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Macronutrients Adequacy Of Diet Consumed By Children Of South Sinai- Egypt.

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ABSTRACT

South Sinai is a remote governorate in Egypt. Publications points to many nutritional deficiencies among children including vitamins and trace elements. Macronutrient assessment wasn't studied at this area. purpose of this work was to assess the dietary macro nutrients intake within school age children living at South Sinai. Cross sectional study for South Sinai school children was designed. A total of 862 children aging 4 to 18 y were randomly selected among students at public schools from 6 visited cities in South Sinia Governorate. Nutritional consumption data was collected using standard 24 hours dietary recalls (24-HDRs) by nutritionists interviewers. Local recipes samples were collected and analyzed for their contents of moisture, protein, fat, ash, crude fiber and carbohydrate using standard methods. Each macronutrient was then calculated in grams using Nutrisurvey software program. The % fulfillment of the recommended daily allowance (RDA) was then calculated. Subjects were classified into 4 age groups in each studied area for proper comparison. illustrated that the mean daily intake of energy (Kcal/d), carbohydrate (g/day), fats (g/day) and fibers (g/day) in different study sites were below RDA. Significant difference ($p < 0.05$) between different age groups and different study sites are very clear. Protein intakes were within RDA. Sidre city showed the worst results. Adolescents had marked macronutrient deficiencies. All macronutrients intakes for children and adolescents living at S.Sinai under study were lower than their RDAs except of protein. Health education programs and organized supplementation is mandatory. These programs have to consider sites and age groups differences.

Keywords: macro nutrients, South Sinai (S.S), Recommended Dietary Allowance (RDA), children, Food Frequency Questionnaire (FFQ)

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INTRODUCTION

South Sinai (S.S) governorate is a desert area which lies at Sinai Peninsula in the hyper arid zone. Half of inhabitants descend from Bedouin tribes which have special dietary habits and traditional modes of cooking. Most inhabitants are distributed in six areas; each of them includes a city and surrounding Bedouin settlements (EEAA, 2004).

Among S.S children; wasting (WHZ < -1.96 SD), underweight (WAZ < -1.96 SD) and stunting (HAZ < -1.96 SD) were prevalent among 4.2%, 8.9% and 11%; respectively (Hassan et al, 2012).

To our knowledge, there is no comprehensive study assessing the adequacy of macronutrient intake for children living at this remote area. Yet, published data mentioned dietary calcium and vitamin D deficiency (Abdel-Aziz et al, 2015) and dietary iron, zinc, vitamins A and C deficiencies (Ghanem et al, 2015).

Recommended Dietary Allowance (RDA) is defined as the average daily dietary intake level sufficient to meet the nutrient requirements of nearly all (97%-98%) apparently healthy people (Dietary reference, 1998). RDAs served as the premier nutrient standard for the United States as well as many developed and developing world. They used to provide standards for good nutrition, evaluating dietary survey data planning and procuring food supplies for groups (Food and Nutrition Board, 1997).

Measurement of dietary intake is usually conducted of one of 3 purposes: to compare average nutrient intakes for different groups, to rank different individuals within a group and to estimate an individual's intake. Dietary measurement techniques can be categorized as daily food consumption methods (food record and 24-hour recall) and recalled or average food consumption methods (diet history and Food Frequency Questionnaire) (Buzzard IM, 1994).

Twenty four hour dietary recall (24-HDR) is considered the method of choice for assessing nutrient intake on population base. A single 24 h recall estimates the average nutrient intake roughly, as the composition of the diet varies substantially day by day. This individual variation has been considered acceptable for group-wise comparisons (Biro et al., 2002).

Food analysis for local diets is essential to get the nutrient composition of such foodstuffs and get accurate values of nutrient intakes.

The purpose of this work was to assess the dietary macronutrients intake within school age children of S.S governorate by using FFQ, 24-HDR and food analysis.

SUBJECTS AND METHODS

Subjects:

Table1: Distribution of the studied children according to study site and gender

Area	Male	Female	Total
Tour (T)	72	96	168
Abo-Redeis (R)	35	64	99
Abo-Zeneima (Z)	31	35	66
Sidre (S)	109	109	218
St-Kathren (K)	99	103	202
Nuewibaa (N)	50	59	109
Total	396	466	862

Cross sectional study for S.S school children was designed. A total of 862 children aging 4 to 18 years old, were randomly selected among pupils and students at public schools from 6 visited cities in S.S Governorate [Tour (T) , Abo-Redeis (R) , Abo-Zeneima (Z) , Sidre (S) , St-Kathren (K) and Nuewibaa (N)].

Studied children represent ecologic diversity in S.S regarding ethnic origin, gender and socio economic status. Table (1) illustrates distribution of the study subjects. This piece of work was mediated through the project titled "Improvement of health and nutrition status of children living at South Sinai". It was funded by the SSRDP which belong to the EU (project 238). Consent was taken by every child caretaker according to regulations of ethical committee of National Research Centre.

Dietary assessment:

All participants were interviewed at their school by a trained dietitian to have their 24-HDR using standard method described by Block (1989)

The 24 hours dietary recalls (24-HDRs) were unannounced and conducted by trained interviewers. During the 24-HDR, each subject recalled and described in detail, all types and amounts of foods and beverages consumed in the previous 24 hours on two separate occasions, a weekday and a weekend day. The 24-hour period specified for the dietary recall was defined as the 24 consecutive hours between midnight on day one and midnight on the following day. To assist in estimating portion sizes of consumed foods, respondents were encouraged to view measuring cups and measuring spoons. At the end of this study, there were a total of four completed 24-HDRs for each participant.

Food Analysis:

According to the recorded recipes that we had from 24- HDR sheets and FFQ, we collected local food samples from all the six cities of S.S (n=75). These foodstuffs were not recorded in nutrisurvey data base. We prepared them for subsequent analysis of macronutrients. Examples of such foodstuffs are local bread (known as Farasheeh, Fermented arabic and Baladi), rice with specific additives (curcumin, peas or beans), fresh vegetables, Green soup, cooked vegetables, goat meat, fried fish, sea food with vegetables, hard cheese (Affiq) and others.

The moisture contents, protein, fat, ash, crude fiber and carbohydrate (CHO) were determined using standard methods of Association of Official Analytical chemist (2000). Table (3) illustrates composition of a sample of analyzed local foodstuffs.

Nutrients consumption were measured as absolute values for energy (E) (Kcal/d), carbohydrates (g/d), proteins (g/d), fats (g/d), and fibers (g/d) to detect whether each subject achieved the recommended daily allowance (RDA) according to the food composition tables for Egypt prepared by the **Nutrition Institute (1996)** and **FAO (1996)**. Subjects were classified into 4 age groups in each studied area for proper comparison. Table (2) illustrates nutrients intake for different age groups in the 6 studied areas.

Data were analyzed with Nutrisurvey for SMART software (Erhardt, 2007).

Descriptive statistics are presented as mean values and standard deviations (mean \pm SD). Comparisons of variables between different age groups and different study areas were conducted using ANOVA test. $P < 0.05$ means statistical significant difference. All analyses were performed using **SPSS v13**.

RESULTS

Absolute values of macronutrients consumption of E (Kcal/d), CHO (g/d), fat (g/d) proteins (g/d) and fibers (g/d) are presented in table (2). It illustrates that the mean daily intake of E (Kcal/d) ranged between 1372.61 ± 329.38 and 1716.8 ± 457.57 Kcal/d based on site of study. The carbohydrate intake ranged from 184.9 ± 5.98 to 288.5 ± 13.4 g/day. Fat intake ranged from 31.29 ± 2.57 to 59.65 ± 4.44 g/day. The protein intake for children under study ranged from 29.2 ± 2.62 and 58.3 ± 7.14 g/day. Daily intake of protein per body weight ranged from 0.8-1.7 gm protein / Kg/ day. Dietary fiber intake ranged from 8.7 ± 0.93 to 21.75 ± 1.67 g/day in different study sites.

The proximate composition of some collected food samples are presented in table (3).

Table (4) illustrates the % fulfillment of energy consumption of different study age groups and different study sites. Table (5) represents % fulfillment of carbohydrates consumption. Table (6) represents % fulfillment of protein consumption. Table (7) represents % fulfillment of fat consumption. Table (8) represents % fulfillment of fiber consumption.

Results show that protein consumption is adequate and comply with RDA for all studied age groups in the six studied areas with mean % fulfillment of 90.36-172.83%.

E, CHO, fats and fibers consumption were markedly below RDA at all studied age groups and the six studied areas. Significant difference ($p < 0.05$) between different age groups and different study sites are very clear. Among 6 study sites, Tur was the least affected. Meanwhile, 15-18 years age group was the most affected compared to other age groups.

DISCUSSION

Adequacy of macronutrients is essential for growth and proper physical and mental fitness among children and adolescents. Published data demonstrated that among S.Sinai children; wasting (WHZ < -1.96 SD), underweight (WAZ < -1.96 SD) and stunting (HAZ < -1.96 SD) were prevalent among 4.2%, 8.9% and 11%; respectively (Hassan et al, 2012). In addition, data showed dietary calcium and vitamin D deficiencies (Abdel-Aziz et al, 2015) and dietary iron, zinc, vitamins A and C deficiencies (Ghanem et al, 2015). These data point to the presence of nutritional problem at this governorate. Assessment of nutritional adequacy is mandatory to define the specific nutrient deficiency for future design of intervention program through supplementation and health education activities. To our knowledge, no comprehensive macronutrient consumption evaluation for such a community has been published.

Results of overall % fulfillment of E consumption ranged between 67.12 ± 14.39 and 80.68 ± 17.60 of the RDA (RDA 1989). These values are below needed E for children at these age groups. Significant differences between study sites were observed ($p < 0.05$). Tur was the least affected (80.68 ± 17.60), while other sites showed worst figures specially Sidre.

The same trend was observed regarding CHO, fats and fibers consumption. The overall % fulfillment of CHO consumption ranged between 67.47 ± 14.44 and 82.99 ± 19.76 of the RDA (RDA 1989). Significant differences between study sites were observed ($p < 0.05$). Tur was the least affected (82.99 ± 19.76), while other sites showed worst figures specially Sidre.

% fulfillment of fats consumption ranged between 54.50 ± 17.63 and 67.53 ± 24.68 of the RDA (RDA 1989). Significant differences between study sites were observed ($p < 0.05$). Tur was the least affected (82.99 ± 19.76), while other sites showed worst figures specially Kathrene.

% fulfillment of fibers consumption ranged between 43.15 ± 28.22 and 61.10 ± 27.76 of the RDA (RDA 1989). Significant differences between study sites were observed ($p < 0.05$). Tur was the least affected, while other sites showed worst figures specially Nuweibaa.

Overall % fulfillment of proteins consumption ranged between 119.64 ± 47.65 and 141.28 ± 55.10 of the RDA (RDA 1989), which are above required. Significant differences between study sites were observed ($p < 0.05$).

Availability of accurate data pertaining to a population's dietary patterns and associated health outcomes is critical for proper development and implementation of related policies (Al-Thani et al, 2017). Low E, fat and CHO consumption could explain the presence of underweight (8.9%), wasting (4.2%) and stunting (11.0%) among S.Sinai children (Hassan et al, 2012).

In general, children of (T) have the least macronutrients deficiency; those of (S) are the worst. Different study sites showed discrepancy in nutrients consumption of E, CHO, fats, proteins and fibers which are mainly due to diversity in dietary habits and inequality of socio economic status of different areas

Pattern of decreased macronutrients consumption is not uniform regarding studied age groups. However; age group 15-18 years have low % fulfillment of E, fats, CHO and proteins compared to other age groups. They consume more fibers. Individualization of nutrition supplementation program is essential for S.S community.

CONCLUSION

All macronutrients intakes for children and adolescents living at S.Sinai under study were lower than their RDAs except of protein intake.

The lake of nutrients intake differ with geographic distribution. Tur city was the least affected, while Sidre was the worst.

There is difference in macronutrients adequacy with different age groups.

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