Received 29 April 2018
Revised 27 July 2018
Accepted 31 July 2018

Adequacy of dairy product intake among children in Kuwait using a short dietary assessment questionnaire

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Abstract

Purpose – This paper aims to assess the consumption of dairy products in Kuwaiti children, and develop and validate a semi-quantitative food frequency questionnaire to measure dairy product consumption.

Design/methodology/approach – This cross-sectional study was based on a sample of child–parent dyads (n = 150). A dietary assessment questionnaire on local dairy products consumed by preschool and preadolescent children was developed. Serving and portion sizes were evaluated on the basis of the guidelines of the United States Department of Agriculture and the American Academy of Pediatrics to calculate median intake levels of three age groups (3-5, 6-8 and 9-11 years).

Findings – All children met or exceeded the recommended daily servings of dairy products for their age and sex. Dairy product intake was often from processed dairy including milk-based desserts, flavored milk and cheese. Compared to boys, girls consumed more yogurt (15.5 per cent vs 14.2 per cent, p = 0.001) and milk-based desserts (15.5 vs 14.3, p = 0.001). In boys, flavored milk contributed more to the total dairy intake than in girls, especially in 6-8-year-olds (21.8 per cent vs 18.9 per cent, p = 0.021). Weight status was not associated with dairy product intake in either sex.

Originality/value – This is the first study that quantifies dairy product consumption in Kuwaiti children and provides insight into sex-specific trends in dairy product selection. The findings of this study may help in investigating relationships between dairy product consumption in children and disease risk factors, and are important for the development of local dietary guidelines for children.

Keywords Milk, Children, Adolescents, Nutrition, Obesity, Dairy products, Dietary intake, Weight status

Paper type Research paper

Introduction

Kuwait, along with Bahrain, Iran, the Kingdom of Saudi Arabia, Oman, Qatar and the United Arab Emirates, is recognized as a country in an advanced nutrition transition with a

The authors acknowledge Ms Dana Alqenai and Ms Fatimah Ali for their efforts in collecting the data, and thank the participants of the study. No external funding was received for any component of this work.

Disclosure statement: The authors have nothing to disclose.

Nutrition & Food Science
Vol. 49 No. 1, 2019
pp. 112-128
Emerald Publishing Limited
0034-6659
DOI 10.1108/NFS-04-2018-0120

high prevalence of overweight and obesity and a moderate prevalence of undernutrition and micronutrient deficiencies (Hwalla *et al.*, 2017). Kuwaiti children have the highest prevalence of overweight and obesity among Gulf countries (Ng *et al.*, 2011); among 10-14-year-old children, 30.7 per cent were overweight and 14.6 per cent obese (El-Bayoumy *et al.*, 2009). In a nationally representative sample, 9-13-year-old Kuwaiti children exceeded the estimated energy requirements by 31.5-72.6 per cent and showed deficiencies in fiber, calcium, folate and vitamin C intake (Zaghloul *et al.*, 2013). Intake of sweetened carbonated beverages and packaged fruit juices negatively affect intake of milk and dairy among Kuwaiti high school students. In the Kuwaiti pediatric population, from infants to school-aged children, high rates of rickets associated with vitamin D deficiency and cow milk allergy exist (Molla *et al.*, 2000; Alyahya, 2017; Alkazemi *et al.*, 2018). Diet recommendations often emphasize consumption of dairy products to improve the quality of children's diet and decrease overweight and obesity rates, and many cultures value dairy products as nourishing and nutrient-dense in calcium (Edelstein, 2013; Rizzoli *et al.*, 2014).

Gueguen and Pointillart (2000) showed a high rate of absorption of milk calcium. Adequate calcium intake throughout childhood and adolescence is required to achieve maximal bone mass in young adulthood (Prentice *et al.*, 2006). Milk and dairy products are important sources of macronutrients and micronutrients for children; they contain protein, phosphorus and vitamin D, which contribute to bone health and healthy growth in children (Dror and Allen, 2014). However, in clinical, longitudinal, retrospective and cross-sectional studies, increased consumption of dairy products or total dietary calcium did not consistently benefit bone health in children or young adults (Lanou *et al.*, 2005).

Dairy consumption and its contribution to calcium intake also have a protective effect against cardiovascular disease (CVD) (Moreno *et al.*, 2015). In contrast, frequent consumption of dairy fat is associated with an increased risk of obesity (Wang *et al.*, 2016). The relationship between dairy foods and weight may be influenced by the type of dairy product. For example, the intake of yogurt is associated with a reduced risk of weight gain and cardiovascular risk factors (Marette and Picard-Deland, 2014; Keast *et al.*, 2015). Yogurt and its fermented equivalents remain an excellent source of calcium; however, they are distinct from other fresh dairy products because they contain live active bacteria and therefore, are better tolerated by lactase-deficient subjects (Smith *et al.*, 1985). Because of the high prevalence of lactose intolerance in the Middle East, more households prefer these products (Chibber, 2013). Many children and adolescents substitute milk with flavored milk, because of an increased perception that it is a healthier alternative to carbonated beverages (Chibber, 2013). However, there is a concern that the higher caloric content of flavored milk, due to its added sugar, may negatively affect overall diet quality and increase body weight in children (Fayet-Moore, 2015).

To our knowledge, no study has described and quantified dairy product intake in Kuwait to date. Culturally, appropriate tools to qualitatively or quantitatively assess dietary intake in Kuwaiti populations are lacking. Short dietary assessment instruments, known as screeners, are a useful tool to characterize a population's median intake, discriminate higher vs lower intake for individuals or populations, examine interrelationships between diet and other variables and compare findings from smaller studies to larger population studies (National Cancer Institute, 2017a). Screeners may be useful in situations that do not require assessment of the total diet or quantitative accuracy in dietary estimates (National Cancer Institute, 2017b). Estimates of intake from short dietary assessment instruments are not as accurate as those from more detailed methods, such as 24-h dietary recall. However, calibrating a screener against a more precise 24-h dietary recall can ensure that a screener is providing the best and most accurate estimates possible (National Cancer Institute, 2017a).

This study used a quick survey to understand dairy consumption trends. Specifically, the aim is:

- to validate a brief semi-quantitative food frequency questionnaire (SFFQ) that included local dairy product choices;
- to assess dairy product consumption among a sample of Kuwaiti children 3-11 years old; and
- to evaluate dairy product intake by sex- and age-specific recommendations according to the US Department of Agriculture (USDA) *MyPlate* guidelines (2016) and the American Academy of Pediatrics (AAP).

Materials and methods

Study design, recruitment and eligibility

A cross-sectional study with a non-probabilistic sampling outline for convenience was conducted to describe dairy product intake among Kuwaiti children recruited from local malls and shopping areas. The minimum sample size was estimated to be five to ten respondents (k) per parameter of the model, based on Hair *et al.*'s (2009) study. A questionnaire with 13 parameters was used, requiring a minimum of 56-130 participants. Estimating a 20 per cent loss rate, the sample size was corrected to 78-156 participants.

A total of 180 Kuwaiti parents with children 3-11 years old were approached during open hours in three major shopping areas in Kuwait City between December 2016 and March 2017. These age groups represent preschool to preadolescent children, and were selected because their dietary choices often reflect their parental and family environment more than social influences and peers (Salvy *et al.*, 2010). Only 159 parent–child dyads (79.5 per cent) agreed to participate in the study. Children who were sick and lactose intolerant or had allergies to milk proteins were excluded. The questionnaire was administered to one of the parents, and information about one child per family was obtained.

Study approval and ethical consent

Ethics approval was obtained from the College of Life Sciences Research Committee, and informed consent was obtained from all participants. To ensure data confidentiality, no personal identifiers were collected.

Dietary tool and measures of intake

The SFFQ was modeled after validated tools to assess dairy product consumption among Kuwaiti children (Hunsberger *et al.*, 2015; Vioque *et al.*, 2016). For its development, a comprehensive list of all possible dairy products consumed locally by children was constructed based on expert opinion and previously conducted 24-h dietary recall. A total of 60 dairy products were identified from the 24-h dietary recall, and were categorized under seven dairy product groups. The questionnaire was further modified to include all local choices of dairy products, consumption frequency and portion sizes. The following products were included in the questionnaire: plain milk, flavored milk, plain yogurt and yogurt drink (Laban), milk-based desserts (ice-cream, frozen yogurt and puddings), processed cheese (spreads and slices) and non-processed cheese (such as labneh, unripe and cream cheese). Processed cheese differs from natural cheese in that it is not made directly from milk (or dehydrated milk) but rather from ingredients, such as skim milk, natural cheese, water, butter oil, casein, caseinates, other dairy ingredients, vegetable oils, vegetable proteins and/or minor ingredients (Fox *et al.*, 2017). Portion sizes were explained to mothers using product photographs, three-dimensional food models and household measurement tools, including empty containers of dairy products as visuals to reduce recall bias.

Computing number of servings per day

The portions were specified in volume measures as milliliters of milk, and grams for cheese, yogurt or yogurt drink (Laban). Cheese and milk consumed as ingredients were not accounted in the evaluation of portions. Frequency of consumption was measured in nine categories, ranging from "never" to "six-times per day or more." The frequency of "never" was 0, "1-3 per month" was 0.08, "once per week" was 0.14, "2-4 per week" was 0.43, "5-6 per week" was 0.8, "once per day" was 1, "2-3 per day" was 2.5, "4-5 per day" was 4.5 and "six per day or more" was 6. Dairy product intake was computed by multiplying the frequency of consumption by the unit measure of each product from the SFFQ. To compute the number of servings of dairy products per day, the total amount of each category was converted to number of servings according to the USDA *MyPlate* and the AAP 2 guidelines for dairy consumption for the respective ages and sexes (Dietz and Stern, 2012). Total intake of dairy products in unit measures (mL or g) was converted using age appropriate portion sizes (Table I). Recommended number of servings by age and sex is indicated in Table I according to dietary guidelines by the USA, which is used by the Kuwaiti Health Authorities for Food and Nutrition (Dehghan *et al.*, 2005, Zaghloul *et al.*, 2013).

Validation of the SFFQ using 24-h dietary recall

The study tool, SFFQ, was pretested using 24-h dietary recalls administered over three non-consecutive days to the parents of a total of 35 children (20 girls); only 17 children (8 girls) completed the task. This sample was recruited through invitations in private pediatric clinics. The three non-consecutive 24-h dietary recalls from the participating children included at least one non-weekday. Using the USDA automated multiple-pass method (Moshfegh *et al.*, 2008), a trained nutritionist collected the information from parents on food and beverages consumed by the child during the previous day. The first 24-h dietary recall was collected on the same day when the SFFQ was taken; the second and third 24-h dietary recalls were completed either by telephone interview or in-person interview in the middle and at the end of a one-month period. Portions and serving sizes were carefully estimated using household measures and detailed descriptions of the food, method of preparation and brands. The nutritionist performed the coding of all food items eaten in units of weight or volume as collected from the 24-h dietary recall. The ESHA Food Processor software (2016, version 11.5.226) was used for dietary data entry. In the case of missing nutrient data for unanalyzed food items, the closest similar food in the ESHA Food Processor program was selected to impute the missing nutrients. This software primarily uses food composition tables from USDA. The median intake was determined on the basis of averaging all of the three 24-h dietary recalls as a representation of the individual intake. The validity of the median estimates was evaluated by calculating the percentage differences between the 24-h dietary recall and the SFFQ. Rank estimation was validated using Spearman's correlation coefficient. The degree of miscategorization was determined by joint classification.

Additional measured parameters

Dairy product consumption patterns, information on dairy product purchases, preferences and family sociodemographic information were obtained. Children's weights and heights

Table I.
The number of servings of dairy products per day, evaluated by age and sex groups and for the total population (n = 150)

Sex	Age group (years)	All dairy products†	No sugar dairy products‡	Non-processed dairy products§	Only processed dairy products¥	% Adequacy of total intake of dairy products¤	% Adequacy of no sugar dairy products$^{\check{s}}$
Boys	3-5, N = 37	4.1 (3.1-4.9)	2.7 (1.9-3.3)	2 (1.7-2.6)	2.1 (1.2-2.4)[a1]	−5.4 =*5.4* +89.2	−27 =*18.9* +54.1
	6-8, N = 22	3.9 (3.1-5.3)	2.6 (1.9-3.5)	1.7 (1.3-2.9)	2.3 (1.6-3)	−4.5 =*13.6* +81.8	−45.5 =*13.6* +40.9
	9-11, N = 25	4.4 (2.9-6.7)	3.1 (1.9-4.7)	2.5 (1.5-4)	2.4 (1.7-3)	−28 =*20* +52	−48 =*24* +28
	Total, N = 84	3.9 (3-5.3)	2.7 (1.9-3.6)	2 (1.4-2.9)	2.1 (1.3-2.8)[a2]	−11.9 =*11.9* +76.2	−38.1 =*19* +42.9
Girls	3-5, N = 22	3.1 (2.3-4.6)	2.4 (1.7-2.9)	1.9 (1.4-2.6)	1 (0.7-2.2)[b1], p = .017*	−18.2 =*13.6* +68.2	−40.9 =*13.6* +45.5
	6-8, N = 22	3.9 (3.1-5.3)	3 (2.1-3.7)	2.3 (1.6-3.1)	1.9 (0.9-3)	−18.2 =*4.5* +77.3	−40.9 =*4.5* +54.5
	9-11, N = 22	3.8 (2.3-6.2)	2.5 (1.5-4.2)	2.2 (1.3-3.3)	2.1 (0.7-3)	−36.4 =*13.6* +50	−54.5 =*18.2* +27.3
	Total, N = 66	3.8 (2.4-5.1)	2.7 (1.7-3.7)	2.2 (1.4-3)	1.8 (0.7-2.6)[b2], p = .027*	−24.2 =*10.6* +65.2	−45.5 =*12.1* +42.2
Total	3-5, N = 59	3.7 (2.7-4.9)	2.7 (1.7-3.2)	2 (1.5-2.6)	1.9 (1-2.4)	−10.2 =*8.5* +81.4	−32.2 =*16.9* +50.8
	6-8, N = 44	4 (3.1-5.2)	2.8 (2-3.7)	2.3 (1.4-2.9)	1.9 (1.2-3)	−11.4 =*9.1* +79.6	−43.2 =*9.1* +47.7
	9-11, N = 47	4.1 (2.7-6.2)	2.8 (1.7-4.2)	2.2 (1.4-3.4)	2.1 (1-3)	−31.9 =*17* +51.1	−51.1 =*21.3* +27.7
Total	Total, N = 150	3.9 (2.8-5.2)	2.7 (1.8-3.7)	2.1 (1.4-2.9)	1.9 (1-2.7)	−17.3 =*11.3* +71.3	−42.3 =*16* +42.7

Notes: †All milk groups, servings per day; ‡All milk groups except flavored milk and dessert, servings per day; §All non-processed dairy products, including milk, laban, yogurt, unprocessed cheese, servings per day; ¥All processed dairy products, including flavored milk, desserts, processed cheese, servings per day; ¤Adequacy calculated using age-appropriate number of servings as follows: for 3-5 year-olds: 2-2.5 servings per day; 6-8 year olds: 2.5-3 servings per day; and 9-11 year olds: 3 servings per day; Age-specific serving sizes for various product categories are for 1-3 year olds: half cup milk, half oz cheese, half cup yogurt; for 4-6 year olds: half cup milk, 1 oz cheese, half yogurt, for 7-13 year olds: one cup milk, 1 oz cheese, three-fourth-one cup yogurt; ¤,$\check{s}$Values listed % adequacy as follows: for age and sex, (−): % below recommendation; (=): % adequate; (+): % more than recommendation; Values are represented as median and interquartile range (25th-75th percentiles) of the number of servings of dairy products. Mann–Whitney U-test was used to compare differences between means of servings of dairy products per day; Superscript letters (e.g. [a1], [a2]) denote statistically significant differences between intake values of dairy products in subsets of boys compared to the same subset of girls; (*) indicates significance level at $p < 0.05$

were reported by their parents. Child body mass index (BMI) percentile was determined using the Centers for Disease Control and Prevention (CDC) growth charts with Epi Info Software. Obesity was calculated as *z*BMI and measured by entering height, weight, sex and age into the CDC's *z*BMI calculator to compute BMI percentiles. Three BMI categories were constructed based on these percentiles. Underweight/normal was defined as being in or under the 85th percentile, overweight was defined as being in the 85th-94th percentiles and obese was defined as $\geq$95th percentile. We originally categorized *z*BMI into four levels: underweight, normal weight, overweight and obese, and found that <1 per cent of children were underweight. Because of the small number of children in this category, we combined the underweight and normal weight categories. Age categories (3-5, 6-8 and 9-11 years) were also created for each sex, and comparisons of dairy product intakes by age were conducted. Variables were tested for having sufficient sample size in each category (>10 per cent) and were collapsed when necessary.

Statistical analysis

None of the variables measured was normally distributed. The participants' characteristics, including demographics, and individual responses to statements, were analyzed using descriptive analyses. All variables were expressed as percentages (per cent) of the study population. Categorical variables were compared using Pearson's Chi-square (χ^2) test. Fisher's exact test was used when appropriate, i.e. whenever 20 per cent of the expected cell frequencies were $\leq$5 parametric. Using the variable "Milk beverage in mL," outliers were identified and excluded if they were >75th percentile plus three times the interquartile range or <25th percentile minus three times the interquartile range. Median intakes were calculated after exclusion of outliers and missing data (n = 9). The median dairy product intake of the various groups was reported in mL or g, and the median total dairy product intake was calculated in servings per day with interquartile ranges (25th-75th). Independent samples median tests estimated the likelihood that median values between the sex and weight groups drawn from the same population were equal. Although this test is a less powerful alternative to the Kruskal–Wallis ANOVA, it is more robust in cases where the data set contains extreme outliers as in this study. Mann–Whitney *U* test was used for post hoc analysis. All reported p-values were two-sided and used a significance level of 5 per cent. Differences were considered statistically significant at $p < 0.05$. Statistics were performed using SPSSTM (version 24) for Windows (SPSS Inc., Chicago, IL, USA).

Results

Participant characteristics

Parent–child dyads included in this study numbered 150 with 55.3 per cent boys (n = 84) and 44.7 per cent girls (n = 66). Children were distributed equally among the three age groups: 38.7 per cent (n = 58) were 3-5 years old; 30.0 per cent (n = 45) were 6-8 years old; and 31.3 per cent (n = 47) were 9-11 years old. The majority of children, 82.6 per cent (n = 121), were of normal weight, 11.4 per cent were overweight and 5.3 per cent were obese. Only one boy (0.76 per cent) was found to be underweight. No significant differences in the distribution of weight status between the two sexes were observed (mean BMI $\pm$ SD, 16.9 $\pm$ 1.6, 68.8 per cent). Of the 150 recruited parents, 80.7 per cent (n = 121) were mothers, and 19.3 per cent (n = 29) were fathers. Most parents were employed, 83.3 per cent (n = 125). Among the recruited parents, 57.9 per cent (n = 87) had a college or higher degree, and the remainder (42 per cent; n = 63) had a college diploma or lower.

The validity of the median estimates

The SFFQ overestimated dairy product intake by approximately 8-10 per cent for both males and females. For daily servings of dairy products, the median (range) de-attenuated correlation coefficient was 0.29 (0.12-0.63) for males and 0.31 (−0.8 to 0.43) for females. Cross-classification analysis indicated extreme miscategorization rates of 2-7 per cent. The correlations for the major nutrient intakes calculated using the SFFQ with and without taking portion sizes into account were >0.85.

Daily dairy product intake and adequacy

The total median intake of dairy products for the 3-5-year age group was 3.7 (2.7-4.9) servings/day, which exceeded the recommendation of 2-2.5 servings per day (Table I). Older children (6-8 and 9-11-year age groups), also exceeded the daily recommended dairy product intake (2.5 and 3 servings per day, respectively) with median intakes of 4 (3.1-5.2) and 4.1 (2.7-6.2) servings per day, respectively. When median dairy product consumption was computed for all dairy categories excluding flavored milk and milk-based desserts, the 3-5 and 6-8-year age groups still exceeded the daily recommended intake, with median intakes of 2.7 (1.7-3.2) and 2.8 servings per day, respectively. However, the median intake of the 9-13-year-old group fell below the recommended level (median = 2.8; range 2.7-4.2). Of the total servings of dairy product consumed, 51.4 per cent of dairy product consumption was from processed products (flavored milk, milk-based desserts and processed cheese) among 3-5-year-old children, 47.5 per cent among 6-8-year-olds and 51.2 per cent among 9-11-olds.

The overall adequacy of total dairy product intake (Table I), determined by age and sex-specific daily recommendations, showed 71.3 per cent (n = 107) of all children consumed more than the recommended number of servings per day for their sex and age, 17.3 per cent (n = 28) did not consume enough and 11.3 per cent (n = 17) consumed the recommended number of servings per day. When dairy products containing added sugars were removed and adequacy was recalculated, 42.3 per cent (n = 62) of children fell below the recommendation, 16 per cent (n = 24) were at an adequate intake level for their sex and age and 42.7 per cent (n = 64) exceeded the recommended intake.

Dairy product adequacy according to weight status and age

Among those children who exceeded their daily requirement, 18.8 per cent (n = 8) were overweight and obese, whereas 81.3 per cent (n = 78) were of normal weight. Adequacy of dairy product consumption decreased with age, with the highest inadequacy (per cent of children whose consumption was below the daily recommendation) at 31.9 per cent for children of age 9-11 years (n = 15), whereas children of age 6-8 and 3-5 years had inadequacies of 11.4 per cent (n = 5) and 10.2 per cent (n = 6), respectively (p = 0.001). In contrast, the proportion of children who exceeded the recommended intake for their sex and age was highest among the youngest age group (3-5 years, 81.4 per cent, n = 48), was decreased in the 6-8 years group (79.6 per cent, n = 35) and was lowest in the 9-11 years age group (51.1 per cent, n = 24) (p = 0.001). Dairy products intake was appropriate in 8.5 per cent (n = 5) of the 3-5 years age group, 9.1 per cent (n = 4) for the 6-8 years age group and 17 per cent (n = 8) for the 9-11 years age group. More boys than girls exceeded the recommended intake (76.2 vs 65.2 per cent, respectively), whereas more girls than boys fell below the recommended intake (24.2 vs 11.9 per cent, respectively). Only 10.6 per cent (n = 7) of the girls exactly met the dairy product intake recommendation compared to 11.9 per cent (n = 10) of the boys.

Compared to boys, girls showed a higher intake of yogurt (median = 64.5 g/d vs 43 g/d, respectively, p = 0.035) (Table II). Boys consumed significantly more flavored milk than girls (median = 125 mL/day vs 77.4 mL/day, p = 0.02), and the number of servings per day for all processed dairies was significantly higher among boys than among girls (median = 2.1 vs 1.8 servings per day, p = 0.027). Yogurt and milk type dessert (per cent) contributed more to the total dairy products intake in girls compared to boys 15.5 per cent vs 14.2 per cent, p = 0.001 and 15.5 vs 14.3, p = 0.001, respectively (Table III). Whereas, flavored milk contributed more to the total dairy intake in boys compared to girls, especially those 6-8 years old (21.8 per cent vs 18.9 per cent, p = 0.021).

Children with the highest BMI (≥95th percentile) were reported to consume the lowest amount of flavored milk (median = 27.4 mL/day) compared to those with a normal BMI who showed the highest intake (median = 115 mL/d), and those who were overweight (107.5 mL/day; p = 0.017). There was a noted increase in cheese intake in the oldest age group, for both non-processed (median = 31, 26.7, and 13 g/day for 9-11, 6-8 and 3-5-year-old children; p = 0.004) and processed cheese (median = 39.9, 49.6 and 24.8 g/day for 9-11, 6-8 and 3-5-year-old children, respectively; p = 0.001).

Parental attitudes toward dairy products

Parents reported that their children mainly drank milk as a beverage, with 46.7 per cent (n = 70) choosing long-life milk, 24 per cent (n = 36) fresh milk and 18.7 per cent (n = 28) reconstituted milk powder. Full-fat milk was the most common choice of milk consumed (74.7 per cent, n = 112), followed by low-fat milk (19.3 per cent, n = 29), and skimmed milk (6 per cent, n = 9). The two main reasons of parents for encouraging their child to consume dairy products were tastiness (37.3 per cent, n = 56) and to help their children grow bigger and stronger (30.7 per cent, n = 46). Children consumed dairy products at breakfast (46.7 per cent; n = 70), lunch (20.7 per cent; n = 31) and dinner (32.7 per cent; n = 49). More than half of the parents (66 per cent; n = 99) encouraged their children to drink milk on a daily basis, 14 per cent (n = 36) occasionally and 1.3 per cent (n = 14) never encouraged consumption of milk. Similarly, 52 per cent (n = 78) of the parents included a milk beverage in their child's lunch box, and 40.7 per cent (n = 61) always prepared a cheese or labneh sandwich for school (Table IV).

Discussion

This is the first study to describe the development of SFFQ specific to quantify the daily intake of dairy products in Kuwaiti children, which was used to investigate dairy product intake and assess adequacy of dairy product intake by Kuwaiti children. Dairy products were selected to identify dietary components that help children and adolescents maintain a healthy body weight (Brouwer-Brolsma *et al.*, 2018; Spence *et al.*, 2011). The importance of assessing dietary adequacy of dairy products in epidemiologic studies is to obtain the common rather than the current or absolute intake, and to rank individuals by intake (Willet, 2013). With this purpose in mind, this SFFQ is the right step for developing a dietary assessment method to study the relationship of dairy product consumption with growth, nurture and chronic diseases in a local context. This method allowed estimating adequacy of dairy product intake using specified categories and frequency with a minimum loss of information by asking participants about intakes of specified portion sizes (Güneş *et al.*, 2016) with minimal recall bias associated with estimating portion sizes.

The results provide insights into the current trends of dairy product intake among Kuwaiti children. Dairy product intake exceeded recommended levels for most children when all dairy products were included in the total daily intake. When flavored milk and milk-based desserts

Table II. Intake per day for all dairy product categories, evaluated by age and sex groups and for the total population (n = 150)

Sex	Age group (years)	Milk, mL/d	Milk type dessert, g/d	Flavored milk, ml/d	Yogurt, g/d	Laban, g/d	Processed cheese, g/d	NP cheese, g/d
Boys	3-5, N = 37	125 (125-200)	100 (43-100)	125 (53-134.5)	43 (8-82.3)	14 (14-78.7)	26.7 (4.3-44.8)	13.3 (2.5-28.8)
	6-8, N = 22	112.5 (44.7-185)	90 (43-105)	137.5 (53.8-200)	43 (12.5-64.5)	64.5 (12.5-85)	55.8 (26.7-62)	26.7 (11.9-62)
	9-11, N = 25	180 (116.3-200)	100 (43-135)	180 (53.8-200)	43 (11-100)	64.5 (17.5-100)	62 (9.14-83.7)	31 (11-93)
	Total, N = 84	*125 (100-200)*	*100 (43-100)*	*125 (53.8-200)*^{a1}	*43 (9.5-100)*^{a2}	*43 (14-100)*	*39.9 (13.3-62)*	*26.7 (4.9-49.6)*
Girls	3-5, N = 22	125 (44.7-157.5)	43 (14-80)	59.1 (17.5-100)	43 (14-100)	14 (11-57.3)	13.3 (3.9-38.8)	4.9 (3.9-27.7)
	6-8, N = 22	137.5 (105.6-200)	70.9 (14-100)	82.3 (20.1-131.3)	64.5 (14-80)	43 (43-100)	35.5 (13.3-69.8)	26.7 (8.7-52.7)
	9-11, N = 22	137.5 (105.6-200)	70.9 (14-100)	82.3 (20.1-131.3)	64.5 (14-80)	43 (43-100)	35.5 (13.3-69.8)	26.7 (8.7-52.7)
	Total, N = 66	*125 (61.8-180)*	*64.5 (14-100)*	*77.4 (21-125)*^{b1}, *$p = 0.02$**	*64.5 (14-100)*^{b2}, *$p = 0.035$**	*43 (14-100)*	*26.7 (4.8-62)*	*13.3 (4.8-49.6)*
Total	3-5, N = 59	125 (100-200)	43 (43-100)	77.4 (53.8-125)	43 (14-100)	14 (13.6-77.4)	24.8 (4.4-39.9)	13 (2.5-26.7)
	6-8, N = 44	125 (56.4-195)	80 (43-100)	116.3 (53.8-172.5)	43 (14-76.3)	43 (28.6-100)	49.6 (26.7-62)	26.7 (8.7-58.9)
	9-11, N = 47	125 (86-200)	100 (43-120)	125 (53.8-200)	64.5 (12-100)	43 (14-100)	39.9 (4.9-74.4)	31 (8.7-74.4)
	Total, N = 150	*125 (77.4-200)*	*80 (43-100)*	*103.8 (953.8-169)*	*43 (14-100)*	*43 (14-100)*	*31 (8.7-62)*	*26.7 (4.9-49.6)*

Notes: Values are represented as median and interquartile range (25th-75th percentiles) of the total amount consumed of each dairy product category in milliliters for liquids and grams for solids per day. Superscript letters (e.g. ^{a1}, ^{a2}) denote statistically significant differences between intake values of dairy products in subsets of boys compared to the same subset of girls; (*) indicates significance level $p < 0.05$

Table III. Percentages of dairy product categories from the total of all dairy products consumed per day, evaluated by age and sex groups and for the total population (n = 150)

Sex	Age group (years)	Milk	Milk type dessert	Flavored milk	Yogurt	Laban	Processed cheese	NP cheese
Boys	3-5, N = 37	20.4 (18.9-24.6)	14.6 (13.3-16.1)	19.7 (18.3-21.3)	14.6 (13.3-16.1)	15.3 (13.4-16.2)	4.9 (4.3-8.1)	4.9 (4.2-7.2)
	6-8, N = 22	19.2 (16.9-21.8)[a1]	13.49 (12.5-14.8)[a2]	21.8 (18.7-23.8)[a3]	13.5 (12.5-14.8)[a4]	14.6 (13.2-16.5)	7.7 (6-9.2)	7.8 (5.4-9.1)
	9-11, N = 25	20.5 (17.9-24.4)	14.3 (12-15.4)[a5]	21.3 (19-25.1)	14.3 (12-15.4)[a6]	14.7 (12.3-16.2)	7.9 (6-9.1)	7.6 (4.9-9.1)
	Total, N = 84	*20.5 (17.9-23.4)*	*14.3 (12.7-15.5)*[a7]	*20.2 (18.6-22.8)*	*14.2 (12.7-15.5)*[a8]	*14.8 (13.4-16.3)*	*7.2 (4.9-8.9)*	*6.1 (4.5-8.5)*
Girls	3-5, N = 22	20.5 (17.7-20.9)	16.1 (13.7-16.2)	21.3 (18.3-21.4)	16.1 (13.7-16.2)	15.8 (13.5-16.1)	4.9 (4.7-8.1)	4.9 (4.7-7.7)
	6-8, N = 22	20.7 (18.8-25.5)[b1], *p = 0.023**	14.8 (13.6-16.5)[b2], *p = 0.026**	18.9 (16.3-21.6)[b3], *p = 0.021**	14.8 (13.6-16.5)[b4], *p = 0.026**	13.8 (11.7-16.2)	7.3 (4.9-9.1)	6.9 (4.6-8.5)
	9-11, N = 22	19.9 (17.3-22)	15.7 (13.9-16.2)[b5], 0.01*	20.2 (17.9-21.9)	15.7 (13.9-16.2)[b6], 0.01*	15.5 (12.9-16.1)	6.9 (4.9-9.3)	6.4 (4.8-8.7)
	Total, N = 66	*20.5 (17.8-22.5)*	*15.5 (13.8-16.3)*[b7], *p = 0.001***	*20.2 (17.6-21.6)*	*15.5 (13.8-16.3)*[b8], *p = 0.001***	*14.7 (13.3-16.1)*	*6.8 (4.9-8.9)*	*6.6 (4.7-8.4)*
Total	3-5, N = 59	20.5 (18.6-23.6)	14.8 (13.4-16.1)	20.3 (18.3-21.3)	14.8 (13.4-16.1)	15.3 (13.4-16.1)	4.9 (4.3-7.9)	4.9 (4.3-7.6)
	6-8, N = 44	20.2 (17.8-22.8)	14.3 (13.4-16.3)	19.8 (17.4-22.5)	14.3 (13.4-16.3)	14.3 (12.5-16.3)	7.7 (5.7-9.1)	7.5 (4.8-8.7)
	9-11, N = 47	20.5 (17.8-23)	14.8 (13-16.1)	20.2 (18.5-23.9)	14.8 (13-16.1)	14.9 (12.3-16.1)	7.6 (4.9-9.1)	6.9 (4.8-9)
	Total, N = 150	*20.5 (17.9-23)*	*14.6 (13.4-16.1)*	*20.2 (18.3-22.3)*	*14.6 (13.4-16.1)*	*14.8 (13.4-16.1)*	*6.9 (4.9-8.9)*	*6.3 (4.6-8.5)*

Notes: Values are represented as median and interquartile range (25-75th percentiles); All volumes in milliliters for liquids were converted to grams, using specific gravity: for milk = 1.016 g/mL and for flavored milk = 1.056 g/mL. Mann–Whitney U test was used to determine differences between median levels of intake. Superscript letters (e.g. [a1], [a2]) denote statistically significant differences between intake values of dairy products in subsets of boys compared to the same subset of girls (*) indicates significance level $p < 0.05$ and (**) indicates significance level of $p < 0.01$

	N	(%)
Which milk does your child usually drink as a beverage?		
Fresh milk	36	24
Long-life milk	*70*	*46.7*
Concentrated milk	8	5.3
Formula milk	8	5.3
Reconstituted milk powder	28	18.7
Skim milk	9	6
Low-fat milk	29	19.3
Whole milk	*112*	*74.7*
Why do you encourage your child to consume dairy products? (choose one)		
My child likes it, it tastes good	*56*	*37.3*
Because of their nutritional content	15	10
As a part of a healthy diet	26	17.3
To help my children grow bigger and stronger	46	30.7
To help my child put on weight	7	4.7
What motivates you to buy dairy products? (choose one)		
Taste	57	38
Quality	*64*	*42.7*
Brand popularity	8	5.3
Good price	15	10
Nutrient value	6	4
At what meal does your child consume the most dairy products?		
Breakfast	*70*	*46.7*
Lunch	31	20.7
Dinner	49	32.7
Do you ensure that your child drinks milk every day?		
Always	*99*	*66*
Usually	28	18.7
Sometimes	21	14
Never	2	1.3
Do you ensure that your child's lunch box contains a milk beverage?		
Always	*78*	*52*
Usually	22	14.7
Sometimes	36	24
Never	14	9.3
Do you prepare a labneh (yogurt spread) or cheese sandwich for your child for school?		
Always	*61*	*40.7*
Usually	32	21.3
Sometimes	45	30
Never	12	8

Note: Italic font represents the response with the highest frequency

Table IV. Purchasing habits and milk drinking behavior as reported by parents

were excluded, dairy product intake of 9-11 year-old children was below the appropriate recommendations. The data showed that processed dairy products, including processed cheese, flavored milk and milk-based desserts, comprised a big portion of daily dairy product intake for all age groups. Consumption of processed dairy products was highest among the older children, indicating a decline in milk consumption starting before adolescence.

Nassar *et al.* (2014) found that adequacy of milk and dairy product intake among a group of 190 Kuwaiti adolescents aged 16-18 years (48.4 per cent males) was affected by intake of sweetened carbonated beverages and, to a lesser extent, by packaged fruit juices, both of which are inferior in nutrient density to milk and yogurt-based beverages. Such findings are concerning because the risk of becoming obese is increased 1.6-fold in children for each additional serving per day of non-nutrient-dense beverages. Milk and dairy products, in comparison with other beverages, are a good source of essential nutrients to ensure growth and development and improve overall diet quality (Spence *et al.*, 2011). Similar studies from other parts of the world, including France and Australia, have shown a decline in mean dairy intake as children grow older, with the most apparent decline noted in adolescents (Fayet *et al.*, 2013). This decline was mostly reported for regular milk intake and was associated with a reduction in breakfast consumption, which is a key behavior impacting milk intake as children age (Coxam *et al.*, 2015). Among children who continue to eat breakfast, milk is replaced by other processed dairy products or drinks, such as fruit juices and hot beverages (Coxam *et al.*, 2015). Among Turkish teenagers of age 6-18 years, Koca *et al.* (2017) showed that breakfast consumption decreased with age (79.1 per cent at 6-11 years vs 52.1 per cent at 12-18 years, $p < 0.001$), and with a high proportion of adolescents (64 per cent) reporting no consumption of dairy products. In a Brazilian sample of adolescents of age 10-19 years, Pereira *et al.* (2017) showed that even though coffee was the most frequently consumed beverage at breakfast, whole milk was also reported to be highly consumed. In addition, many studies in adolescents demonstrated that breakfast consumers had higher mean intake of calcium, phosphorous, thiamin, riboflavin and vitamins A, B6 and D because of the consumption of dairy products (Pereira *et al.*, 2017, Peters *et al.*, 2012). Many cultural differences exist in different countries regarding dietary habits, and breakfast choices and inclusion of dairy products may differ significantly Johansen *et al.* (2011).

The data in this study showed that regular milk consumption decreased in older children of both sexes and 47.8 per cent parents reported that their children consumed the majority of their daily dairy products at breakfast. Furthermore, other dairy products, such as yogurt, labneh and cheese, were consumed during other meals of the day and replaced regular milk intake. However, this study also showed that other dairy products, typically consumed outside of breakfast, such as fermented yogurt and Laban, did not replace milk intake as much as processed dairy products, including milk-based desserts, flavored milk and processed cheese. These dairy product choices may be driven by many influential factors, such as positive emotions including enjoyment and pleasure over the functional value on health (Rahnama and Rajabpour, 2017; Racey *et al.*, 2017). Higher consumption of cheese has been associated with higher intakes of saturated fat, trans-fatty acids and sodium (Campmans-Kuijpers *et al.*, 2016). Fermented products, such as Laban and yogurt, provide a more digestible form of dairy that is as nutritious as regular milk, providing calcium, protein and potassium. Therefore, the fermented products can easily help children and adolescents meet their RDA for these nutrients. In addition, fermented dairy products are associated with better diet quality and with lower body fat, lower risk for CVD and higher cardiorespiratory fitness (Koca *et al.*, 2017; Moreno *et al.*, 2015). Because this study did not evaluate the contribution of dairy product categories to the overall diet, it is unknown whether the decrease in consumption of milk and fermented products with age is associated with a decrease in diet quality in older children. Further investigations are needed to assess how much daily milk and laban may be being replaced by soft drinks or juices.

A sex-specific trend for dairy product intake was observed. For example, boys showed a higher intake of flavored milk and processed dairy products, whereas girls consumed more yogurt. Because of the study design, it is difficult to understand whether these sex-specific trends are related to parental influence on food choices (Shaban *et al.*, 2018). For example, girls may choose more yogurt and less flavored milk to mimic their mothers' dietary patterns or because of parental concerns about the daughters' weights. For boys, parents are usually less restrictive with food choices, care less about body weight issues and generally are more concerned about them growing taller and stronger. Obese children also consumed the least amount of flavored milk, which may also be reflective of a restrictive dietary pattern. While weight control issues were raised by some parents in this study, a consensus on the role of calcium from dairy products for normal growth and development and general bone health exists, and most parents encourage dairy product consumption (Rozenberg *et al.*, 2016).

Little is known about the influence of dairy product categories on body weight, body composition and growth in Kuwaiti children. Nezami *et al.* (2016) found that dairy product consumption is associated in both sexes with growth, but only in boys with body composition and central obesity. In boys, total dairy intake was associated with waist circumference ($\beta = 0.02$; 95 per cent CI: 0-0.04; $p = 0.039$), fat free mass ($\beta = 4.8$; 95 per cent CI: 1.8-7.9; $p = 0.002$), and fat mass ($\beta = 3.9$; 95 per cent CI: 6-7.2; $p = 0.021$), and cheese was associated with fat free mass ($\beta = 4.2$; 95 per cent CI: 0.9-7.5; $p = 0.01$). Such data are important in the development of dietary guidelines.

For Kuwaitis, there are no population-specific dietary guidelines, and international guidelines are usually used for dietary assessments. To achieve bone health, the Institute of Medicine Dietary Reference Intake committee set the recommended dietary allowances of calcium at 1,300 mg/day and of vitamin D at 600 IU/day for children 9-18 years old. The Dietary Guidelines for Americans recommend three servings per day of low- or non-fat dairy to meet this level of calcium and vitamin D intake (National Research Council, 2011). Adequate consumption of dairy products in line with food-based dietary guidelines can help meet nutritional requirements for calcium and other nutrients such as phosphorous, iodine, B12, potassium and magnesium (USA Department of Agriculture and USA Department of Health and Human Services, 2010).

Recent human and animal studies indicate that a higher calcium intake is associated with reduced body fat or smaller increases in body fat over time (Wang *et al.*, 2016). In adipose cells of transgenic mice, high calcium from a dairy-enriched diet reduces lipogenesis, stimulate lipolysis and reduces body fat accumulation, independent of the level of energy intake (Ping-Delfos and Soares, 2011; Soares *et al.*, 2012). Several studies showed an inverse relationship between obesity and dairy product intake in children Keast *et al.* (2015). This study did not establish an association with overweight and obesity because children with overweight and obesity were underrepresented in the study sample, due to the recruitment strategy, which was not representative of all Kuwaiti children. Individuals who are more interested in health and well-being, and therefore, are healthier than the general population, may have been selectively attracted. The latest population data published by the Kuwait Nutrition Surveillance System (KNSS) in 2015 ($n = 5444$) reported 15 per cent overweight and 20 per cent obese males, and 19 per cent overweight and 20 per cent obese females. For the KNSS report, recruitment of participants occurred in schools, clinics and hospital settings. A large sample of the population must be surveyed to evaluate such relationships with enough variability in weight status and intake. Nevertheless, similar to the KNSS, this study found that most children exceeded three servings of dairy products per day.

Because this SFFQ overestimated actual intake, the possibility that parents may have overestimated their child's intake by reporting what was usually served to the child rather than what was consumed cannot be excluded. Incomplete reporting may occur because of subjects not remembering what specific foods or beverages were consumed, inaccurately measuring or estimating portion sizes or purposely failing to report specific items. Conducting this type of research requires more effort and collaboration with school officials and government ministries to be reflective of the entire Kuwaiti population. Developing the Kuwaiti research culture is important, as often the lack of incentives for participants limits their interest in participating in research studies. Providing participants with easy-to-use booklets with guidelines for appropriate methods to estimate weight, and measure foods and beverages, training research assistants on how to record data and providing resources for recruitment and training can increase the accuracy of study results.

Conclusions

Most children meet the age- and sex-appropriate guidelines for dairy product intake according to the USDA *MyPlate* and AAP guidelines of two to three servings of milk per day. Dairy product intake exceeding the recommended level may be associated with feeding problems and an increased risk of overweight, obesity and anemia in children; and thus, requires further investigation when assessing dairy product intake. Age- and sex-appropriate dairy product intake in terms of serving sizes should be used to ensure that children meet their requirements without compromising their intake of other equally important food groups. Increased consumption of processed dairy products compared to healthier options should be addressed in relation to diet quality by dietitians and health educators in an effort to control sugar and fat consumption among children.

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