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**DEVELOPMENT OF A SEMI-QUANTITATIVE FOOD FREQUENCY
QUESTIONNAIRE FOR USE IN UNITED ARAB EMIRATES AND KUWAIT
BASED ON LOCAL FOODS**

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1 **ABSTRACT**

2 **Background** The Food Frequency Questionnaire (FFQ) is one of the
3 most commonly used tools in epidemiologic studies to assess long-term
4 nutritional exposure. The purpose of this study is to describe the development of
5 a culture specific FFQ for Arab populations in the United Arab Emirates (UAE)
6 and Kuwait.

7 **Methods** We interviewed samples of Arab populations over 18 years old in
8 UAE and Kuwait assessing their dietary intakes using 24-hour dietary recall.
9 Based on the most commonly reported foods and portion sizes, we constructed a
10 food list with the units of measurement. The food list was converted to a Semi-
11 Quantitative Food Frequency Questionnaire (SFFQ) format following the basic
12 pattern of SFFQ using usual reported portions. The long SFFQ was field-tested,
13 shortened and developed into the final SFFQ.

14 To estimate nutrients from mixed dishes we collected recipes of those mixed
15 dishes that were commonly eaten, and estimated their nutritional content by
16 using nutrient values of the ingredients that took into account method of
17 preparation from the US Department of Agriculture's Food Composition
18 Database.

19 **Results** The SFFQs consist of 153 and 152 items for UAE and Kuwait,
20 respectively and will be validated in the subsequent year. The participants
21 reported average intakes over the past year. On average the participants
22 reported eating 3.4 servings/d of fruits and 3.1 servings/d of vegetables in UAE
23 versus 2.8 servings/d of fruits and 3.2 servings/d of vegetables in Kuwait.

1 Participants reported eating cereal 4.8 times/d in UAE and 5.3 times/d in Kuwait.

2 The mean intake of dairy products was 2.2/day in UAE and 3.4 among Kuwaiti.

3

4 **Conclusion:** We have developed SFFQs to measure diet in UAE and
5 Kuwait that will serve the needs of public health researchers and clinicians and
6 are currently validating those instruments.

7

1 **BACKGROUND**

2 The residents of the Arab countries in the Persian Gulf region have become more
3 sedentary and have dramatically changed their diet over the last two decades.
4 They consume more fat, meat, sugar, rice and wheat flour than before (1-4).
5 This has resulted in a rise in obesity, diabetes, and cardiovascular disease
6 prevalence. There is a need to study the relation between diet and chronic
7 diseases in this population, but there is no customized instrument to do so. The
8 Food Frequency Questionnaire (FFQ) is the most commonly used method to
9 assess diet in relation to chronic disease (5). Based on a complete search of
10 the literature (using Medline medical subject heading and text words) and
11 personal communication with nutritionists in United Arab Emirate and Kuwait
12 Universities), we could not find a validated FFQ for use in these countries.
13 Hence, we decided to develop a SFFQ and accompanying food composition
14 database for UAE and Kuwait.

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16 **SUBJECTS AND METHODS**

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18 **Population** Our sample consisted of 326 apparently healthy persons of Arab
19 origin, between the ages of 18 and 65 years, living in UAE and Kuwait in 2003-
20 2004. Of these 126 provided information using the 24-hour dietary recall, and
21 200 participated in the testing of the long-FFQ in the SFFQ development and its
22 subsequent pilot testing.

1 **Development of the semi-quantitative food frequency questionnaire** To
2 develop the SFFQ we went through the following steps: construction of a food
3 list, definition of portion sizes, and assignment of frequency of consumption, pilot
4 test of long-FFQ and assembling the selected food list into SFFQ. We are
5 currently validating the shortened version of SFFQ.

6

7 **24-hour Dietary Recall (DR)** Qualified nutritionists interviewed the
8 participants. The nutritionists asked the participants what they ate in the
9 previous 24-hours in direct chronological order from the first foods in the morning
10 to the last foods before breakfast on the day of the interview. To standardize
11 data collection, we prepared a manual of procedures for the interviewers. The
12 interviewers used a food atlas modified from “Food portion sizes: A photographic
13 Atlas” (6) containing coloured pictures of 8 different portion sizes, of foods
14 commonly eaten in UAE and Kuwait.

15 We constructed a long food list from information we obtained from the 24-hour
16 dietary recalls, and supplemented it with foods derived from popular cookbooks,
17 and suggestions of experienced local dieticians. We obtained the range of
18 portion sizes from the 24-hour dietary recall and cookbooks. For items such as
19 eggs we considered one of those items as a portion. For fruits such as banana
20 or orange, a medium size was considered to be as a “unit” of the fruit. For foods
21 with non-unitary measures, such as grapes, we considered $\frac{1}{2}$ cup to be one unit.
22 For other foods one unit of a utensil that was mostly reported by respondents

1 was assumed as one portion size. To get an estimate of the usual portion we
2 used the mode of the portion size distribution for each food reported.

3 We formatted the SFFQ based on the pattern of the Harvard FFQ. We organized
4 the main foods by the traditional food groups into seven food categories: Milk,
5 milk product and fats (including milk with different amount of fat, Labnah, etc.),
6 vegetables (fresh or cooked), fruit, meat, eggs and meat products (including
7 meat organs), cereal and cereal product, beverages, herbs and spices,
8 processed food and mixed dishes. We also asked about consumption of sweet
9 and baked goods (faaloodah, baklava, etc.) and nuts like almond, and hamoose.

10 To distinguish the fibre content of the diet and the quality of carbohydrates, we
11 differentiated between the types of consumed cereal and cereal product (white or
12 wholemeal bread, whole grain). In the last section of the FFQ we asked about
13 type of cooking oils and fats and also, minerals including calcium, iron and zinc
14 and multivitamins.

15 We used 9 categories to assess frequency of intake varying from “never or less
16 than once a month to 6 or more time per day. For each food item, participants
17 indicate their average frequency of consumption over the past year of a specified
18 serving size by checking 1 of the 9 frequency categories. For foods that contain
19 an extremely high amount of a particular nutrient but are used infrequently, such
20 as liver, we re-categorized the options for frequency of intake. For instance, we
21 used eliminated options of higher intake (once per day) but distinguished
22 between never and less than once a month at the lower end. We will compute
23 the daily intake based on the midpoint of the reported frequency category for

1 each food item; for example we will take a response of “2-4/week” to be 3/7 or
2 0.43 times/day.

3 Although most fruits and vegetables are available the year round in UAE in
4 Kuwait, their intakes may vary depending upon cost and cultural preferences of
5 foods by season. For this reasons we designed specific questions for fruit and
6 vegetable consumption by season. We determined the length of the season from
7 local experts who used their experience.

8 We pilot tested the long-FFQ among 200 participants from the same populations
9 (but not those who participated in the 24hr DR). The objectives were to
10 determine the completeness of the food list and to shorten the food list by
11 deleting foods that were not commonly consumed. Based on the analysis of the
12 pilot we completed the food list and created SFFQ known as SFFQ1.

13 **Food Composition Database**

14 We will use the food composition database to convert intakes of foods into
15 nutrients. We constructed one nutrient database for UAE and Kuwait, as most
16 foods are similar in both countries. We extracted the nutrient contents of the
17 food items from Table SR17 of the USDA food database which is available online
18 as the starting point to establish database
19 (<http://www.nal.usda.gov/fnic/foodcomp/Data/SR17/sr17.html>). From SR17 we
20 chose those varieties of food items which are not very specific to a region and
21 are more representative, for example; for apple we chose “apples, raw, with skin
22 (NDB No:09003)” or for orange, we chose “oranges, raw all commercial varieties

1 (NDB No: 09200)". But for mixed dishes we created a new nutrient database
2 appropriate for local foods (Table 7).

3 To obtain the nutrient content of local foods a local nutritionist collected 2 recipes
4 from each low, middle and high-income family. We supplemented these recipes
5 from the "Food composition: Kuwaiti composite dishes" (7) and other popular
6 cookbooks. The average of ingredients from those recipes was used to create a
7 base recipe for the nutrient database. We matched ingredients of the recipes
8 with the appropriate food items in the USDA database to obtain nutrient content,
9 taking cooking method into account.

10 Over the next year, we will invite a sample of 400 cohort members to participate
11 in a dietary assessment validation study. To minimize within person and
12 seasonal variations, we will collect four 24hr DRs in different seasons from them.
13 Then, we will compare food and nutrient intakes estimated from the SFFQ with
14 the mean intake estimated from these four 24-hour diet recalls. To assess
15 reproducibility we will repeat the SFFQ two times over the next year. We use
16 Statistical analyses SPSS 10.1 for windows (SPSS Inc, Chicago IL) for all
17 analyses.

18 **Results**

19 There were 326 participants with different occupations in Kuwait and UAE in our
20 study. The populations were similar in UAE and Kuwait with respect to age, sex
21 distribution, and BMI, but Kuwaiti women had higher education levels than those
22 in UAE (Tables 1 and 2). No significant differences were noted between female
23 and male respondents with respect to BMI ($P=0.4$, 0.5 for UAE and Kuwait,

1 respectively). However, in UAE women had a higher mean of BMI than men
2 while in Kuwait men were heavier than women.

3 **Frequency of consumed food**

4 Tables 3 and 4 show the frequency of consumption of some foods in UAE and
5 Kuwait. About 32% of respondents in UAE and 26% of Kuwaiti reported that they
6 had at least one glass of milk daily on average in the past year. Sixty-eight
7 percent of the UAE and 48% of Kuwaiti participants reported consuming rice
8 once per day. 67% and 51% of people (UAE and Kuwaiti respectively) ate an
9 egg at least 2 times/week. Overall in UAE, 86% of participants did not eat
10 chicken with skin while 42% of Kuwaitis did not eat chicken with skin. Among
11 fruits, apple, oranges and bananas were consumed very frequently.

12 **Daily food intake**

13 The estimated daily intakes of seven major food groups among Kuwaiti and UAE
14 men and women are shown in Tables 5 and 6. On average the participants
15 reported eating 3.4 servings/d of fruits and 3.1 servings/d of vegetables in UAE
16 versus 2.8 servings/d of fruits and 3.2 servings/d of vegetables in Kuwait.
17 Cereals are important staples in the diet of both countries and the participants
18 reported eating cereal 4.8 times/d in UAE and 5.3 times/d in Kuwaiti. All
19 participants reported consuming cereals at least once per day. Meat was
20 consumed nearly two times/day in both countries and among the meat group
21 poultry was consumed more often than red meat or fish. The mean intake of
22 dairy products was 2.2/day in UAE and 3.4/day Kuwait.

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2 **Discussion**

3 In this paper we have described the development of a semi-quantitative FFQ and
4 food composition database for the Arab population in UAE and Kuwait. The
5 goals of diet assessment in epidemiologic studies are to obtain a measure of
6 usual rather than current diet, and rank people by intake, in contrast to clinical
7 settings where current absolute intake is more important. The FFQ has been
8 developed with these purposes in mind and has become the standard method to
9 collect dietary data in studies of chronic disease all over the world. We opted to
10 use a semi-quantitative FFQ, which estimated food intake in categories rather
11 than the exact frequency, because it has been shown that there is minimal loss
12 of information in estimating nutrient intakes using food intake categories (8). We
13 also asked the participants about intakes of pre-specified portion sizes rather
14 than asking them to estimate their regular portion size. Correlations for nutrient
15 intake calculated using the FFQ with and without taking portion sizes into
16 account were over 0.9 (5). The advantage of using categories to estimate food
17 intake, and pre-specified portion sizes are that the SFFQ becomes easier to
18 administer, and likely more reliable. We did not attempt to make a
19 comprehensive list of foods to include in the SFFQ. Rather, we kept items in the
20 SFFQ if they were nutrient rich, consumed frequently and discriminated intake
21 between individuals. The other criterion we considered together with the nutrient
22 content (including caloric value) was the presence of other substances of
23 interest, for instance caffeine. Most FFQs have between 100-150 items (9) and

1 our SFFQ has 153 (UAE) and 152 (Kuwait) items. Increasing the number of
2 items in the FFQ has been shown to increase over-reporting (10).

3 To estimate nutrient intake from SFFQ, there is a need for a food composition
4 table listing the average nutrient content of foods contained in the SFFQ. To
5 obtain nutrient intake we multiply the average nutrient content of a specified
6 portion of food listed in the food composition table by the average frequency of
7 intake reported in the SFFQ. The food composition table can be a substantial
8 source of variation in the estimation of nutrients using the SFFQ. As no
9 nutritional database has ever been gathered in UAE or Kuwait, we used the US
10 Department of Agriculture nutrient database as our standard to estimate nutrient
11 content. The advantages of this approach are: First, the USDA food composition
12 database is probably the most comprehensive in the world. For example, there
13 are 26 categories of spinach including different types of spinach, raw spinach,
14 and spinach cooked in a variety of ways (11), allowing us to choose the most
15 appropriate one. Second, the nutrient estimation assays have been done in a
16 standardized manner. Third, it has the largest number of nutrients reported.
17 Fourth, the USDA food composition database is continually updated. Last, UAE
18 and Kuwait import foods from all around the world and mixture of food items from
19 different region are available in the market. For mixed dishes that were not listed
20 in the USDA database we calculated nutrient intake by analyzing recipes.
21 Moreover, there are nearly 150 food composition tables in use around the world
22 and their values are primarily based on USDA (12-14), and even European
23 countries include nutrient information from USDA to their food composition table

1 (15;16). Finally, similar approaches have been taken by other investigators in
2 Israel, (17) and Costa Rica (18).

3 A limitation of this study is that we are using 24-hour dietary recall instead of food
4 diaries to validate the SFFQ. However, the 24-hour dietary recall has been used
5 in such circumstances for validation. The age group represented in UAE and
6 Kuwait sample are mostly <50 years for both males and females, thus the overall
7 impression in the dietary habits is biased towards the younger group. For
8 example the consumption of rice as well as dates might be underestimated. The
9 way to make it more accurate is of course to repeat it (validate). Another
10 limitation of is that most participants from both countries were women and some
11 foods which men may eat may be underestimated. However, a nutritionist with
12 experience in those countries reviewed the food lists to ensure the
13 completeness.

14 **Conclusion:** The validated questionnaire and food composition database will
15 not only be useful tools for our own study, but they will also be assets that other
16 researchers in the region can use or adapt to suit their needs. We have
17 enclosed two SFFQs in this article so other researchers in the field of public
18 health can use this comprehensive SFFQ. We are evaluating SFFQs and the
19 validated SFFQ will be available online for all public health researchers in the
20 region.

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Table1 Demographic characteristics of UAE participants

	Men (N=35)	Women (N=91)	Overall (N=126)
Age	43.0±11	34.3±10	37.0±11
BMI (kg/m ²)	27.4±4	28.7±7	28.3±7
Education			
None	22.7%	10%	13%
Primary school	9.0%	8%	9%
Secondary school	23%	30%	31%
Trade School	32%	3%	2%
University	23%	49%	45%
Income (Dirham)			
<5000	12.5%	9%	11%
5001-10000	12.5%	63%	60%
10001-15000	19%	24%	22%
>15000	12.5%	4%	6%

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Conversion rate for US \$

1 Dirham = 0.3 US\$

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Table2 Demographic characteristics of Kuwaiti participants

	Men (N=56)	Women (N=145)	Overall (N=201)
Age	45.6 ±14.0	37.3±12	39.6±13.3
BMI (kg/m ²)	26.6±7	25.9±5	26.0±6
Education			
None	0%	0%	0%
Primary school	0%	5%	4%
Secondary school	32%	18%	21%
Trade School	5%	4%	4%
University	64%	72%	70%
Income			
<500	68%	31%	61%
501-1000	32%	54%	36%
>1000	0%	15%	3%

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Conversion rate for \$US

1 Dinar = 3 US\$

- 1 **Table 3** Frequency of Food Consumption reported by UAE
- 2 Participants (Men=24, women=76) reported on the long-FFQ (values
- 3 are in percent)

Foods	Frequency of Consumption					
	Never/ <1/mo	1-3/mo	1/wk	2-4/wk	1/d	>1/d
Dairy Products						
Whole milk						
Men	26	4	0	22	44	4
Women	48	7	5	13	26	1
Overall	43	6	4	15	30	2
White Cheese						
Men	17	9	13	44	17	0
Women	21	14	12	25	27	1
Overall	20	13	12	29	25	1
Cereal and cereal Products						
White bread						
Men	9	9	17	48	17	0
Women	13	25	26	13	21	3
Overall	12	21	24	21	20	2
Rice						
Men	0	0	4	9	74	13
Women	3	1	8	21	66	1
Overall	2	1	7	18	68	4
Meat, eggs						
Eggs						
Men	0	4	4	44	48	0
Women	7	14	20	33	27	0
Overall	5	12	16	35	32	0
Chicken with skin						
Men	74	0	0	13	13	0
Women	90	4	3	4	3	0
Overall	86	1	2	6	5	0
Chicken without skin						
Men	17	0	0	52	30	0
Women	3	3	3	71	20	1
Overall	6	2	2	67	22	1

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- 1 **Table 3 con't** Frequency of Food Consumption reported by UAE
- 2 Participants (Men=24, women=76) reported on the long-FFQ (values are
- 3 in percent)

Foods	Frequency of Consumption					
	Never/ <1/mo	1-3/mo	1/wk	2-4/wk	1/d	>1/d
Beef as main dish						
Men	0	13	26	61	0	0
Women	20	33	22	26	0	0
Overall	15	28	23	34	0	0
Fruits						
Apple						
Men	0	4	13	39	35	9
Women	14	14	20	33	20	0
Overall	11	12	18	34	23	2
Bananas						
Men	4	4	17	44	17	13
Women	14	23	38	18	7	0
Overall	12	19	33	24	9	3
Vegetables						
Spinach						
Men	61	17	9	13	0	0
Women	43	29	18	8	3	0
Overall	47	26	16	9	2	0
Potatoes						
Men	35	17	13	30	4	0
Women	48	17	12	12	12	0
Overall	45	17	12	16	10	0

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- 1 **Table 4** Frequency of Food Consumption reported by Kuwaiti
- 2 Participants (Men=22, women=78) reported on the long-FFQ
- 3 (values are in percent)

Foods	Frequency of Consumption					
	Never/ <1/mo	1-3/mo	1/wk	2-4/wk	1/d	>1/d
Dairy Products						
Whole milk						
Men	51	13	4	6	22	4
Women	41	5	9	18	9	18
Overall	49	11	5	9	19	7
White Cheese						
Men	9	14	14	32	23	9
Women	18	17	15	24	21	5
Overall	16	16	15	26	21	6
Cereal and cereal Products						
White bread						
Men	36	9	5	18	18	14
Women	31	18	13	12	22	5
Overall	32	16	11	13	21	27
Rice						
Men	0	0	0	18	68	14
Women	6	6	12	27	42	6
Overall	5	5	9	25	48	8
Meat, eggs						
Eggs						
Men	18	14	9	32	18	9
Women	8	22	22	26	19	4
Overall	10	20	19	27	19	5
Chicken with skin						
Men	59	0	5	27	9	0
Women	37	13	5	27	17	1
Overall	42	10	5	27	15	1
Chicken without skin						
Men	23	5	14	41	18	0
Women	28	8	10	40	13	1
Overall	27	7	11	40	14	1

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- 1 **Table 4 con't** Frequency of Food Consumption reported by Kuwaiti
- 2 Participants (Men=22, women=78) reported on the long-FFQ (values are
- 3 In percent)

Foods	Frequency of Consumption					
	Never/ <1/mo	1-3/mo	1/wk	2-4/wk	1/d	>1/d
Beef as main dish						
Men	27	23	18	27	5	0
Women	37	26	17	17	4	0
Overall	35	25	17	19	4	0
Fruits						
Apple						
Men	0	41	23	18	14	5
Women	15	24	18	18	22	3
Overall	12	28	19	18	20	3
Bananas						
Men	5	9	18	41	27	0
Women	18	32	14	17	14	5
Overall	15	27	15	22	17	4
Vegetables						
Spinach						
Men	64	27	9	0	0	0
Women	51	33	5	9	1	0
Overall	54	32	6	7	1	0
Potatoes						
Men	55	9	14	23	0	0
Women	37	22	19	15	6	0
Overall	41	19	18	17	5	0

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Table 5 Average daily intake of main foods estimated by long-FFQ reported by UAE participants (Men=24, Women=76)

Sex	Foods	Min	Max	Mean	Std. Deviation
Women	Fruits	0.2	8.5	3.0	1.7
	Vegetables	0.4	7.9	3.0	1.5
	Dairy products	0.0	5.2	2.1	1.0
	Meat	0.6	4.2	1.7	0.7
	Cereals and cereal products	0.7	10.7	4.7	2.2
Men	Fruits	1.8	8.8	4.8	2.0
	Vegetables	0.3	6.6	3.7	1.6
	Dairy products	0.4	7.0	2.5	1.3
	Meat	0.6	4.4	2.3	0.9
	Cereals and cereal products	1.5	6.6	5.0	1.2
Overall	Fruits	0.2	8.8	3.4	1.9
	Vegetables	0.2	7.9	3.1	1.6
	Dairy products	0.2	7.1	2.2	1.1
	Meat	0.6	4.4	1.9	0.8
	Cereals and cereal products	0.7	10.8	4.8	2.0

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Table 6 Average daily intake of main foods estimated by long-FFQ reported by Kuwaiti participants (Men=22, Women=78)

Sex	Foods	Min	Max	Mean	Std. Deviation
Women	Fruits	0.4	8.1	2.8	1.7
	Vegetables	0.0	10.5	3.3	2.2
	Dairy products	0.0	9.7	3.3	2.3
	Meat	0.2	9.9	1.8	1.3
	Cereals and cereal products	0.7	20.1	4.9	3.2
Men	Fruits	0.5	7.3	3.1	1.8
	Vegetables	0.3	6.5	3.0	1.9
	Dairy products	0.4	6.6	3.5	1.7
	Meat	0.4	6.6	2.5	1.6
	Cereals and cereal products	2.3	12.8	6.5	2.4
Overall	Fruits	0.4	8	2.8	1.7
	Vegetables	0.00	10.5	3.2	2.1
	Dairy products	0.00	9.7	3.4	2.3
	Meat	0.2	9.9	1.9	1.4
	Cereals and cereal products	0.7	20.1	5.3	3.1

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Table 7: Nutrient composition per serving (100g) of some commonly eaten foods in UAE and Kuwait

Food	Total calories (Kcal)	CHO (g)	Fat (g)	Protein (g)	Fiber (g)	Vitamins (mg)							Ca (mg)	Phosp hours (mg)	Iron (mg)
						A (RE, μ)	Folate(μ)	B1	B6	B12	C	E (α)			
<u>Mixed dish</u>															
Kofta	173	3.1	11.1	15.0	0.6	63.1	14.1	0.09	0.26	1.7	12.6	0.1	23.7	128	1.6
Qouzi	206	15.0	11.2	10.5	0.6	5.1	36.7	0.1	0.1	0.9	2.3	0.3	18.0	90.3	1.4
Marga Laham	95	7.1	4.0	7.5	0.8	19.0	4.6	0.07	0.2	0.7	7.0	0.04	7.1	65.4	0.8
Jereesh	226	29.7	7.0	12.9	5.2	13.9	22.7	0.2	0.2	0.7	3.5	0.4	21.1	252	2.1
<u>Sweets</u>															
Balalett	210	35	4.7	6.6	0.1	Trace	10	0.01	0.06	Trace	Trace	0.5	28.5	105	1.5
Elba	264	30.6	12.6	11.3	Trace	206	25	0.1	0.1	1.3	1.1	0.6	522	356	2.1

LIST OF ABBREVIATIONS

SFFQ	Semi-Quantitative Food Frequency Questionnaire
24hr DR	24 hour Dietary Recall
UAE	United Arab Emirates
PURE	Prospective Urban and Rural Epidemiologic
SPSS	Statistical Packages for Social Sciences

AUTHORS CONTRIBUTIONS

- MD Participate in design of study, coordinate and performed statistical analysis, drafted the manuscript
- AM Participate in design of study, performed statistical analysis, helped to draft the manuscript
- NH Coordinate study in Kuwait, helped to draft the manuscript
- AY Facilitated data collection in UAE, helped to draft the manuscript
- FN Coordinate study in UAE
- SY Participate in design of study, helped to draft the manuscript

All authors read and approved the final manuscript.

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