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EVALUATION OF DIETARY QUALITY OF STUNTING CHILDREN WITH STIMULANT OVERWEIGHT USING HEALTHY EATING INDEX

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Abstract

Objective: Prevalence of malnutrition and concurrent over nutrition is high in the community. Household access to adequate food is affected by the economic conditions, like culture and knowledge .We aimed to evaluate the association between dietary patterns with simultaneous obesity and stunting in children who were affected by this accelerating pattern.

Material &Method: This cross-sectional study was conducted in two phases. So2400 students among 7 to 12 years old were selected randomly from elementary school in Zahedan,, Iran. From these, 45 students having (BMIZ›1 and BMIZ›2), and stunting (Height-for-age Z-score, WHZ<-1), as defined stunting with concurrent overweight were selected as case group. Then 90 pupils by normal height-for-age Z-score and weight for age were selected as control participants. They were matched about age, gender with case group.

Data were collected through face to face interview with mothers using 24-hour food recall and general information questionnaires and healthy eating index was used for diet quality assessment. This index was calculated based on nine components related to food guide pyramid, total fat intake percent, saturated fat percentage of total fat, cholesterol and diet diversity. Furthermore HEI score was classified into three groups less than 45 (weak), 45 to 72 (modification need) and more than 72 (good).

Results: In present study, we found that 1.8 % of children had stunting with concurrent overweight. Mean score of HEI was 40.9±13.53 and 64.11±12.73 in children with stunting and concurrent overweight and in normal children respectively. There was significant difference between HEI of case and control group (P=0.03). Diet quality scores ranged from 12.5 to 70. Besides there were not significant differences among case and control groups for the components of HEI (P=0.6). Diet quality scores show that all of children have poor diet or diet that needs improvement and no subject had a "good diet".

Conclusion: In the present study, the overall diet quality and nutritional habits of Zahedan Primary School pupils need modification and improvement.

Key Words: healthy eating index, overweight, stunting, children, Zahedan

Introduction:

Today coexistence of stunting and overweight is a problem due to nutritional issues. This lead to further increases of infection related disease and chronic diseases. Therefore in order to prevent or reduce this problem, understanding their determinants and the population's differences for designing the intervention program is necessary[1-3]. Dietary pattern approaches which includes the food behavior assessments might be provide more information about nutritional causes of simultaneous stunting and overweight. Regarding high relationship between nutrients and foods intake using multivariate approach such as dietary patterns in this area could be partly resolve the issues related to control the confounding dietary factors as well as the interactions between foods and nutrients[4-5]. Recently there are several nutrition studies in our country that were focused on the various nutritional deficiencies such as protein-energy malnutrition, Iron deficiency anemia, iodine - calcium - zinc and Vitamins A, B2 and D deficiency disorders. Besides growing number of chronic diseases related to nutrition including obesity, diabetes, cardiovascular disease and cancer due to changes in food consumption patterns, lack of mobility and mechanical life, taking more than the recommended amounts of fats-sugars and fast foods in the daily diet program are considered too[6]. So the healthy eating index (HEI) was designed in 1995, in order to evaluate the overall quality of diet and diet compliance of dietary guidelines and food guide pyramid. HEI assessing diet quality based on the different aspects of a healthy diet and determined with distinct dietary diversity and dietary patterns related to the each society. Therefore it measured the relation between HEI score and nutrients intake and

risk of non-communicable diseases. HEI determination is necessary due to the diet diversity differences in five folds groups of food pyramid[5].

In fact HEI is determined the dietary compliance from food guidelines and food guide pyramid in children and adolescents. It is determined in order to beginning the dietary modification as soon as finding deficiency or overfeeding from the same period [7]. In healthy eating index the consumed servings of all food guide pyramid groups, indicates that the index can applicable in evaluating dietary consumption based on food guide pyramid. In addition, a significant negative correlation between fat intake, percentage of saturated fat and cholesterol, increases the practical importance of this indicator. Since healthy diet contains the large amounts of fiber, fruits and vegetables (rich in potassium) and high levels of dairy products (rich in calcium). The correlation between HEI with these nutrients is indicative for ensuring adequacy of intake with high scores of this index in children and adolescents diet. In addition to an overall score of mentioned index, it is important to notice score of each component too. Thus HEI is an appropriate tool to evaluate the adequacy of nutrition in children and adolescents[5]. The aim study was to use HEI to assess diet quality in Stunting children with stimulant overweight and determine related factors with this coexistence .

Material and Methods:

Participants and study design: This cross sectional study was conducted in two phases on a total of 2400 primary student aged between 7 to 12 years old from sixty elementary schools. Participants were selected randomly from primary school children living in Zahedan, Iran. In the second phase forty five students who had inclusion criteria were selected. To increase the statistical power of study, the number of normal students as control group were considered two times more than children with simultaneous overweight and obesity as case group (figure1).
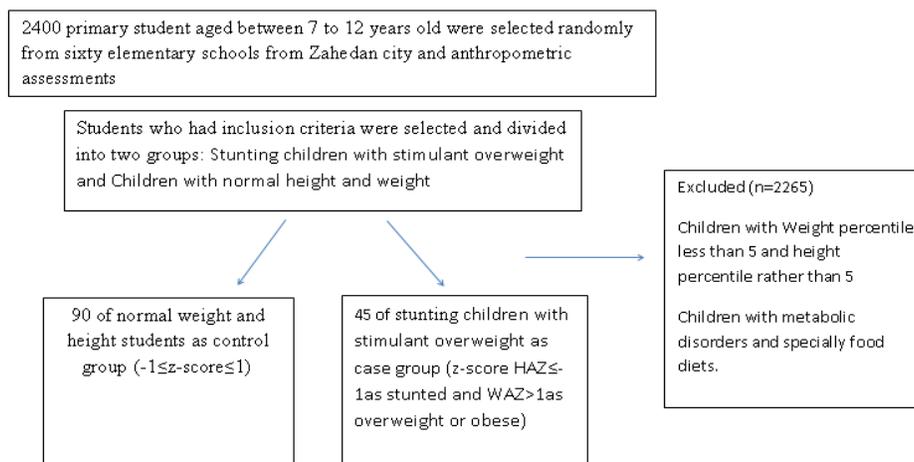
Figure 1: diagram depicting the flow of participants through the study.

Anthropometric assessments: All measurements were taken by the trained dieticians .In the first phase of study, height was measured to the nearest 0.1 cm with a stadiometer , height was measured in a standing position, without shoes, using tapemeter while shoulders were in a normal state. A Seca scale was used to measure weight with light clothes and without shoes to the nearest 0.1 kg. After collecting the anthropometric data on children's height and weight by WHO, Anthro software, the qualified participants had detected z score below -1 of height for age considered as the stunting and z score more than 1 of BMI for age considered as overweight. Therefore control group were selected through children by normal height and weight (-1 < z score < 1).

Assessment of dietary intake:

In the second phase, 45 students with simultaneous stunting and overweight were specified as a case group and 90 normal students as a control group. Control participants were selected after matching for age, sex, and grade of school. Qualified children, whose parents agreed to participate in this study, invited to being ready in school. Subjects were usually interviewed, along with their parents by a face-to face method. The parents were asked to the series of demographic questions and recall of food. To assist their parents to recall accurately, household utensils were used. Portion-sizes of consumed foods were converted to gram, using household measures. Each food and beverage was then coded according to the prescribed protocol and analyzed for contents of energy and the other nutrients in the 1.2 version of the software called DFPW (Dorosty Food Processor for Windows) all nutrients level such as macro nutrients and micro nutrients, calorie, fiber and water were evaluated too.

The Healthy Eating Index (HEI) is a measure of diet quality indices that evaluates the conformance to Federal dietary guidance. Dietary intake assessment was undertaken with one-day 24-hour recalls. HEI was calculated based on nine components (food guide pyramid groups: components 1 to 5, the percent of fat and saturated fatty acid intake, cholesterol consumption: components 6 to 8 and dietary variety score: component 9). The score range of each component was 0 to 10 and therefore, the sum score of this index was equal to 90.

HEI total score can vary from 0 to100 and consists of 10 components. The first five components is indicator of participant's compliance from food guide pyramid related to the recommendations in the case of five food groups including bread and cereals, vegetables, fruits, milk and dairy, and meat. The maximum point is yielded whether food intake were equal or near the recommended serving amount daily (Table 1).The consumption of total fat and saturated fat

are based on the percentage of energy intake that were considered as 6 and 7 components respectively. Cholesterol intake and diet diversity score were indicated by 8 and 9 components. Furthermore similar foods such as orange and orange juice were considered as a case in diet diversity.

We considered the 0 and 10 scores for the person who has received lower than 30% or higher than 45% of energy from fats, lower that 10% or higher than 15% of energy from saturated fats and lower than 300 mg or upper than 450 mg from cholesterol, respectively. This rate is based on the number of servings recommended for each age and sex group. These servings have listed according to the mentioned amounts (Table 1). So the people who have received the number of servings to fully recommended, gain the highest score equal to 10 [8]. Also intermediate scores are calculated for the partial compliance according to the dietary recommendations. Higher scores indicate person followed the recommendations of the Food Guide Pyramid and Dietary Guidelines[9]. We adjusted the available information in terms of nutritional data by HEI developed calculation method by USDA[8].

Table 1: Healthy Eating Index scoring methods.

HEI components	HEI and scoring					
	7-10 years children		11-14 years girls		11-14 years boys	
	Maximum score	Minimum score	Maximum score	Minimum score	Maximum score	Minimum score
Bread & Cereal	7.8	0	9	0	9.9	0
vegetables	3.7	0	4	0	4.5	0
Fruits	2.7	0	3	0	3.5	0
Dairy	2	0	3	0	3	0
Meat	2.3	0	2.4	0	2.6	0
Whole fat (%)	≤30%	≥45%	≤30%	≥45%	≤30%	≥45%
Saturated fat (%)	≤10%	≥15%	≤10%	≥15%	≤10%	≥15%
Cholesterol(mg)	≤300	≥450	≤300	≥450	≤300	≥450
Sodium(mg)	≤2400	≥4800	≤2400	≥4800	≤2400	≥4800
Diet diversity	≥8	≤3	≥8	≤3	≥8	≤3

Statistical Analysis

SPSS for Windows, version 16 (SPSS Inc., Chicago, IL, USA) was used in all statistical procedures. The findings related to the HEI score were reported as mean ±SD. HEI score was classified into three groups of less than 50 (weak), 51-80 (modification need) and more than 80 (good diets). Due to the lack of valid data on sodium intake, one of the 10 components of the USDA Healthy Eating Index was removed. So total HEI scores was changed to 90 instead of 100 and classification was also done in accordance with 90. Normality of data was analyzed by the Kolmogorov–Smirnov test. Wilcoxon and Mann–Whitney tests for non-normally distributed data in studied groups. P value <0.05 was considered as statistically significant.

Results:

In present study, there was not any significant differences among children with stimulant stunting and overweight compared to normal children related to age, number of family member and number of children (P>0.05) (Table 2). Anthropometric measurements including weight, height and BMI in children of case group were 34.92 ± 10.11 kg, 130.48 ± 11.58 cm, 20.04 ± 3.07 kg/m^2 respectively. While children in control group had 30.25 ± 7.79 kg, 133.95 ± 12.08 cm and 16.57 ± 2.07 kg/m^2 of weight, height and BMI respectively.

Table 2: Demographic characteristics of study population.

Variables	Study	groups	F value	P value
	Stunting children with stimulant overweight (Mean±SD)	Children with normal height and weight (Mean±SD)		
Age (year)	10.1±1.88	9.53±1.94	0.065	0.1
Number of family members	6.02±1.9	5.6±2	0.11	0.2
Number of children	4.1±2.25	3.65±1.89	0.96	0.1

There were significant differences according to the mean anthropometric measurements (body weight, height, and BMI) between case and control group (P=0.001).

Total HEI score were significantly higher in normal group compared to case group (46.11± 12.73 vs. 40.91 ± 13.53) (P=0.03) (Table 3).

Table 3: Evaluation of HEI in study population.

Study groups	HEI (Mean±SD)	F value	P value
Stunting children with stimulant overweight	40.0±13.53	0.06	0.03
Children with normal weight and height	46.11±12.73		

Distribution of children's dietary pattern based on the scores of HEI is presented (P=0.61) (Table 4). The HEI scores for 44.4% of case group and 34.4% of normal group were classified as poor diet and 55.6% of children in case group and 65.6% of them in normal group were classified into needs improvement. In present study due to the HEI scores, there were not any classified subjects in good diet group.

Bread and cereals intake was higher among normal children compared to the stunted with overweight children(P=0.02). Besides calorie intake was significantly higher among stunted children compared to the non-stunted children (P=0.04). There were not any significant differences in the average intake of the other components of HEI (P>0.05) (Table 4).

There were not any difference in the average intake of the other components in the needs improvement group compared with the poor diet group (P>0.05) (Table 5).

Table 4: Distribution of children's dietary pattern based on the scores of HEI.

Diet plan in Children	Stunting children with stimulant overweight N (%)	Children with normal Height & weight N (%)	P-value
Improvement need pattern	25 (55.6)	59 (65.6)	0.6
Weak pattern	20 (40.4)	31 (34.4)	

Table 5: Mean±SD of HEI components in 2 study groups.

HEI components	Study groups		P value
	Stunting children with stimulant overweight (Mean±SD)	Children with normal height & weight (Mean±SD)	
Bread & Cereal score	5.35±2.36	6.18±2.34	0.02
Vegetables score	1.44±1.16	1.73±1.37	0.7
Fruits score	1.41±1.11	1.45±1.31	0.3

Dairy score	1.52±1.42	1.53±1.33	0.8
Meat score	2.53±1.71	2.13±0.87	0.3
Diversity score	7.4±2.21	7.74±3.63	0.8
Cholesterol (mg)	210.38±159.19	185.75±182.64	0.09
SFA score	42.59±2	38.46±2.27	0.1
TFA score	54.07±2.04	50.34±2.62	0.2
Calorie intake	1788.5±578.72	1568.82±642.75	0.04

(SFA=Saturated fatty acid);

(TFA=Total fatty acid)

Discussion:

Mirmiran et al.(2004) conducted a study on Tehran adolescents and the results indicated that 74% of adolescent's diet needed improvement, 23% was good and 3% was poor[5]. Nilufer et al. reported that the mean score was found to be 51.5 ± 9.07 according to the HEI-2005.There were no differences according to gender; 42.8% had a poor diet and 57.2% had a diet that needs improvement. No subjects had a "good diet [10].

Kuhnlein etal in 2001 reported that HEI score in 74.4% of adolescent and 84.5% of pupil children were between 51 and 80. This means that only 2.9% and 3.5% of studied cases had a good diet [11].

In present study we found that the average intake of each HEI component didn't have a significant difference among two groups of case and control, except bread and cereal group. In this study, the total grain score was found to be low in stunted children, and there was significant difference between normal children compared to the stunted with overweight group. Whole grain consumption in the recommended amounts prevents from chronic disease and helps to maintenance of healthy weight and preventing from consumption of junk foods. Consumption of grain based on RDA could be maintain the healthy weight. However consumption of whole grains in children and adolescents remains generally low. Whole grain consumption should be encouraged for children, adolescents, and their parents by the health professionals, especially dietitians [10] .To improve the availability of whole grain, breads and the other products at home, parents should be provided with information to help them identify and prepare whole grain products. Nutritionists should be advised whole grain because they are good source of fiber, Mg, Ca, K and vitamin E. No significant difference was observed in the HEI components between two groups of needs improvement need and weak pattern among normal or stunting

children with stimulant overweight. There was not any significant difference between two groups of needs improvement and weak pattern due to intake of food groups including bread and cereal, fruits and vegetables, dairy and meat as well as dietary variety, percent of fat and saturated fatty acid intake, cholesterol consumption.

Cholesterol intake was higher in weak dietary pattern compare needs improvement pattern and there was no significant difference statistically. Nilufer et al. (2011) indicated the average percent of fat and saturated fatty acid intake was significantly higher in weak pattern group although, in this study, there was no significant difference among two pattern foods [10] . The average intake of the other components in needs improvement pattern was higher than weak pattern. The same result was reported by Nilufer et al[10] according to the HEI-2005 assessment, the diet quality of the majority of Turkish adolescents needs to be improved due to the high intake of fat, saturated fat, and sugar and low intake of dairy products, fruits, and vegetable s(less than five servings of recommended amounts). Mirmiran et al. [5] found that saturated fatty acid intake and cholesterol consumption in good dietary pattern was significantly higher than two other groups, whereas in the present study wasn't observe any good dietary pattern. Hann et al. (2002)[12] indicated that there was positive correlation among HEI score more than 85 (from 100) with the increasing serving food guide pyramid intake. Also they observed a positive correlation between dietary variety and diet quality with HEI. The same result was reported by Mirmiran[5] that a strong and significant positive correlation has seen between number of food items intake with HEI. Since healthy diet was contained higher amount of fiber, vegetables and fruits (rich source of potassium) and dairy (rich source of calcium), the correlation between HEI with these food groups consumption has showed an diet quality of children and adolescents with high HEI score. Drewneski et al. [13] were found the relationship between dietary variety and high consumption f fruits and vegetables by assessing HEI on children and elderly people in 1997.

Esfarjani et al. (2013) [4] reported mean consumption of dairy products, dried fruits and nuts were significantly lower among stunted children than those in the control group. Also fat consumption in stunted children was higher than the other children, but energy and other nutrients intake were not significantly different among stunted children and non-stunted children. Ibrahim et al. [14] in Egypt made similar conclusion that deficiency of several nutrients, including proteins is seen in stunted children and the combined effect of these deficiencies might have role in the retardation of growth in height. We found that energy intake of studied groups of children had a significant difference. The energy intake in stunting children with stimulant overweight was higher than normal children which was the same as expected

predict. This difference in energy intake might be due to the unhealthy dietary habits and factors that could affected these habits. This inappropriate dietary habits can be influenced by friends, advertising, and promotion of commercial products such as soft drinks, sugary and salty foods, chips, and fast foods which affect the negatively the eating habits of children. Healthy eating habits may help children growth potential and may provide the beneficial health effects throughout the life. According to the results of present study and according to original HEI, most of the children had improvement needs dietary pattern and no subjects have a good diet. Therefore, a general conclusion is that nutritional care of children is requisite to achieving mental and physical abilities of them. Nutritional care in children leads to promote growth indices, getting healthy and nutritious food, creating beliefs and dietary habits in childhood and adolescence. Furthermore the authors recommend promoting awareness, attitude and nutritional function of caregivers in household and in the community as main providers of nutritional care. The limitation of this study was assessing food intake by only the 24-hour recall method. Dietary intake may vary from day to day, and a 24-hour recall assessment may not reflect an individual's habitual intake.

Acknowledgments:

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