Nutritional Status among South Sinai Children using Anthropometric measures

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ABSTRACT

Background: No information exists on nutritional status of South Sinai residing children, Egypt. Aim: Assessing prevalence of malnutrition among South Sinai children. Methods: Cross sectional study included 3987 healthy children (0 to 11 years); randomly selected; represent about 12% of all children from the 6 areas of South Sinai. Height and weight were measured. Weight-for-age Z score (WAZ), height-for-age Z score (HAZ) and weight-for-height Z score (WHZ) were used to estimate the children's nutritional status. Venous blood sample was obtained to measure plasma hemoglobin level for school students. Results: 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. Prevalence of underweight, at risk of wasting and be anemic were more prevalent among boys than girls (p < 0.01). On the other side, 8% were overweight and 4% were obese. Although small percentage of anemic school children was suffering from growth deviation (wasting, 2.8%; underweight, 5.6%; stunting, 9.9%; overweight, 2.8% and obese, 1.4%), >55% of them were at risk of growth deviations (wasting, underweight and stunting). Under nutrition were more prevalent among South Sinai children than their peers in Greater Cairo, while overweight nutrition was less prevalent. Conclusion: The highest prevalence of malnutrition was detected in infant’s age. Anemia of primary school children was more prevalent among those at risk of under nutrition than undernourished ones. Community education on environmental sanitation and personal hygienic practices, proper child rearing, breast-feeding and weaning practices would possibly reverse the trends.

Key words: children, malnutrition, anthropometric assessment, South Sinai.

Introduction

Adequate nutrition is needed to ensure optimum growth and development of infants and young children (Ramli et al., 2009). Malnutrition is a major public health concern affecting a significant number of school age children influencing their health, growth and development, and school academic performance (Chesire et al., 2008). Malnutrition continues to affect a large proportion of children in the developing world (Pramod Singh et al., 2009).

Less information about nutritional pattern that contributing to the nutritional status of children in South Sinai is available (South Sinai Environmental and Developmental Profile, 2003) . Ascertaining this information about nutritional status is an important step to inform public health policy and to design appropriately targeted interventions that will effectively address the problem of childhood malnutrition.

Child Malnutrition is defined as a pathological state resulting from inadequate nutrition, including under nutrition due to insufficient intake of energy and other nutrients; overnutrition (overweight and obesity) due to excessive consumption of energy and other nutrients; and deficiency diseases due to insufficient intake of one or more specific nutrients such as vitamins or minerals (Ge and Chang, 2001). Anthropometry is one of the most basic tools for assessing nutritional status, whether overnutrition or undernutrition. In the assessment of child malnutrition, a large number of measures are available. Height- and weight-based measurements are the most practical tools for assessing nutritional status because of their simplicity and low cost. In children, the most commonly used anthropometric indices of malnutrition are weight-for-height, height-for-age, and weight-for-age. These indices can be expressed in terms of z-scores, percentiles, or percentage of median, which enable comparison of a child or a group of children with a reference population (WHO, 1995).

Weight-for-height is already routinely used in preschool children in clinical settings to screen for underweight and overweight (WHO, 1995; Mei et al., 2002). A WHO expert committee (WHO, 1995) recommended use of a weight-for-height z score (i.e., a z score of 2, which corresponds to the 97.7th percentile) for children aged younger than 10 y.
Hence, the objective of this study is to determine the prevalence of undernutrition (underweight, stunting and wasting), overnutrition (overweight and obesity) and anemia among South Sinai children.

Subjects and methods:

This piece of work was mediated through the project "Improvement of health and nutrition status of children living at South Sinai". It is funded by the SSRDP which belong to the EU (project 238). Consent was taken by every child caretaker according to regulations of National Research Centre ethical committee.

Subjects:

Study design:

The study was cross-sectional multistage survey. It included six localities out of the eight within South Sinai (El-Tur, Abu Redeis, Abu Zenima, Saint Kathrine, Noweiba and Ras Sidre) and was selected to represent all social, environmental and ethnic variations in the area.

Sample size:

Sample size was calculated according to the following formula designed by Dawson-Saunders and Trapp (1994)

\[ n = \frac{Z^2 \cdot p(1-p)}{e^2} \]

Where; \( Z \) is the Z value for the corresponding confidence level (1.96 for 95% confidence), \( e \) is the margin of error (0.05 = ± 5%), and \( p \) is the estimated value for the proportion of a sample that have the condition of interest (there are no previous literatures published in South Sinai thus for uncertain prevalence it recommended that a calculation be done for a value of 50% (the most conservative estimate).

It included 3987 healthy subjects (2032 boys and 1955 girls), they represent about 12% of all children of the same age based on a sample representing all areas of South Sinai. The selection was randomly, based mainly on the age factor of these subjects which ranged between 0 to 11 years (1 year + six months).

Age was accurately calculated from birth certificate or from the school files. Collected data have been used for study purpose only. The parents of the subjects under study were informed about the purpose of the study and of the name of the research institute before agreeing to participate. Assurance was given that their cooperation was voluntary and that no negative consequences would result to those who decided not to participate in the study. Also, the parents were informed that they could skip any question they did not want to answer. Study protocol was approved by the Ethical Committee of National Research Centre.

Methods:

The co-investigators in the project were professional physicians, well-trained in anthropometry. They provided training and participated in the data collection. Each team received 20 hours of classroom instructions over a 10-day period, which was followed by practical training for 4 hours per day for 2 weeks. The accuracy of the team measurements was evaluated during the training and during the field study by their respective supervisors. Quality control was accomplished on teams sequentially withdrawn from the field for re-evaluation. Intra-observer and inter-observer differences were periodically checked during fieldwork. Each subject included in the study was subjected to the following:

- A simple questionnaire was sent to the parents to be fulfilled, with special emphasize on age of the child, birth weight, birth order, spacing and frequency of the attacks of gastroenteritis or bronchitis. Children with history of chronic illness (e.g. bronchial asthma, diabetes mellitus and rheumatic fever), congenital or chromosomal diseases, endocrinal diseases or preterm delivery were excluded from the study.
- Full clinical examination for each subject was done to exclude the presence of any clinically detectable health problems that would interfere with the child's normal growth.
- Anthropometric measurements for each subject were attempted, including body weight (Wt) and body height (Ht). The landmarks, instruments used and techniques followed were those recommended by the international biological program (I.B.P) (Hiernaux and Tanner, 1969 and Cameron, 1986). Three consecutive readings were obtained for each measurement; by one researcher; assisted by another researcher; who was well
trained on performing these measurements before starting this piece of research, and the mean was recorded. The body weight was measured using a standardized Seca Scale balance to the nearest 10 gm with minimal clothes for which no correction was made. The body height was measured using Holtain portable anthropometer to the nearest 0.1 cm.

- Blood hemoglobin was measured for 1810 children through pin prick blood collection a colorimetric assay (Van Assendelft 1977). While venous blood was collected for complete blood count for 344 children using auto analyzer apparatus.

**Data analysis:**

The study subjects were classified into 3 age groups by sex: infants aged from 0 to 2 years + 6 months, preschool children aged from 3 up to 5 years, and school children aged from 6 up to 11 years (Table 1).

Anthropometrical indicators; weight –for-age, height-for-age and weight-for-height; were expressed in terms of standard deviation scores (z-scores), using the standard CDC (Center for Disease Control) growth charts: United States (National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion, 2000) N.B., the new 2006 WHO growth standards are made up to 60 months only. Unfortunately, weight-for-height Z score was calculated up to the age of 11 years for the boys and 9 years for the girls according to the WHO standard growth curves, as the data for the higher ages were not available. Z score was calculated according to Bruce (2001) equation:

$$Z_{\text{score}} (\text{or SD-score}) = \frac{\text{(Observed value)} - \text{(median reference value)}}{\text{Standard deviation of reference population}}$$

The cut-off points of -2 Z score (< -1.96 SD) were used to classify the nutritional status of the children as recommended by WHO (1995) into underweight (weight-for-age Z score [WAZ]), stunted (height-for-age Z score [HAZ]) and wasted child (weight-for-height Z score [WHZ]) respectively. Children had Z score between -1 and -2 (<-1.96 & < -0.96 SD) were considered to be at risk of underweight, stunting and wasting. On the other hand, WHZ also was used to evaluate the overweight (weight-for-height Z score > 0.96 SD and less than 1.96) and obese children (weight-for-height Z score > 1.96 SD).

Anemia in childhood is defined as a hemoglobin (Hb) concentration below established cut-off levels (WHO, 2001). These levels vary depending on the age of the child, and on the laboratory in which the blood sample is tested. Reference ranges for specific laboratories and age groups should always be referred to. The World Health Organization (WHO) has suggested levels of Hb below which anaemia is said to be present. These levels are <11 g/dL in children aged 6-59 months and <11.5 g/dL in children aged 5-11 years and 12 g/dL in older children (aged 12-14) (WHO, 2001; Harris, 2004).

Prevalence of malnutrition (either under or over nutrition) was identified according to the different indices, and also the prevalence of anemia. Pearson’s correlations were done between the blood hemoglobin and the indices of growth deficits. Collected data were compiled, coded; verified and analysis was performed using the computer program SPSS (Statistical package for social science) version 9.05. The data was expressed in number (N) and percent (%). Significant difference was considered at P-value ≤ 0.05.

**Results:**

This study included 3987 subjects (2032 boys and 1955 girls) aged 0 to 11 years, distributed into 3 age categories; infants, preschool and school age in table 1.

Prevalence of stunting, underweight, wasting, overweight and obesity are presented in table 2, using z-scores based on the standard growth curves for WHO (2000) as reference population. Height-for-age Z score (HAZ) for the total sample, recorded stunting (retardation in linear growth,) in 11.0% (11.8% for boys and 10.0% for girls), with 38.9% at nutritional risk for stunting (38.4% for boys and 39.3% for girls). Weight-for-age Z scores (WAZ) results showed that 8.9% (10.2% for boys and 7.5% for girls) of the studied sample were underweight and 41.2% (40.4% for boys and 42.0% for girls) at nutritional risk for underweight. The prevalence of wasting (low weight-for-height Z score, WHZ) is 0.4.2% (4.0% for boys and 4.4% for girls). Also, 36.0% (36.1% for boys and 35.8% for girls) of our subjects were at risk for wasting.

On the other side, overweight, according to WHZ was observed in 8.0% (7.9% for boys and 8.0% for girls), and obesity was observed in 4.0% (4.0% for both boys and girls).

The hemoglobin blood level (Hgb less than 11.5gm/dl) was studied in 1030 school students (523 boys and 507 girls) only of school age. Anemia was detected in 10.1% (105 subjects: 71 boys and 34 girls). It was higher in boys than girls.
Percentage of the anemic school students in relation to the different varieties of growth deviations by age and sex is presented in table 3. Most of the anemic subjects were from those at risk of underweight, stunting or wasting.

From the previous 3 tables, it was evident that the highest prevalence of stunting, underweight and wasting is found at the infant’s age, then the percentage decrease in preschool followed by the school age. While the highest prevalence of obesity and overweight is found at the infant’s age, then the percentage decrease in preschool followed by another increase in the school age. Anemia was higher in boys than girls. Most of the anemic subjects were from those at risk of underweight, stunting or wasting. Anemia was more prevalent among boys suffering from under nutrition than girls (stunting, underweight, wasting and at risk of stunting or underweight or wasting), while it was more prevalent among girls suffering from over nutrition (overweight and obesity).

Pearson’s Correlations between the hemoglobin blood level on one side and the markers of growth deficit on the other side, revealed insignificant correlations between them (table 4).

Discussion:

Anthropometry has become a practical tool for evaluating the nutritional status of populations, particularly of children in developing countries (Hakeem et al., 2004) and nutritional status is the best indicator of the global well-being of children (Onis et al., 2000). One of the major global health problem faced by the developing countries, today is malnutrition (UNICEF, 1990; Saunders et al., 2011). Of course, Egypt too, is not an exception to this problem of malnutrition (El Masry, 2007; Hassan et al., 2006). The primary cause of ill-health and premature mortality among children, in developing countries is attributed to under nutrition (Odunayo and
Oyewole, 2006). In developing countries, it is postulated that poverty and ignorance are primary casual factors of malnutrition (Nandy et al., 2005).

There are several studies (Bailey and Ferro-Luzzi, 1995; El Masry, 2007; Shaaban et al., 2008), investigating the problem of malnutrition among children in different parts of Egypt. However, scanty information exists regarding malnutrition among children in South Sinai.

The study provides anthropometric data on the nutritional status in a group of children, about 12% of all children of the same age based on a sample representing all areas of South Sinai (6 areas), Egypt. Nutritional status is an integral component of the overall health of an individual (Som et al., 2007), and provides an indicator of the well-being of children (Dutta et al., 2009) living in a particular region. In this regard, the importance of the nutritional status of children in the developing countries should be emphasized, not only for the improvement of health of children in the coming generation, but also for the overall development of the concerned region in near future (Rao et al., 2005).

The findings of this study reflect high prevalence of malnutrition among children living in South Sinai. The highest prevalence of stunting (18.5%), underweight (19.2%) and wasting (9.8%) is found at the infant’s age, then the percentage decrease in preschool (14.7%, 12.5%, 4.4%, respectively) followed by the school age (8.5%, 5.9%, 2.2%, respectively). The highest prevalence of obesity and overweight is found at the infant’s age (6.8%, 9.4%, respectively), then the percentage decrease in preschool (1.5%, 7.4%, respectively) followed by another increase in the school age (4.2%, 7.8%, respectively).

In this study, the prevalence of under nutrition, particularly stunting is higher than underweight and wasting. This gave image about chronic under nutrition among this age group represented by stunting (HAZ, 11%), which is more prevalent than that of acute conditions as underweight (WAZ, 8.9%) and wasting (WHZ, 4.2%), where infants girls more affected than boys and the reverse occurs among preschools and school children.

Comparing this results with that of the Egyptian National Growth Curve (Ghali et al., 2008), the current results recorded less values of weight-for-age, height-for-age and weight-for-height in all studied age groups, indicating higher prevalence of malnutrition. El-Masry (2007), in her study of nutritional assessment of Egyptian primary school children stated that prevalence of stunting and at risk of stunting was higher in boys than girls, while the prevalence of underweight (or wasting) and at risk of underweight by the different indices was higher in girls than boys. WAZ recorded overweight in 10 % of the children, and obesity in 5.0 % for both sex. This indicate higher prevalence of under nutrition and lower prevalence of over nutrition in South Sinai than that of the previous study in Greater Cairo area (El-Masry, 2007). The same also was observed for the preschool age children (Shaaban et al., 2008).

While, on comparing the nutritional status of children in the current study with the results of other similar studies elsewhere: Kerac et al., 2011, in their study of the prevalence of wasting among 15 534 infants under 6 months and 147 694 children aged 6 to under 60 months in 21 developing countries and implications of new case definitions using WHO growth standards: a secondary data analysis, wasting among infants under 6 months is prevalent in many of the developing countries examined in this study. They also, found that wasting was more marked for infants under 6 months than children who come in agree with the current results. Ramachandran and Gopalan, 2011, in assessing the nutritional status of Indian preschool children concluded that poor growth is an adaptation to chronic low energy intake and stunting is a measure of cumulative impact of chronic energy deficiency on linear growth. In Saudi Arabia, El Mouzan and his colleagues, 2010, in their community-based study for the prevalence of malnutrition in Saudi children younger than 5 years of age, stated that the prevalence was lower in girls for all indicators, in reverse to the current results.

Goon et al., 2011, in their study on anthropometrically determined nutritional status of urban primary school children in Makurdi, Nigeria, found that underweight and stunting occurred in 43.4% and 52.7%, respectively, as in the present study stunting is more prevalent. Boys were more underweight (48.8%) than girls (38.5%), and the difference was statistically significant. Conversely to the current research, girls tend to be more stunted (56.8%) compared to boys (48.4%). Cheshire et al., 2008, in Kenya, in agree with the current results stated that there is under nutrition among school age children, with stunting being the most prevalent. The girls were more wasted than the boys, whereas the boys were more stunted. On the other hand, Pramod Singh et al., 2009, stated in their study of underweight and stunting in young children in an the eastern Tarai (plains) district of Nepal that more than half (53.3%) of the children were found to be underweight and more than one third (36.6%) had stunting. Ji CY; Working Group on Obesity in China (WGOC), 2007, in their research for describing the nationwide prevalence of childhood overweight / obesity, and their group variations and trends over the past 20 years in the Chinese urban population, found a dramatic and steady increasing trend among all sex-age subgroups in the five urban groups, and such a trend was stronger in boys than in girls, and much stronger in children than in adolescents in reverse to some of the current results.

Anemia (Hgb less than 11.5gm/dl) was detected in 10.1% of school students and it was higher in boys than girls. Most of the anemic subjects were from those at risk of underweight, stunting or wasting. Anemia was more prevalent among boys suffering from under nutrition than girls (stunting, underweight, wasting and at risk
of stunting or underweight or wasting), while it was more prevalent among girls suffering from over nutrition (overweight and obesity). Khatib and Elmadfa, 2009, found in their study on Bedouin schoolchildren in North Badia, Jordan that mean prevalence of nutritional deficits among children were stunting (23.4%), anemia (57.5%), and iron deficiency (28.4%) which is more than our results and can be refueled to different genetic and nutritional habits. However, for hemoglobin status, no significant differences between genders were detected.

Conclusion and Recommendations:

Programmes aimed at improving nutritional status in South Sinai should focus on children particularly under two years of age, of female sex, from families of low socioeconomic status and encourage breast-feeding and weaning practices.

Anemia of primary school children was more prevalent among those at risk of under nutrition than undernourished ones. The Ministry of Education and Ministry of Health therefore need to develop policies which can alleviate under nutrition among school age children. We also recommend that awareness be created among the school age children, parents and teachers, on the dietary requirements of both boys and girls.

References


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