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Assessment of the Nutritional Status of first year primary school children in El Horga village, Gezira state

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ABSTRACT

Objective: To assess the nutritional status of first year primary school children in El Horga village as a basis for further intervention.

Methods: A cross-sectional study was conducted in all first year primary school children, aged 6-7 years, in El Horga village, in the Gezira State, central Sudan, 53 males and 62 females. The study was designed to assess the nutritional status using clinical signs, standard anthropometric measurements and biochemical investigations.

Results: Mean anthropometric measurements were 19.1± 2.6 kg for weight, and 112.5±5.1 cm for height. Compared to National Center for Health Statistics (NCHS) reference parameters, 63.5% of children were stunted (height for age, H/A <-2 Z score), 18.3% were wasted (weight for height, W/H <-2 Z score) and 57.5% underweight (weight for age, W/A< -2 Z score). Mean for mid upper circumference (MUAC) was 16.7± 0.2 cm, and 8.4± 0.19 mm for triceps skin fold (TSF). According to MAUC, 45.2% of children suffered malnutrition, 28.7% were moderately undernourished and 16.5% were severely undernourished. Significantly low adipose tissue stores were found in 41.8%.

Biochemical results were as follows: mean haemoglobin (Hb) concentration of all children was

11.4±1.2 g/dl, PCV 34.1±2.2%, MCHC 32.8±2.4g/dl. total serum protein 6.8±0.9 g/dl, serum albumin 4.0±0.8 g/dl, serum iron 50.2±21.2µg/dl, TIBC 266.6±51.6µg/dl, and 21.2±8.6% transferrin saturation. 56.5% of the study group were anaemic (Hb<11g/dl) and 30.4% suffered from iron deficiency anaemia with transferrin saturation <15%.

Conclusion: The children under study were shorter and lighter as compared to reference standards. A considerable number were anaemic. Consequently, the nutritional status of children should be further investigated and improved through nutritional programmes and food fortification.

Key words: nutritional status, primary school children, Sudan.

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ملخص الدراسة

الأهداف: هدفت هذه الدراسة لتقييم المستوى الغذائي لأطفال السنة الأولى لمرحلة الأساس بقرية الحرقة بولاية الجزيرة.

الطريقة: هذه الدراسة المقطعية صممت لجميع تلاميذ الصف الأول الذين تتراوح أعمارهم بين 6-7 سنوات بقرية الحرقة بولاية الجزيرة. العدد الكلى 115 تلميذ ا 53 من الذكور و 62 من الأناث.وذلك لتقييم الحا لة الغذائية لهؤلاء الأطفال مستخدمين القياسات البشرية و التحاليل الكيوحيوية.

النتائج:مقارنة بمرجعية المركز الوطني للأحصاء الصحى نجد أن 63.5% من الأطفال يعانون من التقزم (الطول للعمر < -2 حرز Z) و 18.3 % مصابين بالهزا ل (**الوزن** للطول < -2 حرز Z) و 57.5 % خفيفي الوزن (الوزن للعمر < -2 حرز Z) متوسط القياسات البشرية 16.7±0.2سم لمحاط منتصف الذراع و 8.4 ± 0.19ملم لسمك الجلد.

باستخدام محاط منتصف الذراع وجد أن 45.9% يعانون من سوء التغذيةمنهم16.5%

يعانون من من سوء تغذية وخيمة. النقص الواضح لمخزون الدهون تحت الجلد وجد فى 41.8% من هؤلاء الأطفال.

نتائج التحاليل الكيوحيوية كانت كالأتي: متوسط خضاب الدم لكل الأطفال كان 11.4±1.2 جم%, للهيماتوكريت PCV 34.1±2.2%, متوسط تركيز خضاب الدم في الكريات الحمراء MCHC 32.8±2.4 جم% ,بروتين المصل الكامل 6.8±0.9 جم%, والبيومين المصل 4.0±0.8 جم% . الحديد في المصل كان 50.2±21.2 ميكروجرام%, TIBC 266.6± 51.6 ميكروجرام%, وتشبع الترانسفرين كان 21.2±8.6%. كما أتضح من هذه النتائج أيضا أن 56.5% من هؤلاء الأطفال يعانون من فقر الدم (خضاب الدم <11 جم%). و 34.4% يعانون من أنيميا نقص الحديد (تشبع الترانسفرين <15%).

الخلاصة: الأطفال في هذه الدراسة أقصر وأخف مقارنة بالمعدلات المرجعية المعيارية, وعدد كبير منهم يعاني من فقر الدم . لهذا يجب الألتفات للحالة الغذائية لأطفال المدارس وذلك بعمل مزيد من الأستقصاءات والمداخلات كبرا مج التغذية و أضافة عنصر الحديد والمغذيات الأخرى لغذاء الطفل.

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INTRODUCTION. The nutritional status, particularly the major nutritional deficiencies, has its effect on individual well-being, performance, immunity and growth. Rapidly growing infants, children and maturing adolescents have specific requirements for macro and micronutrients[1]. The negative sequale of malnutrition are more common with the severe forms, however consequences of mild and moderate forms are considerable.

The problem of undernutrition is widely spread among different states of the Sudan[2]. In this study, anthropometric and biochemical measurements were used for assessing the nutritional status of the first year primary school children.

SUBJECTS, MATERIALS AND METHODS. This cross-sectional community–based study was conducted at El Horga village in the Gezira State. This village lies on the eastern bank of the Blue Nile, about 40 kms from Wad Medani, the State capital.

The study recruited all first year primary school children, from two classes one for each sex. The total number was 115 (53 boys and 62 girls), aged 6-7 years. Permission was initially obtained from the educational director of the primary schools. Pupils' school records were reviewed for birth certificates, to ascertain the ages of enrolled children. The pupils were briefed about the study, and their parents' consent was obtained. Children aged less than 5 years or more than 7 years, and those who failed to bring their parents' consent or had no birth certificate or had any systemic illness at the time of the study were excluded. Data were collected in six weeks from November to December 2001.

Structured questionnaire was completed addressing general information and questions including socioeconomic background and recalling the type and quantity of food eaten by the child. The socioeconomic status was assessed by parents' level of education, occupation, income and family size. Each child was subjected to detailed clinical examination, with special attention to signs of vitamins deficiencies

Standard anthropometric procedures including height, body weight, mid upper arm circumference (MUAC) and triceps skin fold (TSF) were obtained for each child. A standard durable, lightweight scale, with a capacity of 25 kilograms in one rotation with 100 g. divisions (Salter Model 235) was used to measure the body weight. Scales had been well tested and remonitored to improve performance. The height was measured to the nearest 0.1 cm, on a height measuring board. A nonstretchable tape marked in centimeters, to the nearest 1 mm., were used to measure the mid arm circumference.

The nutritional status of children was determined using the National Center for Health Statistics (NCHS) reference standards.[3] Indices were based on anthropometric data and child age, correlated as follows, weight for age (W/A) weight for height (W/H) and height for age (H/A).

The following cut-off points for MUAC for children age 6-7 years were adopted. The 50th percentile is 18.2 cm and 18.3 cm. for boys and girls respectively. The 5th percentile is 15.7 and 15.6 cm. for both sexes respectively, and the 95th percentile is 20.4-20.3 cm for both sexes respectively.[4]

A special constant-pressure caliper was used to measure the subcutaneous fat layer, which is related to the amount of body fat and varies with age and sex. The measure was taken half-way down the back of the arm over the triceps muscle. The following cut-off points were adopted 5-6 mm for 5th percentile, 8-10 mm for 50th percentile and 16 for 95th percentile for male and female respectively.[5]

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4 ml of blood were collected. 1 ml in E.D.T.A. was used for haemoglobin (Hb) and haematocrit, or packed cell volume (PCV) assessment for each child. 3 ml of blood were used to assess total serum protein using biuret method.[6] Serum albumin was estimated by Spencer and Price modified method using bromocresol green dye-binding.[7] Serum iron and total iron binding capacity (TIBC) were estimated using Ramsay methods.[8]

The standard deviation (SD) units, also called Z-scores, was used to express survey results as advocated by WHO and Waterlow *et al*.[9] The normal growth channel for any population is considered to be ± 2 SD. The cut off points for undernutrition of less than–2 SD for moderate undernutrition, and–3SD for severe undernutrition were used in this study.[3]

STATISTICAL ANALYSIS. Values were presented as a mean and standard deviation of the mean of all measured variables, and Z- scores were calculated, using Microsoft program and Statistical Package for the Social Science (SPSS), under Windows Computer system. Analysis of variance and regression analysis were applied. P< 0.05 and P< 001 were taken as levels of statistical significance.

RESULTS. A total of 115 children of different socio-economic groups and tribes were the subjects of this nutritional assessment. Over 87.8% of fathers were educated, the majority at primary and secondary school levels, while 83.5% of mothers were educated, but mostly at primary and few at intermediate levels. This rate of mothers' education is not surprising, as this area belongs to the Gezira irrigated scheme, where girls' education had been started early in the sixties of the last century.

Compared to NCHS parameters, 63.5% were stunted (<-2 Z score) of whom 45.2% were moderately stunted and 18.3% were severely stunted. 18.2% were wasted (<-2 Z score W/H) 14.7% of them were moderately wasted. 3.5% were severely wasted. 57.5% were underweight (<-2 Z score, W/A) 42.7% of them were moderately underweight and 14.8% were severely underweight.

Table 1 shows the anthropometric parameters stratified according to the age groups. 5.2% had MUAC < 5th percentile, 2.5% were male and 2.6% were females. Compared to Grever's percentile,[4] 11.3% at 5th percentile, and 28.7% at 10th percentile. 48.6% at 50th percentile and 6.0% at 90th percentile.

Table 1: Anthropometric parameters in different age groups.

Age groups (month)	Weight (Kg)	Height (Cm)	MUAC (Cm)	TSF (mm)
72-75 (18)	*17.9±2.01*	*109.4±5.2*	*15.1±1.1*	*6.3±1.9*
76-78 (21)	*17.9±3.80*	*111.8±4.7*	*14.4±1.9*	*7.7±2.0*
79-81 (31)	*19.2±2.90*	*113.4±5.3*	*18.0±2.2*	*9.4±1.6*
82-84 (45)	*19.6±3.01*	*115.4±4.9*	*19.9±3.5*	*10.4±1.6*
Total (115)	*19.1± 2.6*	*112.5± 5.1*	*16.7± 0.2*	*8.4± 0.19*

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The TSF when compared to Frisancho[5] showed that 6.1% were <5th percentile, i.e. had low adipose tissue. 6.9% in the 90th percentile as shown in Table 2.

Table 2: The nutritional percentile of MUAC & TSF of children (age 6-7 yrs) of both sexes.

Measurements	percentiles									
	MALE					Female				
	<5	5th	10th	50th	90th	<5	5th	10th	50th	90th
MUAC	3	5	10	30	5	3	8	23	26	2
TSF	3	7	7	31	5	4	12	15	28	3

Table 3: The biochemical parameters as markers of nutritional status

	Age (month)				
Parameters	72-75	76-78	79-81	82-84	all children
Hb g/dl	11.6±9.4	11.3±1.4	11.0±1.2	11.5±1.1	11.4 ± 1.2
PCV%	34.1±2.4	34.6±2.3	33.4±3.1	34.1±3.1	34.1 ± 2.2
MCHC g/dl	33.7±1.4	32.4±1.8	32.2±3.7	33.1±2.3	32.8 ± 2.4
S. Pr g/dl	6.9±0.80	6.9±0.91	6.8±0.97	6.9±0.79	6.8 ± 0.9
S. alb. G/dl	3.9±0.62	4.1±0.16	4.1±0.70	4.1±6.2	4.0 ± 0.8
S. Fe ug/dl	58.8±19.3	47.9±21.8	42.2±24	51.8±20	50.2 ± 21.2
S-TIBC ug/dl	261.9±51.2	272.1±4.93	267.1±6.4	265.4±4.5	266.6 ± 51.6
Transferrin Saturation%	21.1±7.2	23.2±7.1	18.9±5.7	21.4±7.5	21.2 ± 8.6
No. of samples	18	21	31	45	115

Clinical signs of vitamins deficiencies were found in 17.3% of children, 13.0% had ariboflavinosis and 4.3% had dermatosis. No symptoms or signs suggestive of vitamin A deficiency were detected.

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Table 4: The association between biochemical parameters of children and child gender and family size.

Biochemical Parameters	Family size 3-6	Family size >6	sex male	sex female
Hb g/dl	11.6±1.2	11.2±1.3	11.6±1.3	11.3 ±1.2
PCV %	34.6± 2.7	33.9±3.2	33.7± 2.3	33.5±2.4
MCHC g/dl	33.7±2.6	32.4±3.0	33.1±2.2	32.8±2.7
S. Pr g/dl	7.9± 0.7	7.4±0.8	7.0±0.9	6.8±0.8
S. alb g/dl	4.1±0.7	4.0±0.6	3.9±0.6	4.1±0.7
S. iron µg/dl	56.1±19	52.8±25.0	48.6± 25.0	49.9±21.5
TIBC µg/dl	282±52.0	250±50	282.5±46.0	262.2±52.6
Saturation % Transferrin	21.0±0.3	20.0±7.4	19.8±5.7	20.8±7.2 Saturation %
Total	91	24	53	62

Table 3 shows the means of biochemical parameters. 56.5% of children were suffering from anaemia with haemoglobin <11g % as stated by the WHO.[10]

The mean values of biochemical parameters of children showed no significant differences in relation to gender and family size, Table 4. However, there was difference in anthropometric measurements and sex ($p<0.05$), Table 5.

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Table 5: The association between child sex and anthropometric measurements

Sex	W/A			W/H			H/A			
	N	M	S	N	M	S	N	M	S	Total
Male	18	25	10	48	5	-	18	25	10	53
Female	31	24	7	46	12	4	24	28	10	62
Total	49	49	17	94	17	4	42	53	20	
P<0.05			P<0.05			N.S.				

*N. = normal nutrition

*M. = moderately malnourished.

*S. = severely malnourished

DISCUSSION. A considerable number of children in this study had fallen into the malnourished categories. Comparison with previous data from Sudan, Bushara et al [11] in 1973, reported stunting in 93.0% in a low socioeconomic community in the out-skirts of Khartoum North, whereas El Beily in 1997 reported stunting in 5.8% and wasting in 18.4% in 1252 of primary school chidren.[12]

A nutritional survey conducted in 1973 by the National Nutrition Department (Sudan) and WHO, in six selected states in 3600 children, showed 19.6% as an overall rate of under-nutrition (6.8% as severe and 12.8% as moderate).[13]

MUAC data classified our studied children as follows, 45.2% suffered malnutrition, 28.7% as moderate and 16.5% as severe malnutrition. Ateig in 1995 reported a mean and standard deviation for MUAC in Khartoum primary school children as 18.68 (± 1.96) cm.[14] Our data were higher than Iraqi data where 30.0% were malnourished, 24.0% as moderate and 6.0% as severe.[15]

The triceps skin fold data were used to assess the adequacy of the adipose tissue stores. 41.8% were deficient in adipose tissue store (TSF <50TH percentile).

The percentage of under nutrition in this study is higher than that reported by Pollitt in Philippines[16] where, 19.4% and 1.2% were moderately and severely malnourished respectively. Barros *et. al*, reported in Brazil for first year primary school children 22.0 % stunted, 15.0% wasted and 22.0% underweight.[17] In Kenya primary school children 24.0% were stunted, 22.0% were underweight, and 9.0% were wasted.[18]

Iron deficiency anaemia (Hb < 11g/dl) is considered to be the most common cause of nutritional problems among children.[1] In this study 56.5% of children were anaemic, suggesting a wide spread problem. The majority 47.0% with mild anaemia (Hb =10-11g/dl), 8.6% were with moderate anaemia

(Hb=7-10 g/dl) and only one child had severe anaemia (Hb <7g/dl). The wide range of upper and lower serum iron results in our data explains the larger standard deviation in Table 3.

The mean Hb in this study was 11.4g/dl, which is lower than previous studies in Sudanese school children, Suliman in Gezira State[19] found high prevalence rate of anaemia (65.9%) among school children in Gezira State. He used a cut-off point of 11 g/dl of haemoglobin. Higher data were reported by Norton from Brazil.[20]

The two principal parameters of nutritional anaemia in children suggested by WHO are serum iron level of <50.1µg/dl and transferrin saturation of <15 percent. Low levels of these parameters were detected in 42.2% and 30.4% of our children respectively. Iron deficiency (ID) anaemia is more prevalent in developing countries, 40% in Africa and South Asia.[21]Iron reserve is depleted in over 20% of school children in Brazil.[20] The overall prevalence of ID anaemia in school children was 24.8% in Saudi Arabia.[22]

The average PCV was 34.1%, this had no significant correlation with the child age, this is lower than those reported by Antonio et al in Cuba.[23] The MCHC in our group was 33.7% similar to those reported by Johanna et al in 1982.[24] There was no significant association between MCHC and child age. With respect to iron deficiency anaemia (IDA) indicators suggested by the WHO, [21] it is possible to assign our children as suffering (IDA).

The mean total protein was 6.8 g/dl and 4.0 g/dl for serum albumin, both were within the normal level.

CONCLUSION AND RECOMMENDATIONS:

According to NCHS standards our children were lighter and shorter. Their nutritional status needs to be improved by consuming a balanced diet, also by implementing continuous community based programmes addressing nutritional education and income generation. Introduction of school nutritional program may be useful.

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