the 2007, 2012, and 2017-18 data, the vitamin A-rich fruits (v414k) and other vitamin A-rich vegetables (v414i) variables were combined. For all 4 years, the single other vitamin A-rich fruit and vegetable variable indicates that the child consumed other vitamin A-rich fruits and/or vegetables (yes) or that the child did not consume any other vitamin A-rich fruit or vegetable (no). Furthermore, a single variable for consuming any vitamin A-rich fruits or vegetables was created by combining DGLVs and other vitamin A-rich fruits and vegetables. A single variable for consuming any other fruits or vegetables was included in 2002, 2007, 2012, and 2017-18. In 2002, the variable was manipulated as stated previously (v469u) and variables in 2007, 2012, and 2017-18 were not manipulated (v414l).

The dietary recall on animal-source foods (ASFs) was conducted in a varied manner by survey year (reference Table 2), so foods were combined into food groups modeled after the food groups in the IYCF-MDD indicator. ASF food groups that were created include (1) dairy products (milk, cheese, yogurt, and other milk products), (2) eggs, and (3) meat, fish, poultry, and organ meats. Consumption of dairy products other than milk were gathered first in 2002, and all cheese and yogurt were included in a single variable in 2002 and 2007 (v469x and v414p, respectively), while separate variables for cheese and yogurt were gathered in 2012 and 2017-18 (v414p for cheese and v414v for yogurt in both years). The variable from 2002 was converted to a binary variable according to the previous description and combined with the milk variable to create a single variable for dairy products. Similarly, the single variable for cheese and yogurt in 2007, and separate cheese and yogurt variables in 2012 and 2017-18 were combined with the milk variable in that year to create a single dairy products variable, where "yes" indicates the child was given milk, cheese, and/or yogurt and "no" indicates the child was given neither milk, cheese, nor yogurt. For the IYCF-MDD indicator, the dairy food group also includes infant formula, so a separate variable was created by combining the infant formula variable and dairy variables from 2002, 2007, 2012, and 2017-18. This variable was only used in constructing the IYCF-MDD indicator.

Data on consumption of eggs, separate from other ASFs, was only collected in 2007, 2012, and 2017-18 and was not manipulated (v414g). Data on consumption of meat, fish, poultry, and organ meats, separate from other ASFs, was only collected in 2007, 2012, and 2017-18. In 2007, data were collected on meat, poultry, and organ meats (v414h) and fish (v414n) separately, which were combined into a single variable indicating "yes" for children who were given meat, poultry, and organ meats and/or fish and "no" for children who were given neither meat, poultry, and organ meats nor fish. In 2012 and 2017-18, data were collected on meat and poultry (v414h), fish (v414n), and organ meats (v414m) separately. All 3 of these variables were combined to create a single variable where "yes" indicates that the child was given meat and poultry, fish, and/or organ meats and "no" indicates that the child was not given any meat and poultry, fish, or organ meats.

A variable for any meat, poultry, fish or eggs was created by combining the variable on egg, fish, and poultry consumption (v414g) with meat consumption (v414h) in 1997, converting the 2002 variable of meat, poultry, fish, and eggs to a binary variable (v469v), and by combining the previously described egg variable and meat, poultry, fish, and organ meat variable for 2007, 2012, and 2017-18.

Two final ASF variables were constructed, bringing together i) all ASFs excluding milk, and ii) all ASFs including milk. Only consumption of milk was recorded in 1990 and consumption of cheese, yogurt, and other dairy products was not collected in 1997, so overall ASF variables were not created for those years. In 2002, the variables for cheese, yogurt, and other dairy products (v469x) and meat, poultry, fish, and eggs (v469v) were converted to binary variables and combined into a single variable. Similarly in 2007, the variable for cheese, yogurt, and other dairy products (v414p) was combined with the previously constructed variable for consumption of any meat, poultry, fish or eggs. In 2012 and 2017-18, the separate variables for cheese consumption (v414p) and yogurt consumption (v414v) were combined with the previously constructed variable for consumption of any meat, poultry, fish or eggs, resulting in a variable indicating that the child was given any ASF besides milk (yes) or no ASF besides milk (no). This variable was further combined with the previously described milk variable, creating a variable indicating that the child was given any ASF (yes) or no ASF (no).

A summary of the differences in dietary recalls in DHS surveys is provided in the following table, describing which foods and food groups were available in each survey.

Table 3: Available diet recall data by DHS survey year

Food Group	Survey Year					
	1990	1997	2002	2007	2012	2017-2018
Infant formula & Milk	X	X	X	X	X	X
Juice	X	X	X	X	X	X
Tea	X	X	X	X		
Sugar water	X	X	X			
Baby food				X	X	X
Fruits and vegetables		X	X	X	X	X
Vitamin A-rich fruits and vegetables			X	X	X	X
Dark Green Leafy Vegetables (DGLV)			X	X	X	X
Other fruits and vegetables			X	X	X	X
Animal Source Foods (ASFs)		X	X	X	X	X
Dairy products			X	X	X	X
Eggs				X	X	X
Meat, fish, poultry, and organ meats				X	X	X

According to the UNICEF Infant and Young Child Feeding minimum dietary diversity (IYCF-MDD) indicator, children who consumed 5 or more of the 8 food groups were considered to have met the minimum dietary diversity requirement. The 8 food groups included in this indicator were: (1) breastmilk; (2) grains, roots, and tubers; (3) legumes and nuts; (4) dairy products; (5) meat, fish, poultry, and organ meats; (6) eggs; (7) vitamin A-rich fruits and vegetables; and (8) other fruits and vegetables. Only dietary recall data from 2007, 2012, and 2017-18 were collected appropriately to create the IYCF-MDD indicator. This variable was created in a 2-step process. First, the number of food groups consumed by the child was created by counting each food group for which the child had a "yes" response. A binary variable was then created using a cutoff of 5 food groups. Children who consumed 5, 6, 7, or 8 food groups received a value of "1" indicating that they met the IYCF-MDD requirements, while children who consumed 0, 1, 2, 3, or 4 food groups were given a value of "0", indicating that they did not meet the requirements.

A variable for the minimum meal frequency (MMF), or the number of times a child receives meals, snacks, or milk feeds in the previous 24 hours, was created where the minimum threshold for adequate meal frequency depends on the child's age and breastfeeding status. Breastfed infants 6-8 months have a minimum of 2 meals or snacks and breastfed children 9-23 months of age have a minimum of 3 meals or snacks. Children 6-23 months of age who are not breastfed have a minimum of 4 meals, snacks, and milk feeds, where one must be solid or semi-solid food. Only data from 2002, 2012, and 2017-18 were collected appropriately to create the IYCF-MMF indicator. This variable was created in 4 steps. First, the total number of meals and milk feeds was calculated by adding together the number of times the child was given meals or snacks of solid, semi-solid, or soft foods (m39), with the number of times the child was given milk (v469h in 2002 and v469e in 2012 and 2017-18), with the number of times the child was given infant formula (v469f). Then, children were assigned a "1" or "0" based on their age (as calculated in section 2.2.2), current breastfeeding status (v404), and number of meals or milk feeds they received in the previous day. Children 6-8 months of age who were currently breastfeeding and who consumed 2 or more meals received a value of "1", and a value of "0" if they consumed 0 or 1 meal. Children 9-23 months of age who were currently breastfeeding and who consumed 3 or more meals received a value of "1", while breastfed children 9-23 months who consumed 0, 1, or 2 meals were given a value of "0". Finally, children 6-23 months of age who were not breastfed and who consumed at least 4 meals or milk feeds, where at least one of those was solid, semi-solid or soft foods, were given a value of "1", while non-breastfed children 6-23 months of age who received 0, 1, 2, or 3 meals or milk feeds, or who did not consume any solid, semi-solid, or soft foods, received a value of "0". A value of "1" indicates that the child met the IYCF-MMF requirements and a value of "0" indicates that the child did not meet the requirements.

The IYCF-MDD and IYCF-MMF data were combined to create a single variable, indicating the child received a minimum adequate diet (MAD). Children must meet both MDD and MMF requirements to meet the MAD. Only data from 2012 and 2017-18 were collected appropriately to create the IYCF-MMF indicator. The IYCF-MAD variable was created by combining the IYCF-MDD and IYCF-MMF variables into a single binary variable. Children who had a value of "1" for both IYCF-MDD and IYCF-MMF received a value of "1", while children who had a value of "0" for IYCF-MDD and/or IYCF-MMF received a value of "0". A value of "1" indicates that the child met the IYCF-MAD requirements and a value of "0" indicates that the child did not meet the requirements.

c. Independent variables

Independent variables used in this analysis included year of the DHS survey, geographic location, child's age, mother's education attainment, and household wealth. A variable for DHS year was created as a categorical variable indicating which year the data point originated. Geographic location included the governorate in which the child lived (shgovern) in 1990, 1997, and 2007, (sgovern) in 2002, (shgov) in 2012, and (hv024) in 2017-18) as well as if they live in an urban or rural location (v102). These location variables were taken directly from the DHS data and were not manipulated. Child's age in months was calculated as the difference between the child's birth date (b3) and the interview date (v008). An age squared term was also calculated by squaring the child's age in months.

A categorical variable for mother's education was created from the number of years of education the mother received (v133). Data were categorized into 6 groups for analysis: (1) none (0 years); (2) primary incomplete (1-5 years); (3) primary complete (6 years); (4) secondary incomplete (7-11 years); (5) secondary complete (12 years); and (6) higher (13+ years). The wealth quintile variables created by DHS were used for all models and were not manipulated (wlthind5) in 1990, 1997, and 2002, and hv270 in 2007, 2012, and 2017-18). Wealth indices were created from a principal component analysis with data on household assets, services, and amenities, and represents a household's wealth relative to all households included in the survey. Households were then split into 5 groups based on their wealth index, relative to the other households in the survey. The 5 quintiles indicate households with (1) lowest, (2) second, (3) middle, (4) fourth, and (5) highest wealth.

d. Statistical analysis

Due to occasional changes in the dietary recall tool, data available for as many DHS surveys as possible were included in each model. For models with juice consumption and infant formula or milk consumption as the outcome variable, data from all DHS surveys were used. For models with the outcome variable of tea consumption, data from 1990, 1997, 2002, and 2007 was used, while data from 1990, 1997, and 2002 was used in models where sugar water was the outcome variable.

Models with baby food consumption as the outcome variable were conducted on data from 2007, 2012, and 2017-18. Models on consumption of dark green leafy vegetables (DGLV), consumption of other vitamin A-rich fruits and vegetables, and consumption of other fruits and vegetables were conducted with data from 2002, 2007, 2012, and 2017-18.

Models with consumption of any animal source foods (ASFs) as the outcome variable were conducted in 1997, 2002, 2007, 2012, and 2017-18, while those with egg consumption and meat, fish, or poultry consumption were conducted on data from 2007, 2012, and 2017-18. Models with any dairy consumption as the outcome were conducted on data from 2002, 2007, 2012, and 2017-18.

Models assessing the likelihood of meeting IYCF-MDD, IYCF-MMF, and IYCF-MAD were also conducted. IYCF-MDD models included data from 2002, 2012, and 2017-18. Models predicting IYCF-MMF were conducted on data from 2007, 2012, and 2017-18, and models with IYCF-MAD as the outcome variable were conducted on data from 2012 and 2017-18.

Descriptive statistics, including mean ± standard errors (SD), frequency distributions, and proportions were used to describe relevant demographic and diet characteristics.

Pooled logistic regressions were used to predict trends in consuming each food and meeting IYCF-MDD, IYCF-MMF, and IYCF-MAD over the DHS surveys. Unadjusted and adjusted models were run on children by age group: under 6 months of age and 6-23 months of age due to dietary differences in age groups. Covariates included in the models were age of the child, governorate, urban/rural residence, household wealth, and mother's education attainment. All analyses were conducted using Stata version 15.1 software (StataCorp, College Station, TX, USA).

Appendix 2: Logistic regression model tables

Table 4: Logistic regression models assessing the introduction of BMS, sugar sweetened beverages prior to 6 months of age

Variable	(1) Juice	(2) Sugar water	(3) Tea	(4) Infant Formula	(5) Milk
Year of DHS survey					
1990	Reference	Reference	Reference	Reference	Reference
1997	2.982***	1.026	0.922	2.299***	0.706
	(1.944, 4.569)	(0.66, 1.595)	(0.609, 1.397)	(1.716, 3.077)	(0.471, 1.056)
2002	1.444	1.205	0.100***	3.598***	0.380***
	(0.877, 2.382)	(0.721, 2.015)	(0.039, 0.26)	(2.654, 4.873)	(0.221, 0.654)
2007	1.273		0.091***	5.195***	3.504***
	(0.791, 2.051)		(0.039, 0.212)	(3.911, 6.905)	(2.531, 4.852)
2012	0.641			0.202***	10.687***
	(0.375, 1.094)			(0.127, 0.32)	(7.779, 14.68)
2017	1.175			4.735***	0.649*
	(0.76, 1.815)			(3.656, 6.133)	(0.457, 0.921)
Child's age (months)	2.020** (1.31, 3.115)	0.282***	1.378	1.411***	1.835***
		(0.194, 0.41)	(0.878, 2.164)	(1.164, 1.709)	(1.411, 2.386)
Age squared	0.970	1.163***	0.963	0.955**	0.943*
	(0.907, 1.036)	(1.077, 1.255)	(0.888, 1.043)	(0.924, 0.987)	(0.902, 0.987)
Governorates (Amman reference)					
Balqa	1.461	1.928	1.068	0.862	1.169
	(0.906, 2.357)	(0.975, 3.815)	(0.491, 2.326)	(0.617, 1.202)	(0.793, 1.723)
Zarqa	0.836	0.587	1.162	0.766*	0.829

	(0.569, 1.228)	(0.329, 1.049)	(0.701, 1.926)	(0.602, 0.974)	(0.608, 1.129)
Madaba	1.291	0.487	2.048	0.856	1.225
	(0.586, 2.843)	(0.064, 3.683)	(0.57, 7.366)	(0.502, 1.458)	(0.635, 2.362)
Irbid	1.001	0.911	0.739	0.904	1.267
	(0.706, 1.419)	(0.56, 1.482)	(0.441, 1.24)	(0.726, 1.126)	(0.973, 1.651)
Mafraq	0.753	0.883	1.154	0.677	0.968
	(0.383, 1.48)	(0.337, 2.313)	(0.449, 2.962)	(0.456, 1.003)	(0.58, 1.619)
Ajloun	0.387	0.966	1.375	0.950	1.253
	(0.129, 1.164)	(0.293, 3.186)	(0.386, 4.899)	(0.603, 1.497)	(0.714, 2.198)
Jerash	1.287	0.734	1.132	0.765	0.968
	(0.548, 3.027)	(0.102, 5.284)	(0.203, 6.315)	(0.428, 1.37)	(0.448, 2.092)
Karak	1.343	1.519	1.035	1.210	1.870**
	(0.717, 2.515)	(0.646, 3.57)	(0.377, 2.839)	(0.807, 1.816)	(1.173, 2.982)
Tafilah	1.233	0.997	1.012	0.987	1.195
	(0.465, 3.264)	(0.216, 4.599)	(0.223, 4.596)	(0.528, 1.845)	(0.559, 2.556)
Ma'an	0.556	0.458	0.961	0.814	1.227
	(0.192, 1.612)	(0.117, 1.793)	(0.344, 2.683)	(0.485, 1.365)	(0.652, 2.305)
Aqaba	1.816	0.697	0.887	0.773	0.725
	(0.826, 3.994)	(0.089, 5.479)	(0.113, 6.931)	(0.445, 1.344)	(0.306, 1.722)
Urban/rural (rural reference)	1.119	1.095	1.211	0.823	1.345*
	(0.784, 1.6)	(0.68, 1.763)	(0.733, 1.999)	(0.662, 1.023)	(1.027, 1.764)
Mother's educational attainment					
None					
Primary incomplete (1-5)	0.432	2.736*	1.125	0.805	0.845
	(0.174, 1.074)	(1.011, 7.409)	(0.456, 2.769)	(0.477, 1.362)	(0.45, 1.589)

Primary complete (6)	1.133	1.768	0.918	1.195	0.836
	(0.518, 2.477)	(0.585, 5.341)	(0.339, 2.491)	(0.698, 2.044)	(0.432, 1.619)
Secondary incomplete (7-11)	1.006	2.229	1.276	0.772	0.677
	(0.549, 1.843)	(0.945, 5.262)	(0.612, 2.662)	(0.513, 1.16)	(0.41, 1.118)
Secondary complete (12)	0.658	1.719	0.823	0.860	0.549*
	(0.327, 1.321)	(0.643, 4.599)	(0.333, 2.031)	(0.551, 1.342)	(0.318, 0.948)
Higher (13+)	0.803	2.194	1.041	1.269	0.769
	(0.421, 1.534)	(0.872, 5.524)	(0.459, 2.364)	(0.829, 1.941)	(0.455, 1.301)
Wealth index factor score	1.108	0.933	1.122	1.299***	1.113
	(0.944, 1.302)	(0.727, 1.196)	(0.868, 1.45)	(1.168, 1.443)	(0.988, 1.254)
Constant	0.011***	0.288*	0.061***	0.170***	0.045***
	(0.004, 0.028)	(0.112, 0.744)	(0.024, 0.157)	(0.104, 0.279)	(0.024, 0.084)
N	3733	1504	2033	3775	3732

Odds ratios are shown in the table above; * p<0.05; ** p<0.01; *** p<0.001 Models were adjusted for the age of the child, governorate, urban/rural residence, household wealth, and mother's education attainment.

Table 5: Logistic regression models assessing the introduction of micronutrient rich food groups prior to 6 months of age

Variable	(1) Eggs	(2) Meat, poultry, fish	(3) Dairy	(4) Legumes
Year of DHS survey				
1997		Reference		
2002		0.557 (0.227, 1.367)	Reference	Reference
2007	Reference	0.794 (0.363, 1.737)	2.425*** (1.742, 3.378)	0.331* (0.118, 0.928)
2012	0.785 (0.346, 1.779)	0.623 (0.279, 1.392)	7.210*** (5.175, 10.037)	0.264* (0.091, 0.766)
2017	0.737 (0.351, 1.545)	0.920 (0.466, 1.817)	0.673* (0.485, 0.934)	0.314* (0.127, 0.776)
Child's age (months)	1.193 (0.301, 4.72)	2.294 (0.64, 8.215)	1.491** (1.134, 1.963)	5.086 (0.45, 57.595)
Age squared	1.109 (0.906, 1.356)	1.008 (0.843, 1.205)	1.004 (0.958, 1.052)	0.894 (0.647, 1.235)
Governorates (Amman reference)				
Balqa	0.431 (0.103, 1.805)	1.553 (0.67, 3.6)	1.026 (0.683, 1.538)	0.775 (0.18, 3.344)
Zarqa	0.322 (0.096, 1.08)	0.780 (0.363, 1.676)	0.820 (0.598, 1.125)	0.793 (0.299, 2.1)
Madaba	(empty)	1.049 (0.275, 4.009)	1.069 (0.562, 2.034)	1.513 (0.216, 10.614)
Irbid	0.511 (0.209, 1.25)	0.681 (0.322, 1.44)	1.177 (0.886, 1.564)	0.512 (0.16, 1.633)
Mafraq	0.056 (0.001, 3.018)	0.330 (0.068, 1.603)	1.061 (0.64, 1.759)	(empty)
Ajloun	0.491	0.979	1.074	0.288

	(0.071, 3.379)	(0.254, 3.76)	(0.623, 1.851)	(0.011, 7.445)
Jerash	0.599	1.436	0.659	0.538
	(0.076, 4.688)	(0.388, 5.319)	(0.306, 1.421)	(0.033, 8.81)
Karak	0.871	1.196	1.896*	0.755
	(0.218, 3.482)	(0.383, 3.735)	(1.16, 3.102)	(0.098, 5.831)
Tafilah	0.127	0.878	0.852	(empty)
	(0.001, 25.252)	(0.107, 7.178)	(0.376, 1.928)	
Ma'an	0.843	1.154	1.600	0.986
	(0.102, 6.958)	(0.235, 5.666)	(0.779, 3.285)	(0.069, 14.065)
Aqaba	1.099	0.996	0.850	1.064
	(0.172, 7.023)	(0.201, 4.93)	(0.404, 1.786)	(0.093, 12.173)
Urban/rural (rural reference)	0.708	0.668	1.099	1.735
	(0.27, 1.858)	(0.353, 1.266)	(0.827, 1.46)	(0.472, 6.375)
Mother's educational attainment				
None	Reference	Reference	Reference	(empty)
Primary incomplete (1-5)	0.197	0.562	1.910	0.315
	(0.003, 12.943)	(0.08, 3.952)	(0.741, 4.922)	(0.015, 6.56)
Primary complete (6)	(empty)	0.756	1.283	0.731
		(0.123, 4.664)	(0.48, 3.431)	(0.072, 7.402)
Secondary incomplete (7-11)	0.498 (0.091, 2.727)	0.883 (0.244, 3.195)	1.519 (0.694, 3.327)	0.907 (0.404, 2.033)
Secondary complete (12)	0.382 (0.061, 2.393)	0.883 (0.216, 3.612)	1.924 (0.854, 4.329)	0.366 (0.094, 1.425)
Higher (13+)	0.563	0.727	1.644	(omitted)
	(0.097, 3.255)	(0.186, 2.852)	(0.739, 3.657)	
Wealth index factor score	0.991 (0.658, 1.493)	1.032 (0.758, 1.407)	1.208** (1.066, 1.369)	1.188 (0.749, 1.882)
Constant	0.013**	0.003***	0.041***	0.000**

	(0.001, 0.251)	(0, 0.035)	(0.016, 0.105)	(0, 0.05)
N	2004	3075	2577	2034

Odds ratios are shown in the table above; * p<0.05; ** p<0.01; *** p<0.001 Models were adjusted for the age of the child, governorate, urban/rural residence, household wealth, and mother's education attainment.

Table 6: Logistic regression models assessing the factors associated with achieving minimum dietary diversity, minimum meal frequency, and minimum acceptable diet by infants and young children aged 6-23 months

Variable	(1) MDD	(2) MMF	(3) MAD
Year of DHS survey			
2002		Reference	
2007	Reference		
2012	0.242***	1.465***	Reference
	(0.215, 0.271)	(1.25, 1.717)	
2017	0.213***	0.506***	0.511***
	(0.189, 0.24)	(0.432, 0.593)	(0.443, 0.588)
Child's age (months)	1.562***	1.106**	1.534***
	(1.47, 1.66)	(1.039, 1.178)	(1.396, 1.686)
Age squared	0.987***	0.997**	0.988***
	(0.985, 0.989)	(0.995, 0.999)	(0.984, 0.992)
Governorates (Amman reference)			
Balqa	0.880	0.959	0.742
	(0.713, 1.085)	(0.768, 1.197)	(0.547, 1.005)
Zarqa	1.012	1.202*	0.992
	(0.871, 1.173)	(1.022, 1.414)	(0.804, 1.224)
Madaba	0.772	1.065	0.727
	(0.568, 1.048)	(0.772, 1.469)	(0.467, 1.132)
Irbid	0.891	1.043	0.756**
	(0.778, 1.019)	(0.9, 1.208)	(0.619, 0.923)
Mafraq	0.783*	1.021	0.674*
	(0.627, 0.98)	(0.812, 1.284)	(0.482, 0.943)
Ajloun	0.933	1.137	0.971
	(0.718, 1.214)	(0.856, 1.512)	(0.675, 1.399)
Jerash	1.220	1.500*	1.236
	(0.891, 1.668)	(1.058, 2.125)	(0.817, 1.869)
Karak	0.744*	1.308	0.893
	(0.563, 0.982)	(0.968, 1.77)	(0.611, 1.306)
Tafilah	0.783	0.934	0.742
	(0.523, 1.173)	(0.611, 1.429)	(0.412, 1.336)
Ma'an	0.892	0.920	0.822
	(0.621, 1.282)	(0.639, 1.324)	(0.478, 1.415)
Aqaba	0.844	0.962	0.827
	(0.612, 1.165)	(0.676, 1.369)	(0.515, 1.329)
Urban/rural (rural reference)	0.959 (0.834, 1.102)	0.890 (0.766, 1.032)	0.879 (0.721, 1.071)

Mother's educational attainment (none reference)			
Primary incomplete (1-5)	1.822*	1.213	6.308**
	(1.101, 3.015)	(0.756, 1.945)	(1.575, 25.271)
Primary complete (6)	2.711***	1.373	6.390**
	(1.664, 4.415)	(0.87, 2.168)	(1.634, 25.006)
Secondary incomplete (7-11)	2.215***	1.556*	7.805**
	(1.462, 3.355)	(1.068, 2.267)	(2.12, 28.742)
Secondary complete (12)	2.639***	1.851**	10.247***
	(1.717, 4.052)	(1.249, 2.745)	(2.762, 38.024)
Higher (13+)	2.650***	1.991***	9.073***
	(1.74, 4.041)	(1.354, 2.93)	(2.454, 33.525)
Wealth index factor score	1.232***	1.180***	1.351***
	(1.159, 1.308)	(1.104, 1.262)	(1.242, 1.47)
Constant	0.025***	0.480*	0.002***
	(0.014, 0.045)	(0.269, 0.857)	(0, 0.008)
N	9209	7116	6156

Odds ratios are shown in the table above; * p<0.05; ** p<0.01; *** p<0.001. Models were adjusted for the age of the child, governorate, urban/rural residence, household wealth, and mother’s education attainment.

Table 7: Logistic regression models assessing the introduction of breastmilk substitutes, liquids, and baby foods between 6 and 23 months of age

Variable	(1) Juice	(2) Sugar water	(3) Tea	(4) Infant Formula	(5) Milk	(6) Baby food
Year of DHS survey						
1990	Reference	Reference	Reference	Reference	Reference	
1997	6.360***	0.405***	2.480***	0.616***	3.088***	
	(5.259, 7.692)	(0.256, 0.642)	(1.964, 3.131)	(0.478, 0.793)	(2.58, 3.7)	
2002	2.790***	3.371***	3.024***	0.938	1.889***	
	(2.311, 3.367)	(2.35, 4.834)	(2.396, 3.82)	(0.74, 1.189)	(1.574, 2.267)	
2007	3.400***		2.595***	4.520***	3.041***	
	(2.795, 4.137)		(2.036, 3.31)	(3.613, 5.649)	(2.514, 3.677)	
2012	2.727***			0.613***	4.315***	Reference
	(2.254, 3.297)			(0.477, 0.788)	(3.582, 5.198)	
2017	3.413***			5.735***	1.321**	2.028***
	(2.84, 4.105)			(4.634, 7.104)	(1.106, 1.58)	(1.687, 2.438)
Child's age (months)	1.276***	1.131	1.316***	0.879***	1.362***	0.769***
	(1.213, 1.343)	(0.978, 1.307)	(1.215, 1.427)	(0.827, 0.934)	(1.294, 1.433)	(0.694, 0.854)
Age squared	0.993***	0.998	0.995***	1.002	0.992***	1.005*
	(0.991, 0.995)	(0.994, 1.002)	(0.993, 0.997)	(1, 1.004)	(0.99, 0.994)	(1.001, 1.009)
Governorates (Amman reference)						
Balqa	1.240*	1.464	1.136	0.914	1.216*	0.800
	(1.039, 1.479)	(0.978, 2.192)	(0.881, 1.466)	(0.731, 1.143)	(1.015, 1.455)	(0.558, 1.144)

Zarqa	1.056	0.770	1.087	0.726***	1.049	0.571***
	(0.932, 1.198)	(0.548, 1.083)	(0.905, 1.304)	(0.618, 0.852)	(0.923, 1.191)	(0.437, 0.747)
Madaba	1.037	0.914	1.101	1.307	1.288	0.297***
	(0.796, 1.351)	(0.448, 1.865)	(0.75, 1.616)	(0.95, 1.799)	(0.981, 1.691)	(0.152, 0.579)
Irbid	1.081	0.808	1.281**	0.914	1.116	0.307***
	(0.962, 1.212)	(0.587, 1.112)	(1.085, 1.514)	(0.794, 1.052)	(0.994, 1.253)	(0.235, 0.401)
Mafraq	1.129	0.837	1.749***	0.793	1.320**	0.376***
	(0.929, 1.374)	(0.438, 1.598)	(1.278, 2.393)	(0.621, 1.013)	(1.083, 1.61)	(0.242, 0.585)
Ajloun	0.965	0.741	1.263	0.771	1.215	0.403***
	(0.762, 1.224)	(0.338, 1.627)	(0.871, 1.834)	(0.57, 1.043)	(0.95, 1.551)	(0.243, 0.669)
Jerash	1.015	1.416	1.383	0.940	0.980	0.287***
	(0.77, 1.338)	(0.701, 2.862)	(0.922, 2.074)	(0.664, 1.334)	(0.739, 1.3)	(0.147, 0.559)
Karak	1.160	0.605	1.190	1.096	1.212	0.585*
	(0.915, 1.47)	(0.289, 1.267)	(0.836, 1.693)	(0.82, 1.465)	(0.952, 1.542)	(0.358, 0.955)
Tafilah	1.026	0.832	1.788*	0.601*	1.252	0.620
	(0.731, 1.441)	(0.304, 2.274)	(1.102, 2.901)	(0.381, 0.947)	(0.887, 1.768)	(0.314, 1.224)
Ma'an	1.268	0.436	1.000	0.766	1.137	0.490*
	(0.949, 1.696)	(0.159, 1.191)	(0.651, 1.536)	(0.526, 1.116)	(0.849, 1.522)	(0.247, 0.973)
Aqaba	1.527**	0.173*	0.868	0.536**	1.057	0.651
	(1.12, 2.081)	(0.033, 0.903)	(0.545, 1.381)	(0.358, 0.802)	(0.775, 1.44)	(0.357, 1.186)
Urban/rural (rural reference)	1.013 (0.902, 1.137)	0.911 (0.674, 1.232)	0.926 (0.785, 1.092)	1.028 (0.886, 1.194)	0.980 (0.871, 1.103)	1.318 (0.984, 1.765)

Mother's educational attainment (none reference)						
Primary incomplete (1-5)	1.378* (1.035, 1.835)	3.249** (1.527, 6.907)	1.137 (0.808, 1.598)	2.136*** (1.407, 3.243)	1.017 (0.769, 1.346)	1.280 (0.213, 7.693)
Primary complete (6)	1.575** (1.174, 2.113)	2.208 (0.964, 5.058)	1.192 (0.83, 1.714)	1.211 (0.769, 1.909)	1.231 (0.923, 1.642)	1.214 (0.211, 6.975)
Secondary incomplete (7-11)	1.430** (1.137, 1.799)	2.187* (1.104, 4.336)	0.961 (0.734, 1.26)	1.768** (1.235, 2.531)	1.295* (1.038, 1.617)	3.404 (0.732, 15.825)
Secondary complete (12)	1.388* (1.08, 1.784)	2.741** (1.319, 5.692)	0.704* (0.508, 0.975)	2.312*** (1.587, 3.368)	1.420** (1.112, 1.815)	5.067* (1.084, 23.7)
Higher (13+)	1.646***	2.026	0.760	2.523***	1.534***	7.231*
	(1.293, 2.094)	(0.983, 4.175)	(0.564, 1.023)	(1.75, 3.642)	(1.215, 1.937)	(1.552, 33.669)
Wealth index factor score	1.326*** (1.257, 1.398)	1.084 (0.933, 1.257)	0.895** (0.829, 0.966)	1.249*** (1.164, 1.34)	1.172*** (1.109, 1.237)	1.375*** (1.216, 1.557)
Constant	0.029***	0.008***	0.011***	0.334***	0.025***	0.416
	(0.019, 0.044)	(0.002, 0.027)	(0.006, 0.022)	(0.195, 0.572)	(0.016, 0.038)	(0.078, 2.227)
N	11093	4629	6172	11097	11091	4920

Odds ratios are shown in the table above; * p<0.05; ** p<0.01; *** p<0.00. Models were adjusted for the age of the child, governorate, urban/rural residence, household wealth, and mother's education attainment.

Table 8: Logistic regression models assessing factors associated with the introduction of micronutrient rich food groups to infants and young children 6-23 months of age

Variable	(1) DGLV	(2) Vitamin A-rich F&V	(3) Eggs	(4) Meat, poultry, fish	(5) Dairy	(6) Legumes
Year of DHS survey						
1997				Reference		
2002	Reference	Reference		0.712***	Reference	Reference
				(0.615, 0.825)		
2007	1.520***	1.844***	Reference	0.804**	1.000	0.901
	(1.25, 1.85)	(1.589, 2.14)		(0.687, 0.941)	(0.811, 1.233)	(0.769, 1.056)
2012	0.773*	0.444***	0.314***	0.620***	1.312*	0.348***
	(0.63, 0.947)	(0.38, 0.52)	(0.27, 0.364)	(0.536, 0.716)	(1.066, 1.616)	(0.293, 0.414)
2017	1.138	0.674***	0.428***	0.559***	0.490***	0.406***
	(0.948, 1.365)	(0.587, 0.775)	(0.372, 0.492)	(0.488, 0.642)	(0.413, 0.583)	(0.347, 0.475)
Child's age (months)	1.455*** (1.327, 1.595)	1.279*** (1.196, 1.367)	1.386*** (1.292, 1.488)	1.587*** (1.502, 1.677)	1.418*** (1.313, 1.53)	1.309*** (1.21, 1.415)
Age squared	0.990***	0.993***	0.992***	0.988***	0.990***	0.993***
	(0.986, 0.994)	(0.991, 0.995)	(0.99, 0.994)	(0.986, 0.99)	(0.988, 0.992)	(0.991, 0.995)
Governorates (Amman reference)						
Balqa	1.336*	0.741*	0.849	0.890	0.789	0.904
	(1.016, 1.758)	(0.59, 0.933)	(0.664, 1.084)	(0.735, 1.079)	(0.604, 1.03)	(0.694, 1.178)
Zarqa	0.876	0.558***	0.775**	1.015	1.008	1.272**

	(0.706, 1.086)	(0.472, 0.661)	(0.652, 0.924)	(0.887, 1.162)	(0.822, 1.236)	(1.067, 1.518)
Madaba	1.166	1.060	0.808	1.058	0.975	0.974
	(0.771, 1.764)	(0.771, 1.456)	(0.566, 1.155)	(0.8, 1.401)	(0.654, 1.455)	(0.664, 1.431)
Irbid	1.128	0.728***	0.995	1.089	1.146	1.161
	(0.934, 1.361)	(0.627, 0.844)	(0.851, 1.164)	(0.96, 1.234)	(0.949, 1.383)	(0.983, 1.371)
Mafraq	1.112	0.703**	0.834	0.896	0.985	0.923
	(0.814, 1.518)	(0.542, 0.91)	(0.652, 1.065)	(0.727, 1.106)	(0.743, 1.306)	(0.688, 1.239)
Ajloun	1.046	0.472***	1.034	1.156	0.851	0.914
	(0.719, 1.521)	(0.34, 0.656)	(0.771, 1.388)	(0.898, 1.489)	(0.608, 1.189)	(0.645, 1.295)
Jerash	1.291	0.773	1.203	1.152	0.940	1.165
	(0.848, 1.963)	(0.543, 1.101)	(0.839, 1.726)	(0.859, 1.547)	(0.62, 1.424)	(0.789, 1.721)
Karak	1.080	0.975	0.894	0.980	0.989	0.818
	(0.736, 1.586)	(0.728, 1.306)	(0.655, 1.221)	(0.755, 1.272)	(0.686, 1.423)	(0.569, 1.175)
Tafilah	1.118	0.803	0.742	0.740	1.095	0.967
	(0.651, 1.919)	(0.519, 1.24)	(0.472, 1.164)	(0.514, 1.062)	(0.634, 1.892)	(0.582, 1.606)
Ma'an	1.076	0.879	0.804	0.833	0.903	0.868
	(0.658, 1.759)	(0.6, 1.288)	(0.533, 1.214)	(0.603, 1.152)	(0.581, 1.404)	(0.554, 1.359)
Aqaba	1.084	0.791	0.645*	0.786	0.782	0.955
	(0.693, 1.694)	(0.554, 1.127)	(0.439, 0.949)	(0.574, 1.075)	(0.518, 1.18)	(0.637, 1.433)
Urban/rural (rural reference)	1.112 (0.916, 1.35)	1.137 (0.974, 1.327)	1.038 (0.884, 1.219)	0.966 (0.85, 1.097)	1.028 (0.857, 1.234)	1.037 (0.872, 1.232)
Mother's educational attainment						

(none reference)						
Primary incomplete (1-5)	0.975 (0.478, 1.991)	1.460 (0.819, 2.604)	0.792 (0.443, 1.415)	1.093 (0.77, 1.552)	1.069 (0.632, 1.808)	1.319 (0.77, 2.261)
Primary complete (6)	1.118 (0.566, 2.206)	2.000* (1.148, 3.482)	1.784* (1.031, 3.089)	1.244 (0.879, 1.759)	1.449 (0.849, 2.475)	0.916 (0.533, 1.578)
Secondary incomplete (7-11)	1.468 (0.827, 2.607)	1.947** (1.199, 3.159)	1.300 (0.813, 2.082)	1.531** (1.155, 2.03)	1.329 (0.868, 2.033)	0.979 (0.625, 1.534)
Secondary complete (12)	1.670 (0.926, 3.013)	2.328*** (1.418, 3.822)	1.777* (1.093, 2.889)	1.689*** (1.244, 2.293)	1.353 (0.863, 2.119)	1.153 (0.724, 1.839)
Higher (13+)	1.352	2.248**	1.434	1.763***	1.518	0.871
	(0.756, 2.421)	(1.377, 3.669)	(0.889, 2.315)	(1.314, 2.366)	(0.979, 2.356)	(0.55, 1.381)
Wealth index factor score	1.073 (0.985, 1.17)	1.251*** (1.168, 1.34)	1.100** (1.023, 1.182)	1.171*** (1.106, 1.24)	1.229*** (1.129, 1.337)	1.143*** (1.058, 1.233)
Constant	0.004***	0.040***	0.077***	0.028***	0.376**	0.041***
	(0.002, 0.01)	(0.02, 0.078)	(0.039, 0.152)	(0.017, 0.044)	(0.195, 0.727)	(0.02, 0.084)
N	8297	8298	6461	10064	8301	8297

Odds ratios are shown in the table above; * p<0.05; ** p<0.01; *** p<0.001. Models were adjusted for the age of the child, governorate, urban/rural residence, household wealth, and mother's education attainment.

Table 9: Exclusive breastfeeding and early initiation of breastfeeding

	Under 6 months		6-23 months	
Variable	**Exclusive breastfeeding**	**Early initiation**	**Exclusive breastfeeding**	**Early initiation**
Year of DHS survey (1990 reference)				
1997	0.311***	0.515***	0.003***	0.542***
	(0.213, 0.455)	(0.382, 0.693)	(0, 0.019)	(0.459, 0.641)
2002	0.969	0.607**	0.027***	0.689***
	(0.697, 1.348)	(0.446, 0.826)	(0.015, 0.047)	(0.576, 0.826)
2007	0.775	0.835	0.038***	0.788*
	(0.56, 1.073)	(0.625, 1.116)	(0.022, 0.064)	(0.653, 0.951)
2012	0.860	0.299***	0.053***	0.316***
	(0.596, 1.24)	(0.209, 0.427)	(0.031, 0.091)	(0.261, 0.383)
2017	1.180	4.345***	0.085***	3.260***
	(0.856, 1.628)	(3.114, 6.063)	(0.053, 0.137)	(2.618, 4.061)
Governorates (Amman reference)				
Balqa	0.844	1.874***	0.758	1.465***
	(0.593, 1.202)	(1.388, 2.529)	(0.455, 1.264)	(1.209, 1.775)
Zarqa	0.960	1.316	1.448	1.228*
	(0.696, 1.324)	(0.983, 1.763)	(0.903, 2.322)	(1.025, 1.47)
Madaba	1.011	1.170	1.400	0.939
	(0.665, 1.538)	(0.805, 1.701)	(0.697, 2.814)	(0.758, 1.163)
Irbid	0.904	0.806	0.979	0.816*
	(0.652, 1.254)	(0.606, 1.071)	(0.655, 1.463)	(0.686, 0.969)
Mafraq	1.114	0.828	1.082	1.038
	(0.775, 1.601)	(0.593, 1.155)	(0.664, 1.763)	(0.854, 1.264)
Ajloun	0.764	1.517*	1.025	1.296*
	(0.515, 1.133)	(1.031, 2.232)	(0.544, 1.931)	(1.059, 1.585)
Jerash	1.136	1.083	0.582	0.901
	(0.767, 1.68)	(0.721, 1.629)	(0.272, 1.248)	(0.724, 1.122)
Karak	0.424***	0.825	0.779	1.128
	(0.275, 0.655)	(0.583, 1.168)	(0.463, 1.309)	(0.881, 1.443)
Tafilah	1.088	1.110	1.115	1.182
	(0.742, 1.594)	(0.765, 1.61)	(0.607, 2.047)	(0.923, 1.513)

Ma'an	0.963	1.527*	1.691	1.566***
	(0.627, 1.479)	(1.034, 2.255)	(0.954, 2.996)	(1.216, 2.015)
Aqaba	0.583*	1.020	0.411	1.073
	(0.361, 0.942)	(0.696, 1.495)	(0.148, 1.142)	(0.853, 1.349)
Mother's educational attainment (none reference)				
Primary incomplete (1-5)	0.772	0.842	1.335	1.181
	(0.436, 1.365)	(0.534, 1.327)	(0.836, 2.133)	(0.913, 1.526)
Primary complete (6)	0.693	0.712	2.041*	1.165
	(0.396, 1.214)	(0.426, 1.189)	(1.133, 3.673)	(0.877, 1.548)
Secondary incomplete ..)	0.878	0.880	1.594*	1.018
	(0.581, 1.328)	(0.638, 1.213)	(1.019, 2.491)	(0.841, 1.23)
Secondary complete (12)	0.849	0.848	2.329**	0.965
	(0.52, 1.385)	(0.577, 1.245)	(1.308, 4.142)	(0.767, 1.213)
Higher (13+)	0.695	0.815	1.904*	0.888
	(0.442, 1.094)	(0.572, 1.163)	(1.117, 3.245)	(0.707, 1.118)
Wealth quintiles (lowest reference)				
Second quintile	1.200	0.870	1.144	1.029
	(0.917, 1.569)	(0.68, 1.114)	(0.776, 1.686)	(0.883, 1.199)
Middle quintile	1.020	0.741*	0.781	0.845*
	(0.759, 1.372)	(0.552, 0.994)	(0.545, 1.12)	(0.718, 0.995)
Fourth quintile	0.844	0.750	0.918	0.766**
	(0.608, 1.17)	(0.546, 1.031)	(0.589, 1.429)	(0.632, 0.928)
Highest quintile	0.777	0.734	0.572*	0.732**
	(0.476, 1.267)	(0.513, 1.051)	(0.352, 0.931)	(0.581, 0.923)
Child's age (months)	0.703**	1.133	1.134	1.021
	(0.56, 0.883)	(0.92, 1.393)	(0.916, 1.404)	(0.955, 1.092)
Age squared	0.969	0.996	0.999	0.999
	(0.924, 1.015)	(0.96, 1.034)	(0.993, 1.005)	(0.997, 1.001)
Urban/rural (rural reference)	1.011	1.017	0.803	1.023

	(0.81, 1.262)	(0.815, 1.269)	(0.599, 1.078)	(0.903, 1.16)
Constant	1.396	0.669	0.039***	0.749
	(0.812, 2.396)	(0.422, 1.059)	(0.007, 0.203)	(0.466, 1.204)
N	4827	4698	14020	13944

Odds ratios and 95% confidence intervals are shown in the table above; * p<0.05; ** p<0.01; *** p<0.001