Breastfeeding and complementary feeding practices in the first 6 months of life among Norwegian-Somali and Norwegian-Iraqi infants: the InnBaKost survey

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Abstract

Objective: To examine breastfeeding and complementary feeding practices during the first 6 months of life among Norwegian infants of Somali and Iraqi family origin.

Design: A cross-sectional survey was performed during March 2013–February 2014. Data were collected using a semi-quantitative FFQ adapted from the second Norwegian national dietary survey among infants in 2006–2007.

Setting: Somali-born and Iraqi-born mothers living in eastern Norway were invited to participate.

Subjects: 107 mothers/infants of Somali origin and 80 mothers/infants of Iraqi origin participated.

Results: Breastfeeding was almost universally initiated after birth. Only 7% of Norwegian-Somali and 10% of Norwegian-Iraqi infants were exclusively breastfed at 4 months of age. By 1 month of age, water had been introduced to 30% of Norwegian-Somali and 26% of Norwegian-Iraqi infants, and infant formula to 44% and 34%, respectively. Fifty-four percent of Norwegian-Somali and 68% of Norwegian-Iraqi infants had been introduced to solid or semi-solid foods at 4 months of age. Breastfeeding at 6 months of age was more common among Norwegian-Somali infants (79%) compared to Norwegian-Iraqi infants (58%), P=0.001. Multivariate analyses indicated no significant factors associated with exclusive breastfeeding at 3.5 months of age. Factors positively associated with breastfeeding at 6 months were country of origin (Somalia) and parity (>2).

Conclusions: Breastfeeding initiation was common among Iraqi-born and Somali-born mothers, but the exclusive breastfeeding period was shorter than recommended in both groups. This study suggests that there is a need for new culture-specific approaches to support exclusive breastfeeding and complementary feeding practices among foreign-born mothers living in Norway.

Keywords: Exclusive breastfeeding, breastfeeding, infant feeding, immigrants

Introduction

During the first year of life, the infant is growing fast and adequate nutrition is essential for optimal growth and health. Breast milk provides important immunological and growth modulating factors, and all nutrients in sufficient amounts to cover the infant's nutritional needs for the first 6 months, with the exception of vitamin D[1]. Exclusive breastfeeding for the infant's first 4–6 months has been associated with a reduced risk of infant morbidity and mortality from infections[2]. Long-term benefits of breastfeeding include reduced risk of overweight/obesity, diabetes and high blood pressure, as well as increased intelligence quotient (IQ)[3-6]. On this basis, international agencies such as WHO as well as Norwegian health authorities, recommend exclusive breastfeeding the first 6 months of life followed by a combination of continued breastfeeding and gradual introduction of appropriate complementary foods[7, 8].

The prevalence of breastfeeding in Norway and other Scandinavian countries is generally high as compared to other industrialized countries, such as the UK and France[9]. The Norwegian national dietary surveys among infants conducted in 1998 and 2006 documented high breastfeeding rates in Norway[10, 11]. The last survey reported that 10% of infants were exclusively breastfed and 82% were breastfed at 6 months of age[11]. However, these studies only included mothers born in Scandinavia. A more recent national survey in 2013, including mothers born outside Scandinavia, reported that 3% of all participating infants were exclusively breastfed and 77% were breastfed at 6 months of age[12]. Nine percent of the participating mothers were born outside of Europe but the study did not disaggregate the results with regard to the mother's country of birth.

In recent decades, the population of immigrants and Norwegian-born to immigrant parents has rapidly increased. Numbers from 2014 showed that immigrants constituted about 13% of the Norwegian population, while individuals who were Norwegian-born to immigrant parents accounted for 2.6%[13]. The largest populations of immigrants and Norwegian-born to immigrant parents were in Oslo, constituting 32% of the capital's entire population. The proportions were also high in certain areas of the counties of Akershus and Buskerud[13]. The two non-Western immigrant groups with the highest birth rates in Norway in the last few years have been from Somalia and Iraq[14].

A number of studies have shown that breastfeeding patterns can differ profoundly between ethnic subgroups in a society and these differences may be influenced by several factors, such as cultural contexts and country of residence[15-20]. Studies specifically investigating the infant feeding practices among those with immigrant backgrounds have been called for by the Norwegian Directorate for Health[21].

The main objective of this study was to examine the prevalence of exclusive breastfeeding and breastfeeding and complementary feeding practices among Norwegian-born infants of Somali and Iraqi origin during the first 6 months of life. A secondary objective was to identify factors associated with exclusive breastfeeding and breastfeeding practices in this group of children.

Methods

Subjects and design

A cross-sectional survey was carried out during the period of March 2013 through February 2014 in the Norwegian counties of Oslo, Akershus and Buskerud. Mothers born in Somalia or Iraq and living in one of these counties, and who had a 6-month-old infant, were eligible for inclusion. Children on special diets due to serious illnesses or conditions were excluded from the study. If the

mother had twins or triplets, only one of the children was included by random selection. Identification of the eligible mothers was done through: (1) selected child health centres in Oslo, Akershus and Buskerud, where nurses were asked to inform eligible mothers about the study and to submit their contact information if the mothers were interested in learning more, and (2) lists obtained from the National Population Register showing eligible mothers living in Oslo, Akershus and Buskerud who had given birth between August 2012 and July 2013. The lists were used for: (a) sending information letters to registered addresses about a month before the child turned 6 months old, (b) making follow-up calls to mothers with registered telephone numbers if no response to the information letter was received and (c) visiting the mothers at their registered addresses if they were not reached by letter or telephone. The last approach was only used during the last three months of the recruitment period, in order to make the recruitment more efficient. The snowball method was also used during the whole recruitment period. Mothers could therefore have been approached through multiple channels, about which they were notified in the information letter sent to their addresses.

A paper-based, semi-quantitative food frequency questionnaire (FFQ) was used to collect the data through personal interviews with the participating mothers. Trained female field workers who spoke Norwegian, Somali, Arabic, Kurdish or English scheduled an interview at a time and place chosen by the mother, as close as possible to the date the child reached 6 months of age. In cases in which the mother was unable to meet, a telephone interview was conducted. Each mother who completed the interview received a baby-shop voucher for approximately US$25.

The study was approved by the Regional Committees for Medical Research Ethics and informed consent was obtained from the participating mothers.

The semi-quantitative FFQ

The semi-quantitative FFQ was designed to estimate exclusive breastfeeding, breastfeeding and other complementary feeding practices at 6 months of age and retrospectively from birth up to the given age. The FFQ was based on the FFQ used in the second Norwegian national dietary survey among infants in 2006–2007[22]. A pilot study was conducted on a total of six Somali-born and Iraqi-born mothers to test the FFQ, and it was revised accordingly.

The final FFQ included 50 questions about seven topics: breast milk, infant formula and other milk, solid foods, liquids, food intolerance/allergies, supplements and infant nutrition information. The first questions were related to whether or not the child received breast milk and at what frequency. Breast milk intake was not quantified. The mothers were also asked when the child stopped

receiving breast milk, when she/he started receiving infant formula/other milk, and whether and when solid and semi-solid foods were introduced for the first time. Types of foods, liquids and supplements received and the frequency of consumption at 6 months of age were also recorded.

After completing the FFQ, a single 24-hour recall was conducted in which the mothers were asked to recall all foods and drinks given to the child, including breast milk frequency, from the time the child woke up the day before until the time the child woke up the day of interview. The 24-hour recall was only used during the interview situation in order to assure coherence with some of the answers given on the FFQ with regard to whether the mother was still breastfeeding and/or introducing complementary foods. In case of any detected mismatches or misunderstandings, the mothers were asked to elaborate on the questions of concern.

Participating mothers were asked to bring their infants' health cards to the interview in order to record data on length and weight at birth. In addition, 29 questions were asked regarding background information on parental education levels, current maternal age, age when the mother immigrated to Norway, maternal work situation, maternal marital status, number of children/parity, infant gender and gestational age, among other information.

Definitions of immigrants

Some studies referred to in this article use the term 'ethnic minorities', whereas others use 'immigrants'. Statistics Norway uses the following definitions: (a) 'immigrants' are persons who are born abroad to two foreign-born parents, and who have moved to Norway and (b) 'Norwegian-born to immigrant parents' are those born in Norway to two immigrant parents[13]. In this paper, 'Norwegian-Somali infants' and 'Norwegian-Iraqi infants' refer to Norwegian-born infants of mothers born in Somalia and Iraq, respectively.

Definitions of breastfeeding

Based on the WHO's classification of breastfeeding[23], the following definitions are used throughout this paper. 'Exclusive breastfeeding' refers to infants who received only breast milk, with no additional foods and/or drinks, not even water. They may, however, have received vitamin and/or mineral supplements. 'Breastfeeding' refers to all infants who received breast milk, regardless of whether it was exclusive or given with other complementary foods and/or drinks.

Data entry and statistical analysis

Data from the FFQ and background information were manually entered in CSPro version 5.0 (United States Census Bureau, Macro International, and Serpro, S.A) and further processed and

analysed in SPSS version 22.0 (SPSS Inc., Chicago, IL, USA). Background characteristics did not adhere to normal distribution and continuous variables are therefore presented as median and the 25^{th} and 75^{th} percentiles. Continuous variables were compared by the Mann–Whitney test. The χ^2 test was used to compare categorical variables. Multiple logistic regression analysis was applied to study exclusive breastfeeding at 3.5 months of age and breastfeeding at 6 months of age, in relation to selected maternal and infant characteristics. These ages were chosen to study adherence to the recommendations on infant feeding and previous national data on infants from Norway. Due to the small number of exclusively breastfed infants at 4 months of age (*n* 15), infants exclusively breastfed at 3.5 months (up to 4 months of age) were used in the multivariate model (*n* 40). Maternal age and number of years lived in Norway were reported as continuous variables. In the analysis, maternal age was combined into three categories: ≤24, 25-34 and ≥35 years. Number of years lived in Norway were categorised into two groups: ≤10 and >10 years. Parental education levels were reported in ten categories, capturing the highest education completed by the mother and father in both Norway and any other country. These were reduced to two categories for analysis: no/basic education (≤11 years) and high school/higher education (≥12 years), independent of it being completed in Norway or any other country. Work before pregnancy was also reported in ten categories and combined into two categories in the analysis: not working or working (full-time/part-time). Four categories of number of children were coded into two: ≤2 and >2 children. Six categories for language spoken at home were categorised into two: Norwegian and other languages. Univariate statistical analyses (with a criterion of $P<0.10$) and evidence from the literature was used to decide which variables to examine in the multivariate analyses. In the final models, country of origin, maternal age and maternal education were included regardless of the level of statistical significance in the univariate models. All other variables significant in the univariate models ($P<0.05$) were also included. All analyses were performed by both including and excluding mothers interviewed by telephone (*n* 10) and these indicated no differences in the results. Thus, mothers interviewed by telephone are included in the analyses presented in this paper. Results from the regression analyses are presented with both unadjusted and adjusted OR and CI. In all the final analyses, statistical significance was indicated by two-sided $P<0.05$.

Results

According to lists from the National Population Register, 481 Norwegian-Somali infants and 287 Norwegian-Iraqi infants living in Oslo, Akershus or Buskerud turned 6 months old during the recruitment period (Figure 1). A total of 107 mothers/infants of Somali origin (22.2%) and 80 mothers/infants of Iraqi origin (27.9%) participated in the study. Mothers were mainly recruited by telephone or by us approaching their home address. Among the Somali-born mothers participating,

69% lived in Oslo, 17% in Akershus and 14% in Buskerud. Sixty-nine percent of the interviews were performed in Somali, 30% in Norwegian and 1% in English. Seven percent of the interviews were conducted by telephone. Among the Iraqi-born mothers participating, 51% lived in Oslo, 30% in Akershus and 19% in Buskerud. Half of the interviews were performed in Kurdish, 25% in Arabic and 25% in Norwegian. Four percent were telephone interviews.

Selected characteristics of the infants and their parents are presented in Table 1. Median ages were 30 and 32 years among participating Somali-born and Iraqi-born mothers, respectively. Somali-born mothers had immigrated to Norway at earlier ages than Iraqi-born mothers and had lived in Norway for longer periods of time. Educational levels and the percentage of mothers having worked before pregnancy were significantly higher among the Iraqi-born mothers compared to the Somali-born mothers (Table 1).

Breastfeeding practices

Breastfeeding was almost universally initiated after birth in both groups (a total of 93% within 24 hours). Two percent of the Norwegian-Somali infants and 1% of the Norwegian-Iraqi infants had never been breastfed. Colostrum was fed to the majority of infants, but 8% of Somali-born mothers and 6% of Iraqi-born mothers reported not having fed their children colostrum.

Among Norwegian-Somali infants, the proportion of exclusively breastfed infants was 37% at 1 month of age and 21% at 3 months of age, decreasing to 7% at 4 months of age, and none were exclusively breastfed at 5 months of age (Figure 2). Thirty-five percent of the Norwegian-Iraqi infants were exclusively breastfed at 1 month of age and 26% at 3 months of age; the proportion decreased to 10% at 4 months of age and further decreased to 1% at 5.5 months of age. None were exclusively breastfed at 6 months of age (Figure 2). There were no significant differences in the proportions of exclusive breastfeeding between the two groups.

Breastfeeding decreased from 97% at 1 month of age to 79% at 6 months of age among Norwegian-Somali infants (Figure 2). At 6 months of age, the mean breastfeeding frequency among those still breastfeeding was 6.5 times per day. Among Norwegian-Iraqi infants, breastfeeding decreased from 88% to 58% from 1 to 6 months of age (Figure 2). Mean breastfeeding frequency was 8.5 times per day at 6 months of age among those still breastfeeding. At 4 and 6 months, breastfeeding was more common among Norwegian-Somali infants compared to Norwegian-Iraqi infants ($P<0.001$ and $P=0.001$, respectively).

Twenty-two Somali-born mothers and 34 Iraqi-born mothers ceased breastfeeding before 6 months of age. The most important reasons for this given by the Somali-born mothers were insufficient milk (59%) and the infant no longer wanting breast milk (32%). Among the Iraqi-born mothers, the most important reasons given were insufficient milk (56%), the mother being sick or on medication (15%) and the infant no longer wanting breast milk (12%).

Infant formula and other breast milk substitutes

Figure 3 and Figure 4 show the proportions of Norwegian-Somali and Norwegian-Iraqi infants who had been introduced to foods and drinks at the given age. Forty-four percent of the Norwegian-Somali infants received infant formula the first month, 67% at 4 months and 79% at 6 months. Among Norwegian-Iraqi infants, the proportions that had received infant formula were 34%, 55% and 61% at 1, 4 and 6 months, respectively. Fifty-eight percent of the Norwegian-Somali infants were receiving both breast milk and infant formula at 6 months of age, while this was the case for 19% of the Norwegian-Iraqi infants (data not shown). The rest were either breastfed or formula-fed at 6 months of age. Water was commonly given to both groups. Among the Norwegian-Somali infants, 30% had received water the first month, 69% at 4 months and 93% at 6 months. Among the Norwegian-Iraqi infants, 26% had received water at 1 month, 76% at 4 months and 100% at 6 months. Sweetened drinks/fruit juices were given to 16% of the Norwegian-Somali and 36% of the Norwegian-Iraqi infants at 6 months of age. None of the mothers reported having introduced cow's milk.

Solid and semi-solid foods

Two percent of the Norwegian-Somali infants and 13% of the Norwegian-Iraqi infants had been introduced to solid and/or semi-solid foods earlier than 4 months of age. At 4 months of age, 54% of the Norwegian-Somali and 68% of the Norwegian-Iraqi infants had been introduced to solid and/or semi-solid foods. Baby cereal was the most common solid or semi-solid food introduced. Thirty-five percent of the Norwegian-Somali and 44% of the Norwegian-Iraqi infants had been introduced to fruit puree/berries at this age. One quarter of the infants had also been introduced to potatoes and vegetables in both groups. Among Norwegian-Somali infants, 7% had been introduced to meat, 17% to fish, 6% to bread and 12% to yogurt at 5 months of age or earlier. Among the Norwegian-Iraqi infants, the proportions were 18% for fish and 20% each for meat, bread and yogurt.

Data on selected foods and drinks given to the infants at 6 months of age are presented in Table 2. Baby cereal was the most commonly used food among Norwegian-Somali infants, and a higher

proportion of Norwegian-Somali infants than Norwegian-Iraqi infants had received it ($P<0.01$). Industrially produced baby cereal was used most often, and only a few reported making homemade porridge or other baby cereals in both groups. A number of foods and drinks were given to a higher proportion of Norwegian-Iraqi infants as compared to the Norwegian-Somali infants, including fruit puree/berries, squash/juice, bread, yogurt, ice cream and cookies/cakes. Homemade dinners were given more frequently than industrially produced dinners in both groups. All Norwegian-Iraqi infants received water an average of 2.8 times a day, while 93% of the Norwegian-Somali infants received water an average 2.4 times a day.

Vitamin D supplements

All Norwegian-Somali infants and 94% of Norwegian-Iraqi infants received some kind of vitamin D supplement at 6 months of age (Table 2). Cod liver oil was more frequently used among Norwegian-Somali infants than among Norwegian-Iraqi infants ($P<0.001$), while vitamin D drops were more common among Norwegian-Iraqi infants ($P<0.05$). Twenty percent of the Norwegian-Somali infants started receiving vitamin D supplements before 4 weeks of age, 50% at 4 weeks and 30% between 5 weeks and 4 months of age. Among Norwegian-Iraqi infants receiving vitamin D supplements, 15% started receiving supplements before 4 weeks of age, 30% at 4 weeks and 55% between 5 weeks and 6 months of age.

Factors associated with exclusive breastfeeding at 3.5 months of age

In the unadjusted logistic regression analyses, exclusive breastfeeding at 3.5 months of age was significantly associated with education and work before pregnancy (Table 3). Mothers with higher education were found to be more likely to exclusively breastfeed when the infant was 3.5 months of age than mothers with no or basic education. Mothers working before pregnancy were more likely to exclusively breastfeed than mothers not working before pregnancy. However, none of the factors remained significantly associated with exclusive breastfeeding at 3.5 months of age in the multivariate analysis (Table 3).

Factors associated with breastfeeding at 6 months of age

Country of birth, number of years lived in Norway and number of children were significantly associated with breastfeeding when the infant was 6 months of age in the unadjusted logistic regression analyses (Table 4). Country of origin and number of children remained significantly associated with breastfeeding at 6 months of age in the multivariate analysis adjusting for all other variables (Table 4). Mothers of Somali origin were more likely to breastfeed at 6 months of age

than mothers of Iraqi origin. Furthermore, mothers with more than two children were more likely to breastfeed at 6 months of age than mothers with fewer children.

Discussion

The InnBaKost survey is the first survey in Norway to adapt the FFQ used in the national infant dietary survey from 2006–2007 to describe breastfeeding and other infant feeding practices among 6-month-old infants with immigrant parents. The results indicate a high prevalence of breastfeeding initiation among both Norwegian-Somali and Norwegian-Iraqi infants, but decreasing rates of exclusive breastfeeding during the first half of infancy in both groups. Continued breastfeeding up to 6 months of infant age was more common among Norwegian-Somali mothers than Norwegian-Iraqi mothers in the sample.

Breastfeeding initiation

The majority of the mothers in both study groups initiated breastfeeding. High breastfeeding initiation was also found in the Norwegian national dietary survey[11]. Studies from several other countries generally report a higher initiation rate of breastfeeding among immigrant groups as opposed to non-immigrants[15, 17, 18, 24], although not necessarily for all subgroups[24]. However, in these countries, breastfeeding initiation rates are much lower among the non-immigrant populations than among Norwegian-born mothers[11].

Breastfeeding initiation seems to vary between Somalia and Iraq, the countries of origin for the mothers in our study. There is a paucity of recent quantitative studies on breastfeeding practices in Somalia. One qualitative knowledge, attitude and practices (KAP) study described that only a small proportion of mothers initiated breastfeeding within the first hour and that initial breastfeeding usually took place 2–3 days after birth[25]. In Iraq, a nationwide household survey reported that 73% of mothers initiated breastfeeding early after delivery[26].

Colostrum was reportedly fed to the majority of infants in the present study. Information on colostrum was not captured in the Norwegian national dietary survey. According to the KAP study from Somalia, colostrum was usually fed to less than 30% of the children living in the different areas, as it was often considered heavy, thick and harmful to the child's health[25]. A qualitative study from the US also reported mixed attitudes among Somali mothers. Some, but not all, held on to the Somali belief that feeding colostrum makes the baby sick, and they therefore postponed breastfeeding until several days after birth[27]. In the nationwide study from Iraq, however, almost 93% of the participating women considered colostrum to be good for their children[26].

Exclusive breastfeeding and breastfeeding practices

Duration of exclusive breastfeeding was shorter both among Somali-born and Iraqi-born mothers than the 6 months that is currently recommended in Norway[7, 8]. Less than half of the Norwegian-Somali and Norwegian-Iraqi infants were exclusively breastfed at 1 month and only 7% and 10%, respectively, were exclusively breastfed at 4 months of age. Only one Iraqi infant was exclusively breastfed up to 6 months of age (i.e. at 5.5 months of age) and none were exclusively breastfed at 6 months of age in either study group.

In comparison, data on infants from the Norwegian national survey from 2006–2007 showed a high level of exclusive breastfeeding during the first 3 months of life, with 84% of the infants being exclusively breastfed at 1 month of age and 48% at 4 months, declining to 10% at 6 months[11]. These findings were consistent with earlier national data from Norway[10] and the more recent national survey from 2013[12]. Thus, the rates of exclusive breastfeeding are appreciably lower among these two immigrant groups compared with the non-immigrant population in Norway.

Findings from Denmark have also suggested higher rates of exclusive breastfeeding among women of Nordic origin compared to immigrants and descendants of immigrants[28]. According to those findings, 50% of mothers who had migrated from Iraq were fully breastfeeding for 4 months. The higher rates of full breastfeeding compared to our findings are probably due to the definition of full breastfeeding in the study, which was infants receiving breast milk exclusively, supplemented by water or a maximum of one meal of formula per week. In England, on the other hand, rates of exclusive breastfeeding in women of immigrant background (except Pakistani) were double that of white British women[17]. These findings are, however, probably not quite transferable to our setting, since the prevalence of exclusive breastfeeding and breastfeeding overall is much lower in the UK and most other European countries as compared to Scandinavian countries[9].

The prevalence of exclusive breastfeeding also appears to be low in the country of origin of the two study groups. In the nationwide household survey from Iraq, 38% of the sample reported that they knew what exclusive breastfeeding was, but only about half of these women defined it correctly and reported that exclusive breastfeeding should continue for 6 months postpartum[26]. The KAP study from Somalia found that exclusive breastfeeding did not exist in many areas of the country, as breast milk alone was considered to be inadequate for the child[25]. Similar findings have been reported among immigrant mothers in other qualitative studies conducted in the US and the UK[27, 29].

Breastfeeding cessation was more likely to occur at an earlier age among Iraqi-born than Somali-born mothers. Only 58% of the Iraqi-born mothers were still breastfeeding at 6 months of age, whereas this was the case for 79% of the Somali-born mothers. The latter figure is similar to the 82% of mothers still breastfeeding at 6 months, as reported in the Norwegian national survey[11]. Other studies have reported various breastfeeding patterns among immigrant groups in different countries[17-19]. Studies from Somalia and Iraq have furthermore described that breastfeeding is seen as acceptable for mothers, their networks and professionals, but lack of knowledge, inappropriate beliefs and very close birth-spacing (a new sibling before the child reached 2 years of age) were the major obstacles for optimal breastfeeding practices[25, 26, 30, 31].

Complementary feeding practices

Both infant formula and water had been introduced to more than half of the Norwegian-Somali and Norwegian-Iraqi infants during the first 3 months of life. On the positive side, none of the infants had been introduced to cow's milk. The proportions of infants receiving formula and water were much higher compared to the Norwegian national survey, which showed that 28% had been introduced to formula and 22% to water in the same age group[22].

The KAP study from Somalia identified that water with sugar and milk were considered fundamental constituents of infants' complementary diets, and children were mainly fed cow's or goat's milk in addition to breastfeeding from birth to 3 months of age[25]. Furthermore, concerns about adequate infant weight gain, advice from family members/community and lack of knowledge have been reported by Steinman et al. to be the main reasons for early supplementation with formula among Somali mothers in the US[27]. Early introduction of formula may compromise breastfeeding, as breastfeeding is a supply and demand system and introduction of formula could lead to decreased infant demand for breast milk, thereby decreasing the supply[32]. In order to increase exclusive breastfeeding and breastfeeding rates during the first months of life among these two groups, these aspects may be important to emphasize and communicate, as insufficient milk and the infant no longer wanting breast milk were two of the frequently reported reasons for breastfeeding cessation. Although Norway is known for its extensive and positive breastfeeding tradition and support system, more culture-specific information and support, and teaching of correct attachment and positioning of the baby during breastfeeding, may contribute to solve these problems.

Very few (2%) of the Norwegian-Somali infants received solid or semi-solid foods before 4 months of age, whereas 13% of the Norwegian-Iraqi infants did so, similar to the 11% reported in the Norwegian national survey[22]. The differences were greater at 4 months, when 54% of the Somali

infants and 68% of the Iraqi infants were introduced to solid or semi-solid food, compared to approximately 40% in the Norwegian national survey[22]. Similar to findings in the present study, porridge (87%) and fruit and berries (80%) were the main foods given at 6 months of age in the Norwegian national survey[22]. Dinners were given to 59% of the infants and industrial dinners were more frequently used than homemade in the Norwegian national survey[22], which is the opposite of the findings in this study. This may be due to concerns about lack of freshness of commercially prepared baby foods and the practice of feeding the child the same foods as adults among our sample, which have been reported in other studies[27]. The use of bread, yogurt, sweets, sweetened drinks and juices was much more frequent among Norwegian-Iraqi infants compared to Norwegian-Somali infants in the present study, whereas the reported use of these foods was limited in the Norwegian national survey (0%–10%)[22]. The earlier introduction and more frequent use of foods in general may be explained by the lower breastfeeding prevalence, which has also been described by Griffiths et al.[33], and concerns about adequate infant weight gain, as discussed earlier. The consumption of yogurt or other dairy products, however, is not recommended before 10 months of age[8], as these contain no iron and may therefore replace iron-rich foods and increase the risk of iron deficiency. Furthermore, sugar-sweetened beverages and energy-dense foods have been identified as dietary risk factors for childhood obesity[34] and may cause caries[35]. The consumption of these foods and beverages should thus be limited.

Vitamin D supplements

Most infants in the present study received vitamin D supplementation at 6 months of age. Vitamin D supplementation was also widely used among infants in the Norwegian national survey[22]. This is a positive finding, as the prevalence of vitamin D deficiency often is higher among immigrant populations in Europe compared to the indigenous populations of the countries to which they have migrated[36]. All infants in Norway are recommended to receive vitamin D supplementation from 4 weeks of age[8].

Factors associated with exclusive breastfeeding

Although higher education and work before pregnancy among mothers were positively associated with exclusive breastfeeding at 3.5 months of age in the unadjusted logistic regression analyses, none of the factors were found to be significantly associated with exclusive breastfeeding in the multivariate analysis. In comparison, the Norwegian national survey found that exclusive breastfeeding at 4 months increased with maternal educational level and number of children [11]. The study found a negative association between exclusive breastfeeding and maternal smoking and no association with maternal age, paternal education and geographical region [11]. Similarly, in

Denmark, the likelihood of being fully breasted among Nordic infants increased with maternal age and parity and was higher among women with a high socioeconomic position, while the pattern was less clear for infants of all other immigrant groups [28]. There was, however, a tendency of less fully breastfeeding the longer the migrant had lived in Denmark before the delivery and the younger the mother had been when she immigrated to Denmark, suggesting that acculturation did not favour breastfeeding[28]. This was not observed in our study.

Factors associated with breastfeeding

Differences in breastfeeding patterns among immigrant groups have been described by many [17, 18, 37], and this was also found in the present study where Somali-born mothers were more likely to breastfeed when the infant was 6 months of age than Iraqi-born mothers. Our findings showed increased odds of breastfeeding among mothers with more than two children, while the Norwegian national survey found no consistent pattern between breastfeeding at 6 months and parity [11]. The literature is inconsistent on the association between breastfeeding and parity[19, 37], and a study by Dennis et al. reported an increased odds of continuing to breastfeed with number of children (≥3) among Canadian-born women, whereas being primiparous was associated with increased breastfeeding duration among immigrant mothers [19]

Strengths and weaknesses of the study

Although the response rate was less than 30% in both groups, this study provides unique data on breastfeeding and complementary feeding practices among two very specific subgroups of the population based in three Norwegian counties. Challenges in recruitment of immigrant populations for dietary surveys have been reported by many[38, 39] and extra time and effort in recruiting and sampling are often needed due to limited numbers of people in the target sample frame. Convenience sampling method is often used as the standard approach in "hard-to-sample" population subgroups.

The proportion of participants from each county were almost the same as those estimated in the National Population Register, which reported that 75% of the Somali-born mothers listed lived in Oslo, 12% in Akershus and 13% in Buskerud. Among the Iraqi-born mothers, 53% lived in Oslo, 33% in Akershus and 14% in Buskerud. The use of bilingual information letters and field workers during recruitment and in the interview situations made it possible for non-Norwegian-speaking mothers to participate. However, mothers who were approached through several channels (e.g. reached at a registered telephone number and/or visited at their home address) were more likely to be included than those who only received the information letter.

There is a potential for recall bias, as data on breastfeeding and infant feeding were collected retrospectively. These data were collected no more than 6 months after breastfeeding cessation, and according to a review by Li et al., mothers in many populations studied seem to provide accurate estimates of the initiation and duration of breastfeeding when reported within a 3-year period[40]. However, the validity and reliability of maternal recall for the age of introduction of foods and liquids other than breast milk seems to be less accurate[40].

The multivariate analyses presented in this paper explore only a few, selected factors that might potentially be associated with exclusive breastfeeding and breastfeeding practices. It is likely that other social or other factors not measured in this study also may influence breastfeeding practices. A small sample size limits extensive multivariate analyses in this study. More research is therefore needed to better understand inequalities in breastfeeding practices.

Additionally, as breastfeeding patterns can be influenced by several factors, including country of residence and acculturation, this study cannot be generalised to other immigrant groups in Norway or to immigrant populations residing in other countries.

Conclusion

Breastfeeding initiation was common among both Somali-born and Iraqi-born mothers, but exclusive breastfeeding duration was shorter than recommended in both groups. Although both exclusive breastfeeding and breastfeeding overall are considered to be common in Norway, findings from this study reveal some disparities in breastfeeding and complementary feeding practices for immigrant subgroups in the population. This study further suggests that there may be a value in developing targeted approaches to ensure support for exclusive breastfeeding and breastfeeding by foreign-born mothers in order to achieve equity in breastfeeding and complementary feeding practices among Norwegian-born and Norwegian-immigrant mothers.

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575 **Figure 1** Recruitment of participants in the survey

576 **Figure 2** Exclusive breastfeeding among Norwegian-Somali (●) and Norwegian-Iraqi (■) infants
577 and breastfeeding in general among Norwegian-Somali (▲) and Norwegian-Iraqi (♦) infants during
578 the first 6 months of life (Somali: n=107; Iraqi: n=80)

579 **Figure 3** Solid and/or semi-solid foods (■), infant formula (♦), water (▲) and sweetened drinks/fruit
580 juices (●) among Norwegian-Somali infants during the first 6 months of life (n=107)

581 **Figure 4** Solid and/or semi-solid foods (■), infant formula (♦), water (▲) and sweetened drinks/fruit
582 juices (●) among Norwegian-Iraqi infants during the first 6 months of life (n=80)

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Table 1 Characteristics of the infants and parents sampled (n=187)

Characteristics	Total (n=187) †	Somali origin (n=107)†	Iraqi origin (n=80)†	*P*-value‡
Infants				
Boys/girls	54/46	60/40	48/52	0.094
Birth weight (g)*	3380 (3082-3703)	3350 (3382–3705)	3405 (3044–3707)	0.897
Birth length (cm)	51 (49-52)	51.0 (49.0–52.0)	50.0 (49.0–51.0)	0.050
Gestational age (weeks)*				0.467
<30	2	3	1	
30-37	18	20	15	
≥38	80	77	84	
Mothers				
Age (years)	30.0 (27.0-35.0)	30.0 (27.0–33.0)	32.0 (27.0–37.0)	0.073
≤24	13	16	10	0.328
25-34	61	62	60	
≥35	26	22	30	
Age when immigrated to Norway*	23.0 (16.0-27.0)	21.0 (14.0–25.0)	23.0 (17.5–29.0)	0.009
Number of years lived in Norway*	9.0 (5.0-14.0)	10.0 (5.0–14.0)	7.0 (4.0–12.5)	0.091
≤10	58	52	65	0.088
>10	42	48	35	
Maternal marital status				0.010
Married	80	72	90	
Cohabitant	5	7	3	
Not married/cohabitant	15	21	7	
Education				<0.001
No /basic education	56	72	35	
High school/higher education	44	28	65	
Work before pregnancy				0.020
Not working	62	69	52	
Working (full-time/part-time)	38	31	48	
Number of children				0.018
≤2	54	46	64	
>2	46	54	36	
Language spoken at home				0.092
Norwegian	9	12	5	
Other	91	88	95	
Fathers				
Origin				0.055
Somalia/Iraq	91	94	86	
Other	9	6	14	
Education				0.069
No/basic education	29	33	25	
High school/higher education	60	53	69	
Do not know	11	14	6	

*The birth weights of four Norwegian-Somali infants and two Norwegian-Iraqi infants, and the birth heights of nine Norwegian-Somali and nine Norwegian-Iraqi infants, are missing. The gestational age of one Iraqi-born mother, age when immigrated to Norway and number of years lived in Norway of three Iraqi-born mothers, and number of children of one Somali-born mother, are missing. The education levels of two Somali fathers are missing. These are not included in the calculations.

†Percentages for categorical variables, and median (25^{th} and 75^{th} percentiles) for continuous variables

‡Comparison of infants and parents of Somali and Iraqi origin

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Table 2 Proportion of infants (%) receiving selected foods, drinks and supplements at 6 months of age and frequency (times per day) among users presented as mean (SD) and median

Complementary food/ Supplements	Frequency (times per day) among users of Somali origin (n=107)			Frequency (times per day) among users of Iraqi origin (n=80)			*P*-value
	Proportion of infants (%)	Mean (SD)	Median	Proportion of infants (%)	Mean (SD)	Median	
Baby cereal†	98	2.0 (0.4)	2.0	89	1.7 (0.7)	2.0	0.007
Industrial baby cereal	97	1.9 (0.4)	2.0	88	1.7 (0.7)	2.0	0.010
Homemade	6	0.9 (0.6)	1.0	1	2.0 (-)	2.0	0.120
Dinner†	90	1.0 (0.2)	1.0	83	1.2 (0.9)	1.0	0.151
Industrial	29	0.7 (0.4)	1.0	36	0.8 (0.7)	0.7	0.291
Homemade	71	0.9 (0.2)	1.0	74	0.9 (0.7)	0.7	0.681
Fruit puree/berries†	82	1.1 (0.6)	1.0	98	1.3 (0.9)	1.0	0.001
Industrial	65	1.0 (0.6)	1.0	51	0.8 (0.6)	0.7	0.051
Homemade	26	0.9 (0.6)	0.9	80	1.0 (0.8)	1.0	<0.001
Other food†	29	-	-	58	-	-	<0.001
Bread	13	0.6 (0.3)	0.7	33	0.8 (0.6)	0.9	0.001
Yogurt	12	0.8 (0.4)	1.0	29	0.6 (0.6)	0.3	0.004
Ice cream	0	-	-	4	0.3 (0.0)	0.3	0.043
Cookies/cakes	3	0.3 (0.0)	0.3	25	0.5 (0.3)	0.3	<0.001
Spinach	5	0.6 (0.4)	0.3	5	1.1 (1.0)	1.1	0.918
Honey	2	1.1 (1.2)	1.1	1	0.3 (-)	0.3	0.739
Other food	7	0.5 (0.3)	0.3	11	0.5 (0.4)	0.3	0.375
Liquid†	93	-	-	100	-	-	0.020
Infant formula	79	3.3 (1.4)	3.0	61	3.7 (1.5)	4.0	0.010
Cow milk	0	-	-	0	-	-	-
Water	93	2.4 (1.4)	2.0	100	2.8 (1.5)	3.0	0.012
Sweetened drinks*	8	0.9 (0.6)	1.0	19	0.5 (0.5)	0.3	0.020
Fruit juices*	9	0.9 (0.3)	1.0	23	0.7 (0.7)	0.3	0.013
Rosehip extract	0	-	-	0	-	-	-
Supplements†	100	-	-	94	-	-	0.009
Cod liver oil	68	1.0 (0.2)	1.0	40	0.9 (0.3)	1.0	<0.001
Vitamin D drops	36	1.0 (0.3)	1.0	53	1.0 (0.2)	1.0	0.028
Other supplements	5	1.5 (0.6)	2.0	8	1.5 (1.2)	1.0	0.416

*"Sweetened drinks" include squash for children 0-3 years, squash with sugar, squash artificially sweetened, soda with sugar and soda artificially sweetened. "Fruit juices" include juice and nectar.
†Proportion of infants receiving "Baby cereal" is not necessarily equal to the sum of the two types of baby cereals presented, because the infants could have received more than one type. This is also the case for "Dinner", "Fruit puree/berries", "Other food", "Liquid" and "Supplements".

Table 3 Unadjusted and adjusted OR of breastfeeding at 6 months of age

		Breastfeeding at 6 months				
Characteristics	n[†]	Unadjusted OR	95% CI	Adjusted OR[‡]	95% CI[‡]	*P*-value[*]
Country of origin						
Somalia	85	1.00	-	1.00	-	
Iraq	46	0.35	0.18, 0.67	0.33	0.15, 0.71	0.005
Infant gender						
Male	68	1.00	-			
Female	63	1.43	0.76, 2.71			
Maternal age						
≤24	19	1.00	-	1.00	-	
25-34	74	0.58	0.22, 1.58	0.39	0.13, 1.19	0.676
≥35	38	1.20	0.38, 3.80	0.76	0.20, 2.82	0.099
Overall education						
No/basic education	75	1.00	-	1.00	-	
High school/higher education	56	0.86	0.46, 1.62	1.87	0.82, 4.28	0.140
Number of years lived in Norway						
≤10	68	1.00	-	1.00	-	
>10	61	2.01	1.03, 3.91	1.60	0.77, 3.35	0.210
Work before pregnancy						
Not working	81	1.00	-			
Full-time/part-time	50	1.03	0.54, 1.96			
Number of children						
≤2	61	1.00	-	1.00	-	
>2	69	2.60	1.33, 5.05	2.83	1.29, 6.24	0.010
Language spoken at home						
Norwegian	12	1.00	-			
Other	119	0.97	0.33, 2.90			

[†]Number of breastfed infants within current independent variable. Total number of infants at 6 months of age (*n* 187)

[‡]OR and 95% CI are adjusted for country of birth, maternal age, overall education, number of years lived in Norway and number of children

[*]*P*-values for the adjusted logistic regression model

Table 4 Unadjusted and adjusted OR of exclusive breastfeeding at 3.5 months of age

		Exclusive breastfeeding at 3.5 months				
Characteristics	n[†]	Unadjusted OR	95% CI	Adjusted OR[‡]	95% CI[‡]	*P*-value[*]
Country of origin						
Somalia	20	1.00	-	1.00	-	
Iraq	20	1.45	0.72, 2.93	1.05	0.48, 2.28	0.904
Infant gender						
Male	22	1.00	-			
Female	18	0.98	0.48, 1.97			
Maternal age						
≤24	8	1.00	-	1.00	-	
25-34	21	0.48	0.18, 1.26	0.36	0.13, 1.00	0.051
≥35	11	0.63	0.22, 1.85	0.61	0.20, 1.86	0.381
Overall education						
No/basic education	16	1.00	-	1.00	-	
High school/higher education	24	2.30	1.13, 4.70	2.14	0.96, 4.79	0.064
Number of years lived in Norway						
≤10	21	1.00	-			
>10	19	1.30	0.65, 2.64			
Work before pregnancy						
Not working	19	1.00	-	1.00	-	
Full-time/part-time	21	2.14	1.06, 4.35	1.52	0.24, 1.11	0.088
Number of children						
≤2	23	1.00	-			
>2	17	0.83	0.41, 1.67			
Language spoken at home						
Norwegian	5	1.00	-			
Other	35	0.62	0.21, 1.88			

[†]Number of exclusively breastfed infants within current independent variable. Total number of infants at 3.5 months of age (*n* 187)
[‡]OR and 95% CI are adjusted for country of birth, maternal age, overall education and work before pregnancy
[*]*P*-values for the adjusted logistic regression model

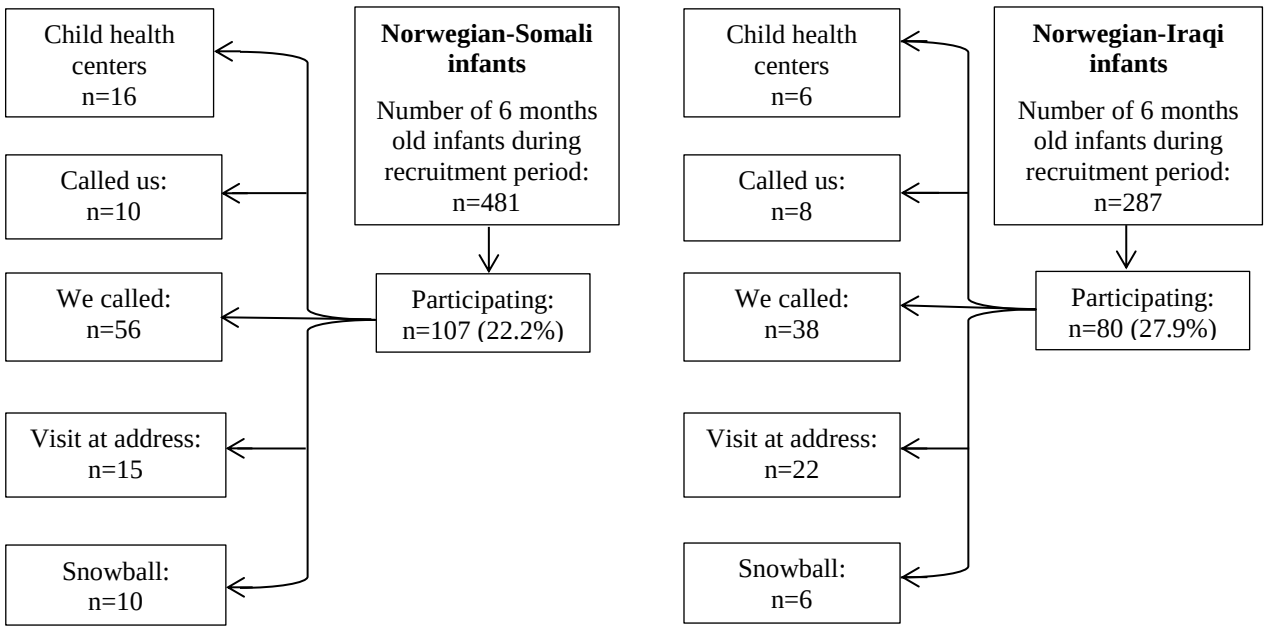

Figure 1 Recruitment of participants in the InnBaKost survey

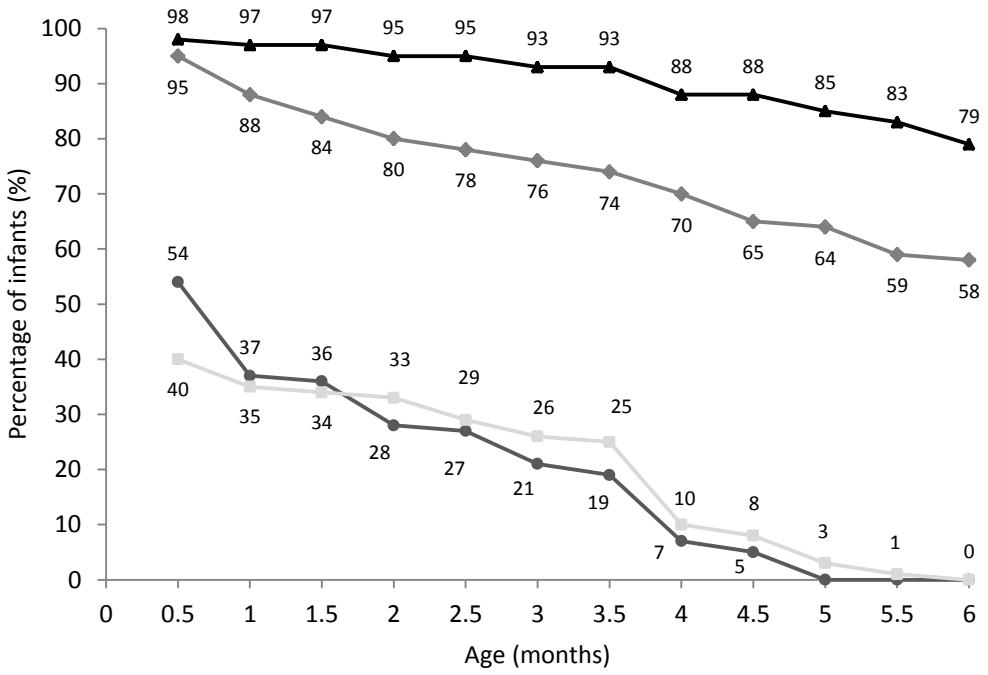

Figure 2 Exclusive breastfeeding among Norwegian-Somali (●) and Norwegian-Iraqi (▪) infants and breastfeeding in general among Norwegian-Somali (▲) and Norwegian-Iraqi (♦) infants during the first 6 months of life, (Somali *n* 107 and Iraqi *n* 80)

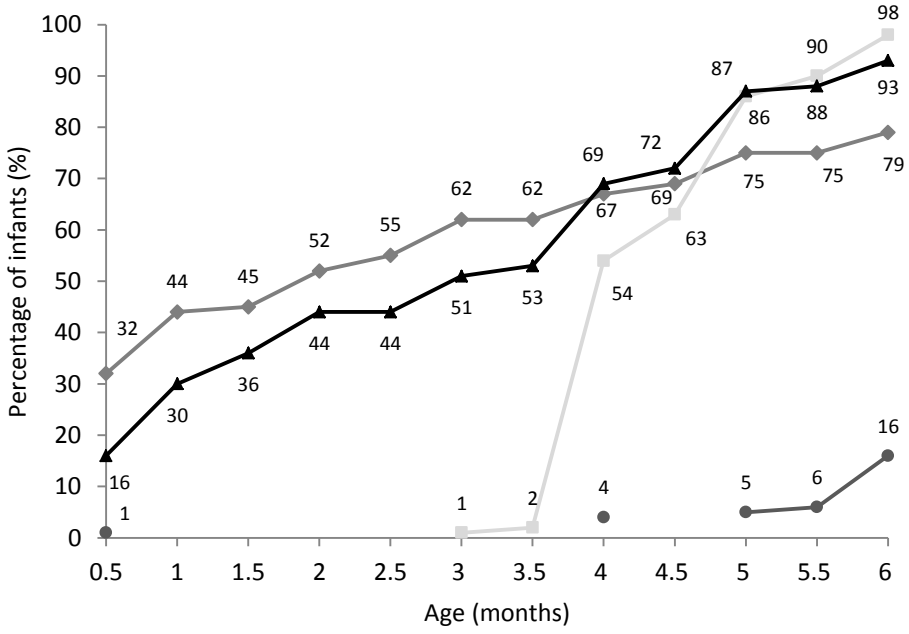

Figure 3 Solid and/or semi-solid foods (▪), infant formula (♦), water (▲) and sweetened drinks/fruit juices (●) among Norwegian-Somali infants during the first 6 months of life (*n* 107)

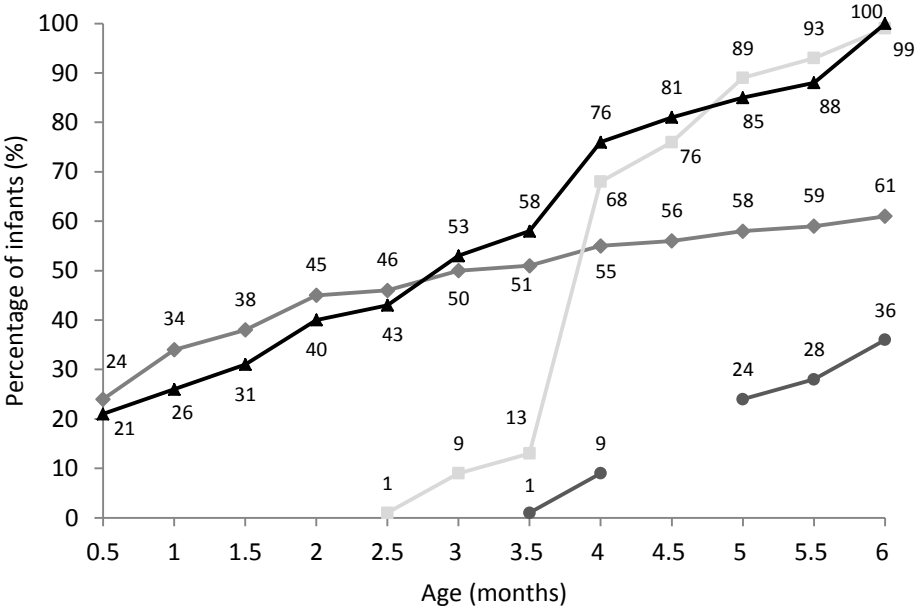

Figure 4 Solid and/or semi-solid foods (▪), infant formula (♦), water (▲) and sweetened drinks/fruit juices (●) among Norwegian-Iraqi infants during the first 6 months of life (*n* 80)