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Evaluation of the Diet in Medical and Para-Medical Students Using Diet Quality Index

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Abstract

Western lifestyle has rapidly been adopted and this has caused changes in dietary habits, types of food, cooking methods, etc. especially among the young Saudi population. We aimed to assess the overall diet quality of young adults.

A total of 140 students were included from the medical and para-medical students of King Abdulaziz University, Jeddah, Kingdom of Saudi Arabia in a cross sectional study. A structured questionnaire was self-administered including socio-demographic characteristics, semi-quantitative pre-validated food frequency questionnaire (FFQ) from which dietary quality index international (DQI-I) was estimated.

It was evident that poor dietary quality, as assessed by DQI-I, was common among the study cohort. FFQ data analysis clearly shows that the study participants were not adherent to the dietary guidelines. Score values of DQI-I and its components were indicative of inadequacy, imbalance, lack of moderation and diversity of nutrients and food items. Positive correlation was observed between DQI-I and some of its components with living arrangement and residency type as indicators of socioeconomic status.

Appropriate indices should be developed for Saudi people, based on the recommendations specific for certain age groups like children, adolescents and young adults.

Abbreviation

DQI-I: Dietary Quality Index International;
FFQ: Food Frequency Questionnaire;
KAU: King Abdulaziz University;
KSA: Kingdom of Saudi Arabia;
MUFA: Monounsaturated Fatty Acids;
PUFA: Polyunsaturated Fatty Acids;
SFA: Saturated Fatty Acids

Introduction

Nutrition plays an important role in the etiology of many conditions including: cardiovascular diseases, diabetes, hypertension and obesity [1]. Micronutrients present in foods, such as iron, zinc, copper and selenium, are essential components of several enzymes involved in inflammatory and metabolic pathways and may contribute to the associations between certain foods and disease [2,3].

These diseases have also been strongly associated with unhealthy lifestyle habits, including lack of exercise, smoking, caffeine overuse and improper sleeping habits [4]. Western lifestyle has rapidly been adopted and this has caused changes in dietary habits, types of food, cooking methods, etc. especially among the young Saudi population [5,6].

Although most studies examine single nutrients and foods or food groups, few examine acculturation in rela¬tion to indicators of diet quality. The latter has led to the development of methods suitable for the characterization of dietary patterns [7]. Diet indices represent a measure of healthy eating patterns are known by various names like diet quality indices [8]. Indexes such as the Diet Quality Index [9] and Healthy Eating Index [10] provide quantitative measures of overall intake relative to di¬etary guidelines and have been associated with chronic disease risk and mortality [11].

Diet indices are integrated measures of healthy eating patterns and have a number of potential uses [7]. When based on dietary guidelines, they represent the best available evidence and consensus of what constitutes a healthy diet. They can be used in epidemiological studies either to investigate associations of overall healthy eating patterns and health outcomes or investigate interactions with other health behaviors or as a confounder in other disease [11,12]. They may also have important uses in studying the behavioral determinants of healthy eating patterns where an integrated measure of diet can be used as the outcome of interest.

Dietary Guidelines and recommendations for Saudi are recently issued by the Saudi Ministry Of Health for maintaining health and reducing risk of chronic diseases [13]. The Food Guide Palm was created to provide more specific guidance in selection and quantity of daily food choices. Therefore, it seemed informative to assess and monitor adherence to these guidelines through a dietary scoring system to rate the quality of diet among Saudi youth.

In the present study we aimed to assess the overall diet quality of young adults [medical and para-medical students of King Abdulaziz University (KAU), Jeddah, Kingdom of Saudi Arabia (KSA)].

Methods

Study design

A cross sectional study was conducted from November 2014 to April 2015 in KAU medical faculty and Hospital. A total of 140 students were included from the medical and para-medical students. Subjects being invited responded voluntarily. The purpose of the study was explained to each participant as was the method of completing the questionnaire. All participants provided informed consent to a protocol approved by the local Ethical Review board of KAUH.

Study participants

Inclusion criteria for respondents include: all male and female medical and paramedical students aged between 19-23 years. Moreover, students with a clinically diagnosed chronic illness or on a prescribed medication, pregnant females and those outside the age bracket were excluded.

Data collection

A structured questionnaire was self-administered and reviewed for completeness and accuracy upon their completion.The questionnaire was divided into sections. Section 1 contained information on socio-demographic variables and self-assessed health status collected by means of 10 questions. They include information about age and gender, racial background, marital status, parents' level of education and employment status, type of residency and living arrangement (i.e., living with family or living in the students' dormitories), personal medical history, family history of any disease, medication use and use of dietary supplementation if any. Respondent's self-reported race and ethnicity were categorized into six groups.

Section 2 of the questionnaire included a 92-item semi-quantitative pre-validated food frequency questionnaire (FFQ) which was used to estimate energy and nutrients intake of the study participants as well as to assess their dietary quality. The reliability and validity of the FFQ have been evaluated previously among participants of a population that is comparable to our present study subjects attending health examination clinics [14]. Participants were questioned about their average intake and the specified serving portion size for each food over the past year. For each food item on the questionnaire, five responses were possible, ranging from "almost never" to "2-4 times a day." Frequencies and portions for the individual food items were converted to average daily intake of macro- and micronutrients for each participant including carbohydrates, total fat, proteins, saturated fat, monounsaturated fatty acids, polyunsaturated fatty acids, fiber, cholesterol, vitamin E, vitamin C, vitamin D, sodium, iron, calcium, selenium, zinc and copper.

To control for total energy intake, all nutrients were adjusted for total energy intake by using the regression residual method [15]. Implausible energy intakes (i.e., <500 kcal/day or >4500 kcal/day) were excluded.

The nutrient database used was based on UK food composition tables [16] together with food composition tables for use in East Asia and the US handbook of food composition [17]. The composition of traditional local foods, not included in the above tables, was derived from another local study [18]. The estimated dietary intake of all nutrients was calculated in terms of percentage recommended nutritional intake for Saudi adults for each individual [13].

Dietary quality index international (DQI-I), as presented in Table (1), is comprised of many components distributed within four categories: variety, adequacy, moderation, and overall balance [19]. Variety in the diet is evaluated in two ways, i.e., overall variety and variety within protein sources, to assess whether intake comes from diverse sources both across and within food groups. Adequacy evaluates the intake of dietary elements that must be supplied sufficiently to guarantee a healthy diet, as a precaution against under nutrition. The scores for the eight components in the category (vegetables; fruits; grains; fiber; protein; iron; calcium and vitamin C) are assigned on the basis of the percentage attainment of the recommended intakes on a continuous scale. Moderation evaluates the intake of food and nutrients that are related to chronic diseases and that may need restriction. Certain levels of total fat, saturated fat, cholesterol and sodium are necessary for the body to function normally, but when taken in excess may contribute to the onset of chronic diseases. The final category examines overall balance of diet in terms of proportionality in energy sources and fatty acid composition. Four aspects of a healthy diet comprise the four main categories of the DQI-I. Under each of these categories, there are specific components of diet to be assessed. Scores for each component are summarized in each of the four main categories, and the scores for all four categories are summed, resulting in the total DQI-I score, ranging from 0 to 100 (0 being the poorest and 100 being the highest possible score). AI: adequate intake; FA: fatty acids; M:S monounsaturated fatty acids: saturated fatty acids; P:S polyunsaturated fatty acids: saturated fatty acids; RDA: recommended daily allowance

Statistical analysis

Data are expressed as mean ± standard deviation for numeric variables and as frequency or proportion for categoric variables. Kolmogorov-Smirnov test was used to assess if the data were distributed normally. Differences in means was assessed by student t-test or $\chi 2$ test for numeric and categoric variables respectively. Correlations between continuous variables were assessed with the use of Spearman correlation rank test. All the analyses were done using the Statistical Package for Social Sciences (SPSS) version 20.0. All reported P values were two-tailed and p values < 0.05 were considered statistically significant.

Results

In total, 140 students (52 males, 88 females) were included in the study. The percentage of medical and paramedical students was approximately equal (52% and 48% respectively). The mean age of study participants was 21.2 ± 0.1 years (Table 2). Both groups were comparable in terms of their residency types, parents education levels and occupation (p>0.05).

Table (1): DQI-I components (Source: Kim et al.,2003)

Component	Score	Scoring criteria
Variety		
Overall food group variety (meat/poultry/fish; dairy products; beans; grains; fruits; vegetables)	15	≥1 serving/day from each food group
	12	Any 1 food group missing
	9	Any 2 food groups missing
	6	Any 3 food groups missing
	3	≥4 food groups missing
	0	None from any food groups
Within-group variety for protein source (meat; poultry; fish; dairy products; beans)	5	≥0.5 serving/day from ≥3 different sources
	3	≥0.5 serving/day from 2 different sources
	1	≥0.5 serving/day from 1 source
	0	None
Adequacy		
Vegetable group	5	≥3-5 servings/day
	0	0 servings/day
Fruit group	5	≥2-4 servings/day
	0	0 servings/day
Grain group	5	≥6-11 servings/day
	0	0 servings/day
Fiber	5	≥20-30g/day
	0	0 g/day
Protein	5	≥10% of energy
	0	0% of energy
Iron	5	≥100% RDA
	0	0% RDA
Calcium	5	≥100% AI
	0	0% AI
Vitamin C	5	≥100% RDA
	0	0% RDA
Moderation		
Total fat	6	≤20% of total energy
	3	>20-30% of total energy
	0	>30% of total energy
SFA	6	≤7% of total energy
	3	>7-10% of total energy
	0	>10% of total energy
Cholesterol	6	≤300mg/day

Total fat	6	≤20% of total energy
	3	>20-30% of total energy
	0	>30% of total energy
SFA	6	≤7% of total energy
	3	>7-10% of total energy
	0	>10% of total energy
Cholesterol	6	≤300mg/day
	3	>300-400mg/day
	0	>400mg/day
Sodium	6	≤2400mg/day
	3	>2400-3400mg/day
	0	>3400mg/day
Empty calorie foods	6	≤3% of total energy
	3	>3-10% of total energy
	0	>10% of total energy
Overall balance		
Macronutrient ratio (carbohydrates: proteins: fat)	6	55-65:10-15:15-25
	4	52 to <55 or >65 to 68: 9 to <10 or >15 to 16: 13 to >15 or >25 to 27
	2	50 to <52 or >68 to 70: 8 to <9 or >16 to 17: 12 to <13 or >27 to 30
	0	Otherwise
FA ratio	4	P:S ration 1-1.5 and M:S ratio 1-1.5
	2	P:S 0.8 to <1 or >1.5 to 1.7 and M:S 0.8 to <1 or >1.5 to 1.7
	0	Otherwise

There was no significant difference between male and female students in socio-demographic characteristics except for their living arrangement (p<0.0001) and smoking habits (p<0.05).

Table (2): Socio-demographic characteristics of the study cohort

	All (N=140)	**Females (n=88)**	**Males (n=52)**	**p**
Age (years)	21.2±0.1	21.3±0.1	20.9±0.1	NS
College				
Medical	87 (62)	54 (61)	33 (64)	NS
Para-medical	57 (38)	34 (39)	19 (36)	
Level				
Second	24 (17)	13 (25)	13 (25)	
Third	89 (64)	31 (60)	31 (60)	NS
Fourth	27 (20)	8 (15)	8 (15)	
Marital status				NS
Single	133 (95)	81 (92)	52 (100)	
Married	7 (5)	7 (8)	0 (0)	
Living arrangement				
students dorm	19 (14)	3 (3)	16 (31)	<0.0001
living alone	4 (3)	4 (5)	0 (0)	
with parents	117 (84)	81 (92)	36 (69)	

Residency types				
Rented flat	44 (31)	23 (26)	21 (40)	NS
Rented villa	2 (1)	2 (2)	0 (0)	
Owned flat	40 (29)	26 (30)	14 (27)	
Owned villa	54 (39)	37 (42)	17 (33)	
Father education				
High school graduate College	54 (39)	31 (35)	23 (44)	NS
degree	56 (40)	41 (47)	19 (37)	
Postgraduate degree	28 (20)	16 (18)	10 (19)	
Mother education				
Secondary school or less	40 (29)	20 (23)	20 (39)	NS
High school graduate College	28 (20)	20 (23)	8 (15)	
degree	55 (39)	34 (39)	21 (40)	
Postgraduate degree	17 (12)	14 (16)	3 (6)	
Father occupation				
Retired/ unemployed	54 (39)	31 (35)	23 (44)	NS
Government officer	19 (14)	10 (11)	9 (17)	
Businessmen	60 (43)	41 (47)	19 (37)	
Skilled professional	7 (5)	6 (7)	1 (2)	
Mother occupation				
Housewives	82 (59)	47 (53)	35 (67)	NS
Government officer	56 (40)	39 (44)	17 (33)	
Businesswomen	0 (0)	0 (0)	0 (0)	
Skilled professional	2 (1)	2 (2)	0 (0)	
Smoking habits				
Nonsmoker	134 (96)	87 (99)	47 (90)	<0.05
Ex-smoker	1 (1)	0 (0)	1 (2)	
Current smoker	5 (4)	1 (1)	4 (8)	

Numeric data are presented as mean ± SD and categorical data as number and percentage. Categorical data were compared by $\chi 2$ test; continuous variables were compared by unpaired t test for normally distributed parameters or Mann-Whitney test for non-normally distributed parameters. Current smoking is defined as smoking at least 1 pack of cigarettes per week and/or 1 shisha (Hookah) per week.

The mean daily energy intake was 2224.7 ±124.2 and 2580.4 329.2 kcal for female and male students respectively. Intakes of macro- and micronutrients are displayed in Table (3).

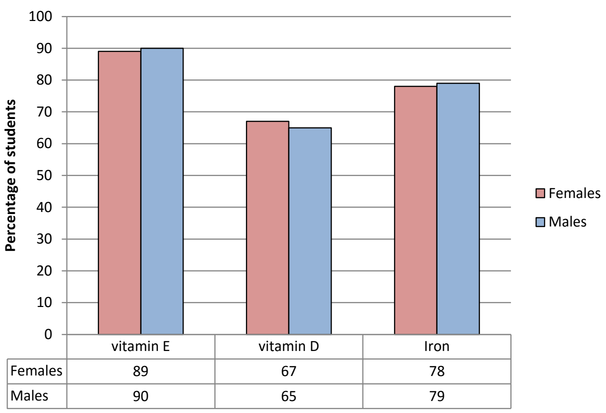
Table (3): Daily energy and nutrients intakes of the study cohort.

	RNI	All (N=140)	Females (n=88)	Males (n=52)	p
Energy (Kcal)	2550 ♂ 2110 ♀	2261.5±122.7	2224.7 ±124.2	2580.4 ±329.2	NS
Carbohydrate (gm)		262.1±13.0	258.4 ±14.4	295.7 ±32.1	NS
Energy-adjusted carbohydrate (gm)		232.8±0.08	232.8 ±0.1	233.0 ±0.2	NS
% of energy from carbohydrates	55%	47.1±0.5	46.7 ±0.7	47.4 ±1.1	NS
Total fat (gm)		96.5±6.0	94.9 ±5.7	111.6 ±16.9	NS
Energy-adjusted fat (gm)		82.2±0.08	82.2 ±0.1	82.4 ±0.2	NS
% of energy from fat	30%	37.8±0.5	38.1 ±0.6	37.5 ±0.9	NS
Protein (gm)		86.0±4.8	84.2 ±4.7	98.3 ±13.3	NS
Energy-adjusted protein (gm)		72.8±0.08	72.8 ±0.1	73.0 ±0.2	NS
% of energy from protein	15%	15.2±0.2	15.2 ±0.2	15.1 ±0.3	NS
SFA (gm)		33.4±2.0	33.0 ±1.9	38.6 ±5.6	NS
Energy-adjusted SFA (gm)		27.6±0.08	27.6 ±0.1	27.8 ±0.2	NS
% of energy from SFA	10%	14.4±0.2	14.7 ±0.3	14.4 ±0.4	NS
MUFA (gm)		32.5±2.0	32.4 ±1.9	36.9 ±5.6	NS
Energy-adjusted MUFA (gm)		27.4±0.08	27.4 ±0.1	27.6 ±0.2	NS
% of energy from MUFA	10%	14.1±0.2	14.5 ±0.3	13.8 ±0.4	NS
PUFA (gm)		17.1±1.2	16.5 ±1.1	20.5 ±3.5	NS
Energy-adjusted PUFA (gm)		13.7±0.08	13.7 ±0.1	13.9 ±0.2	NS
% of energy from PUFA	10%	7.24±0.17	7.35 ±0.2	7.63 ±0.4	NS
Cholesterol (mg)	200	411.1±23.4	401.7 ±24.3	478.0 ±61.2	NS
Fiber (gm)	18	17.1±0.9	16.9 ±1.1	19.3 ±61.2	NS
Vitamin D (μg)	10	7.04±0.4	6.84±0.4	7.36±0.9	NS
Sodium (mg)	<2300	2115.4±128.5	2124.9 ±147.8	2345.9 ±308.8	NS
Calcium (mg)	1000	985.9±56.6	983.9 ±61.8	1085.7 ±142.5	NS
Iron (mg)	19.3–20.5 ♂ 17.0–18.9 ♀	12.1±0.7	11.9 ±0.72	13.7 ±1.9	NS
Selenium (μg)	75 ♂ 60 ♀	83.3±4.3	81.8 ±4.6	94.2 ±10.7	NS
Zinc (mg)	9.5 ♂ 7 ♀	11.4±0.6	11.24 ±0.6	12.9 ±1.8	NS
Copper (μg)	1.2	1.96±0.1	1.85 ±0.1	2.37 ±0.4	NS

Data are presented as mean±SD. continuous variables were compared by unpaired t test for normally distributed parameters or Mann-Whitney test for non-normally distributed parameters. MUFA: monosaturated fatty acids. NS: non significant, PUFA: polyunsaturated fatty acids. RNI: reference nutrient intake, SFA: saturated fatty acids

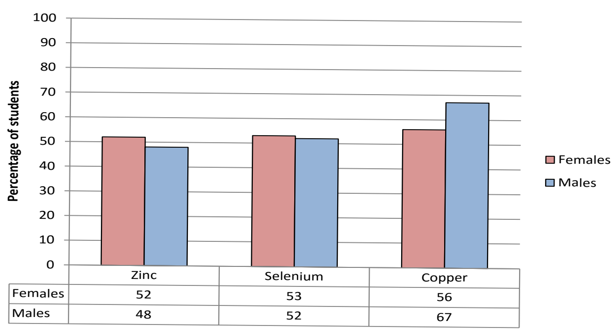
No significant differences were observed in daily levels of intakes with respect to gender difference (p>0.05). On average, carbohydrate contributed 47.1% of total energy intake while 15.2% came from protein intake. About 37.8% of total energy were supplied by total fat, whereas 14.4%, 14.1% and 7.4% were provided by saturated fatty acids (SFA), monounsaturated fatty acids (MUFA) and polyunsaturated fatty acids (PUFA) respectively. The average intake of dietary cholesterol was almost double the recommended level of 200 mg/day and fiber level of intake was about the recommended level (18gm/day). The average intakes of zinc, selenium and copper exceeded reference values while vitamin E, vitamin D and iron intake levels were below reference values as depicted in Figures (1) and (2).

Figure (1): Percentage of female and male students consuming less than the estimated average requirements of the micronutrients: vitamin E, vitamin D and iron.



The distribution of scores values for the 4 components of DQI-I are illustrated in Figure (3). Mean DQI-I scores were 35.2±1.2 for female students and 35.6±1.7 for male students out of a possible 100 points. No significant differences in mean scores for DQI-I components except for overall balance (p<0.05).

Figure (2): Percentage of female and male students consuming above the reference nutrient intake levels of the trace elements: zinc, selenium and copper.



Of all socio-demographic characteristics, living arrangement was positively correlated with DQI-I (r = 0.287, p<0.01), adequacy (r = 0.301, p<0.0001) and variety (r = 0.250, p<0.01) of diet. Additionally, residency type was positively correlated with DQI-I (r = 0.191, p<0.05) and adequacy of diet (r = 0.200, p<0.05).

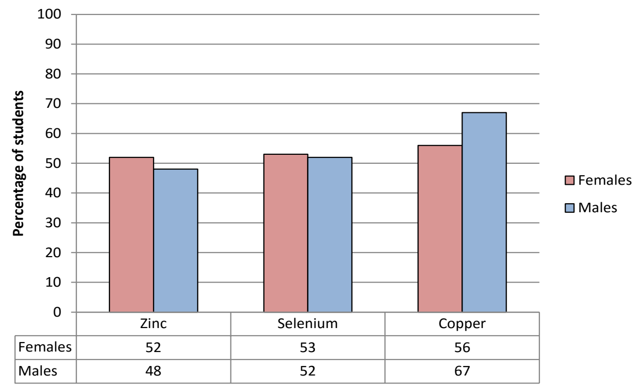


Figure (3): Mean scores of DQI-I and its 4 components of male and female students in the study cohort (N=140)

Discussion

Dietary pattern analysis facilitates the examination of multiple dietary components including nutrients, foods and food groups as a combined exposure, and is therefore a holistic alternative to the single nutrient or food approach [7]. Based on foods, nutrients or a combination of both, a diet index typically measures the degree of adherence to a set of national nutrition guidelines or a recommended diet prototype such as the Mediterranean diet [10]. Indeed the Saudi guidelines are more specific concerning quality of different food items and recommended quantities [13]. Nevertheless, when compared to dietary guidelines of other countries like USA [20] or UK [21], rather minor differences were found.

We aimed in the present study to investigate the overall diet quality of Saudi medical and para-medical students aged 19-23 years. It was evident that poor dietary quality, as assessed by DQI-I, was common among the study cohort. FFQ data analysis clearly shows that the study participants were not adherent to the dietary guidelines. Almost half of the students were consuming above the recommended levels of important trace elements like copper, zinc and selenium. In addition, between 65-90% of the students did not meet the minimal recommended intake levels of important micronutrients like vitamin D, vitamin E and iron. Similar results were described previously in other studies [6,22,23].

DQI-I is a composite measure of four aspects of diet quality (i.e., variety, adequacy, moderation, and balance) that allow for identification of aspects of diet that warrant improvement [7]. Variety in the diet was evaluated in two ways; overall variety and variety within protein sources. Adequacy reflects compliance with prevailing recommendations to ensure a healthy diet. Overall balance category examines the proportionality in energy sources and fatty acid composition. Moderation evaluates the intake of food and nutrients that are related to chronic diseases and may therefore need restriction.

According to the criteria of Kim et al. [7], scores of <60% reflect poor-quality diets. Nevertheless, it is arguable whether the standards used to define high-quality diets according to the DQI-I criterion can be applied to assess data quality of different populations [24]. In the present study, score values of DQI-I and its components were indicative of inadequacy, imbalance, lack of moderation and diversity of nutrients and food items. The component with the lowest mean contributions to total DQI-I score was the overall balance. The results of our study are consistent with the findings of previous studies using other indices in other populations [25,26]. Moreover, lower scores were seen for the four components when compared with scores found in study on the Balearic diet [24,27].

Diet indices can be used in epidemiological studies either to investigate associations of overall healthy eating patterns and health outcomes or investigate interactions with other health behaviors or as a confounder in other disease [11,12]. They may also have important uses in studying the behavioral determinants of healthy eating patterns where an integrated measure of diet can be used as the outcome of interest. In the current study, positive correlation was observed between DQI-I and some of its components with living arrangement and residency type as indicators of socioeconomic status. It has been reported that higher variety scores in the United States were a result of greater economic prosperity and food availability. Nevertheless, effects of acculturation and education are difficult to disentangle because the two factors are often correlated [19].

To the best of our knowledge, no previous studies were conducted locally to assess diet quality of Saudi youth using DQI-I, nor has potential cutoffs for each component of the DQI-I were investigated separately on disease outcome with improved predictability. It is noteworthy that the scoring criteria of several components of the DQI-I were modified for Balearic population in order to obtain a revised DQI-I suitable for use in Mediterranean regions [28].

The use of FFQ as a long-term nutritional exposure method allowed quantifying proportions of infrequently consumed food items can be regarded as a strength point of the current study design [29]. A possible limitation is reporting bias, however underreporting could probably attenuate the present results, as it would be expected that medical and paramedical students should have a healthy dietary pattern.

Conclusion

Our results highlight the necessity to implement effective prevention and health promotion programs targeting younger age groups, especially for medical and paramedical faculties students who are more concerned with healthy lifestyle and dietary habits. Therefore, appropriate indices should be developed for Saudi people, based on the recommendations specific for certain age groups like children, adolescents and young adults.

Diet scores can be used in monitoring and surveillance to assess how well people comply with dietary guidelines, to monitor trends in the population over time, and to target diet and nutrition messages for the public [30,31].

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