ANTHROPOMETRIC EVALUATION OF PRESCHOOL CHILDREN IN RIYADH CITY (SAUDI ARABIA)
BY

Hend M. Bakhashaween
Food Sciences Department of Nutrition & Food Sciences College of HEc & Art Ed.

ABSTRACT

The objective of the study was to assess the nutritional status of Saudi Arabian preschool children using their anthropometric measurements. A random sample of 571 children was selected and a questionnaire was developed for data recording.

Data included weights, heights, skinfol. thickness and demographic variables.

The National Centre for Health Statistics (NCHS) percentiles, the Gomez criteria for malnutrition and the waterlow classification for growth pattern were used to evaluate the nutritional status of the children Descriptive statistics were used to summarize and present the results

Results showed a tendency for obesity among the boys. Approximately 14% of the children were undernourished and 5% of them were wasted. Further research is needed using the nutritional methods to study the food pattern and to determine the nutritional problems of this group of children.

INTRODUCTION:

Anthropometric measurements are useful tools in predicting body composition. Skinfold thickness measurements and body mass index (BMI) predict fatness and body shape. The upper arm muscle area (UMA) and upper arm fat area (UFA) based on measures of upper arm circumference and triceps skinfold thickness are used to predict body composition and nutritional status (Rolland – Cachera, *et al.*, 1997):

The world health organization (WHO) recommended the use of weight for height and height for age as an important indicators of nutritional status particularly for children under the age of 6 years. (WHO, 1989): The use of a reference population defined by the United States National Center for Health Statistics (NCHS) has also been suggested for anthropometric comparisons (NCHS, 1976)

Anthropometric measurements were used widely to evaluate nutritional status of children and adolescents. In Mozambique Prista *et al* (2003) used the anthropometric indicators of nutritional adequacy on 2.316 child and found 3% males and 2 3% females to have stunted growth: 21 9 males and 10 % females to

be wasted; 3% males and 8% females to have wasted and stunted growth and 4.8 % males and 7.7% female were overweight .

Tumwine & Barugahare (2002) studied the nutritional status of children in Kasese district at the Uganda – Congo border using weight and height measurements it was noted that half of the 932 studied children were stunted and 21.9 % were wasted & stunted.

Raj'a, *et al.* (2001) examined the nutritional status of 948 children as reflected in their physical growth. They found that approximately half the children were either stunted or chronically underweight. Depleted fat stores affected two – fifth of the children.

In Srilanka, Fernando, *et al.* (2000) used height and weight measurements to assess the nutritional status of children. The results showed that a great proportion of the children underweight, wasted and stunted .

Weker (2000) assessed the nutritional status of 822 Polish children ages 3-7 years on the basis of anthropometric indices. He reported an average height of 75-90 percentiles for boys and girls. Underweight was found in 16.5 % and obesity was defined in 8.5 % of the children.

Therefore, the objective of this study was to evaluate the nutritional status of preschool children in Riyadh city using their anthropometric measurements.

METHODS

A random sample of 571 children was selected from the Saudi preshoolers attending the kinder garden schools supervised by the Ministry of Education. The sample consisted of 308 boys and 263 girls ages 3-6 years. A questionnaire was used to collect demographic data and to record anthropometric information.

Height was measured to the nearest half centimeter with a stadiometer and weight was measured by using electronic scales to the nearest half kilogram. Mid-upper arm circumference and skinfold thickness were measured as described by Gibson (1994) .

Data were analyzed using the SPSS for windows program. Height, weight / height, Tricep skinfold thickness, and mid-upper arm circumference were compared to NCHS 50 % percentiles and the two later indices were used to calculate mid-upper arm muscle area. The Gomez *et al.* (1956) classification was used to identify groups with under nutrition, and the Waterlow, *et al.* (1977) criteria for growth pattern was used to compare the height for age index.

RESULTS

Table (1) presents the distribution of the children by age and sex. 27.3 % males and 25.5 % females were 5 years old. The percentage of girls 4 and 6 years of age was similar while 6 years old boys were a little more than the 4 years old.

Average weights. heights. tricep skinfold thickness and mid-upper arm circumferences exhibited similar pattern of growth for boys and girls of all age groups. The girls however, seamed to be a little leaner than the boys as seen in their mid-upper arm muscle. There was a steady increase in the averages of the various measurements with age for both sexes. (Table 2)

Table (3) shows that 2.9% of the boys and 4.94 % of the girls had height / age below the average while 3.25 %, 1.14 % of the boys and girls respectively were taller than the average. Furthermore, 1.5 %, 1.2 % of the boys and girls consecutively were below the standard for weight / height. Almost 59 % of the boys and the girls were heavier than the average weight with the largest percentage of heavy children in the age of five. (Table 4):

Measurements of the mid-upper arm circumference revealed a greater number of girls with lower values than the standard while the percentage of boys and girls with greater values than the average were almost equal (Table 5): Measurement of arm muscle sizes are generally used to examine the changes in skeletal muscle, while measurements of the subcutaneous fat are suitable for studying the changes in body fat deposition.

Table (6) summarizes the percent frequencies of the sample as to the tricep skinfold thickness compared to the NCHS 50th percentile. A greater percentage of the girls ages 4 and 5 years had low fat stores. On the other hand, a greater number of boys ages 5 and 6 years had more fat than the girls.

Distribution of the arm muscle area for age measurements are shown in the table 7 and it reveals more boys than girls had lower muscle area. Similar percentages of boys and girls had normal muscle development and more girls than boys had greater muscle mass.

The Gomes classification identified 17.2% of the boys and 13.3 % of the girls with 1st degree malnutrition and only 0.64 %, 0.4% of the boys and girls respectively had 2nd degree malnutrition (Table 8): However, when the Waterlow criteria was used it was found that only 4.95% of the girls had wasted growth and 95% of them had normal growth pattern. Only one boy had a stunted growth and another had a stunted and wasted growth pattern. 2.95% of the boys had wasted growth and 95% of them had normal growth pattern.

Table (1): Distribution of the children by age and sex

Age in Years	Males		Females		Total	
	No.	%	No.	%	No.	%
3	4	0.7	4	0.7	8	1.4
4	58	10.2	53	9.3	111	19.5
5	156	27.3	146	25.5	302	52.8
6	90	15.8	60	10.5	150	26.3
Total	308	54.0	263	46.0	571	100.0

Sample size 571 child   No. = Number of children..

Table (2): Average anthropometric measurements of the children

Age in Years	Sex	Weight (kg)	Height (cm)	Tricep Skinfold (mm)	Arm Circumference (cm)	Arm Muscle (mm)
3	M	13.00 ± 2.58	88.25 ± 5.44	9.75 ± 3.40	15.00 ± 2.00	85.00 ± 12.25
4		17.98 ± 2.92	104.40 ± 5.81	9.50 ± 2.29	16.49 ± 1.29	98.36 ± 11.37
5		19.33 ± 2.75	108.66 ± 5.18	10.62 ± 2.71	16.16 ± 1.25	91.73 ± 12.93
6		21.52 ± 3.86	113.33 ± 5.47	11.78 ± 4.49	17.33 ± 1.78	86.94 ± 11.99
3	F	15.00 ± 2.00	94.25 ± 4.86	10.50 ± 3.11	16.25 ± 1.26	102.50 ± 5.00
4		16.72 ± 2.05	100.06 ± 6.87	9.13 ± 2.18	15.91 ± 1.06	94.72 ± 11.95
5		18.46 ± 2.92	107.59 ± 5.34	10.46 ± 3.11	16.58 ± 1.52	92.88 ± 13.35
6		22.18 ± 4.80	112.75 ± 5.22	13.05 ± 4.88	17.98 ± 2.30	95.25 ± 12.40

Sample size 571 Child   M = Males   F = Females

Table (3): Percent frequencies for height by age

Age in years	Sex	< 90 No.	< 90 %	90 – 110 No.	90 – 110 %	> 110 No.	> 110 %
3	M	2	0.65	2	0.65	--	--
4		4	1.30	51	16.56	7	2.27
5		3	1.00	151	49.03	1	0.33
6		--	--	85	27.61	2	0.65
Total		**9**	**2.90**	**289**	**93.84**	**10**	**3.25**
3	F	--	--	4	1.52		
4		7	2.66	44	16.73	2	0.76
5		4	1.52	141	53.62	1	0.38
6		2	0.76	58	22.05	--	--
Total		**13**	**4.94**	**247**	**93.92**	**3**	**1.14**

Sample size 571 child .   No. = number of children.   M = Males   F = Females

Table (4): Percent frequencies for weight / height

Age in years	Sex	< 90 No.	< 90 %	90 – 110 No.	90 – 110 %	> 110 No.	> 110 %
3	M	3	0.90	1	0.30	--	--
4		1	0.30	37	12.00	20	6.50
5		1	0.30	61	19.80	94	30.50
6		--	--	20	6.50	70	22.70
Total		**5**	**1.50**	**119**	**38.60**	**184**	**59.80**
3	F	1	0.40	3	1.10	--	--
4		1	0.40	34	12.90	18	6.80
5		1	0.40	61	23.20	84	31.90
6		--	--	8	3.00	52	19.80
Total		**3**	**1.20**	**106**	**40.20**	**154**	**58.50**

Sample size 571 child .   No. = number of children.   M = Males   F = Females

Table (5): Percent frequencies for mid – upper arm circumference by age

Age in years	Sex	Percent of NCHS 50th Percentile					
		< 90		90 – 110		> 110	
		No.	%	No.	%	No.	%
3	M	3	1.00	--	--	1	0.30
4		2	0.60	53	17.20	3	1.00
5		18	5.80	125	40.60	13	4.20
6		7	2.30	76	81.80	16	5.20
Total		30	9.70	254	79.60	33	10.70
3	F	--	--	3	1.10	1	0.40
4		5	1.90	45	17.10	3	1.10
5		37	14.10	94	35.70	15	5.70
6		8	3.00	32	12.20	20	7.60
Total		50	19.00	174	66.10	39	14.80

Sample size 571 child .   No. = number of children.   M = Males   F = Females

Table (6): Percent frequencies of tricep skinfold by age

Age in years	Sex	Percent of NCHS 50th Percentile					
		< 90		90 – 110		> 110	
		No.	%	No.	%	No.	%
3	M	2	0.60	--	--	2	0.60
4		21	6.70	12	3.90	25	8.10
5		18	5.90	18	5.80	120	39.00
6		11	3.50	9	2.90	70	22.70
Total		52	16.70	39	12.60	217	70.40
3	F	1	0.50	2	0.90	1	0.50
4		23	10.60	14	6.40	5	2.30
5		48	22.10	31	14.20	44	20.20
6		8	3.60	9	4.10	32	14.70
Total		80	36.80	56	25.60	82	37.70

Sample size 571 child .   No. = number of children.   M = Males   F = Females

Table (7): Percent frequencies for arm muscle area by age

Age in years	Sex	Percent of NCHS 50th Percentile					
		< 90		90 – 110		> 110	
		No.	%	No.	%	No.	%
3	M	3	0.90	1	3.00	--	
4		16	5.20	23	7.50	19	6.20
5		66	21.40	75	24.40	15	4.90
6		58	18.80	30	9.70	2	0.60
Total		143	46.30	129	44.60	36	11.70
3	F	--	--	3	1.10	1	0.40
4		18	6.90	27	10.30	8	3.00
5		67	21.70	67	25.50	22	8.40
6		20	7.60	28	10.60	12	4.60
Total		105	36.20	125	47.50	43	16.40

Sample size 571 child .   No. = number of children.   M = Males   F = Females

Table (8): Distribution of the children by the gomez classification

Age in years	Sex	Percent Frequencies			
		3rd degree	2nd degree	1st degree	Normal
3	M	--	0.32	0.32	0.65
4		--	--	3.25	15.60
5		--	0.32	7.13	43.20
6		--	--	6.50	22.71
Total		—	**0.64**	**17.20**	**82.16**
3	F	--	--	0.40	1.10
4		--	--	1.90	18.30
5		--	--	8.00	47.10
6		--	0.40	3.00	19.80
Total		—	**0.40**	**13.30**	**86.30**

M = Males   F = Females

Table (9): Distribution of the children by the waterlow classification

Age in years	Sex	Classification			
		Stunted & Wasted	Wasted	Stunted	Normal
3	M	0.65	0.65	0.65	0.65
4		--	--	--	18.82
5		--	1.30	—	48.04
6		--	1.00	--	28.24
Total		**0.65**	**2.95**	**0.65**	**95.75**
3	F	--	--	--	1.52
4		--	2.67	--	17.49
5		--	1.52	—	53.99
6		--	0.76	--	22.65
Total		—	**4.95**	—	**95.05**

Sample size 571 child .   M = Males   F = Females

DISCUSSION:

Anthropometric measurements are generally thought to be the most definitive indicators of nutritional status. Simple measurements of height, weight and skinfold thickness are by far the most cost efficient objective methods for identifying both under and over nutrition.

The girls in this study were more leaner than the boys while greater percentage of the boys had higher fat deposits than the girls. Heights for both sexes were within the norms for age. Approximately 14 % of the sample were undernourished and 5% of them had wasted growth pattern.

Similar results were reported by Al – Fragh and Bamgboye (1993) in his study on the Saudi preschoolers in Riyadh where he found undernutrition in 11.5% of the sample and 14.5% of them had wasted growth. He also found 5% of the children with severe malnutrition.

Moreover, Bairgri & Chowdhury (1994) stated in their study of 1976 children in Bangladesh that weight / age. height / age and mid-upper arm circumference are good predictors of motality among children. Asayama, *et al.* (1995) also indicated a close correlation between anthropometric measurements and obesity and fat distribution in the Japanese children.

Furthermore, in a study of 645 males and 635 female preschool children in Kuwait it was found 11.5% of the boys and 9.9% of the girls were stunted. The prevalence of wasting was fairly similar in both sexes. Obesity was more prevelant in girls than boys (Amine & Al- Awadi, 1996):

In addition, it has been suggested using the midupper arm muscle area and fat free mass in the assessment of nutritional status of children before puberty. They reported a high correlation between these indices and 24 – hour creatinine excretion, grip force and analysis of forearm muscle.

Further research is needed to assess the nutritional status of this group of children using the nutritional methods along with the anthropometric measurement in order to identify the nutritional patterns and problems of these children.

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تقييم القياسات الجسمية لأطفال ما قبل المدرسة بمدينة الرياض بالمملكة العربية السعودية

هند مبارك باخشوين

قسم التغذية وعلوم الأطعمة كلية التربية للاقتصاد المنزلي والتربية الفنية بالرياض

الغرض من هذه الدراسة هو تقييم القياسات الجسمية للأطفال في سن ما قبل المدرسة بمدينة الرياض. أجريت الدراسة على عدد ٥٧١ طفل (٣٠٨ أولاد، ٢٦٣ بنات) في سن من ٣ – ٦ سنوات، تم اختيارهم بطريقة عشوائية من مدارس الرياض. تم تصميم استمارات لتجميع بيانات عن القياسات الجسمية مثل الطول ، الوزن ، محيط منتصف الذراع، وسمك طبقة الدهن تحت الجلد ، بالإضافة إلى بيانات عن الحالة الديموجرافية .تم تحليل النتائج المتحصل عليها باستخدام برنامج SPSS.

أ سفرت نتائج الدراسة عن حدوث البدانة بين الأولاد مقارنة بالبنات، وحوالي ١٤ % من الأطفال يعانون من سوء التغذية (بالنقصان) . بالنسبة لأطوال الأطفال تشير الدراسة إلى أن أطوال كل من الأولاد والبنات كانت في الحدود الطبيعية بالنسبة لسنهم.

توصى الدراسة بإجراء أبحاث مستقبلية لدراسة النظام الغذائي للأطفال في مثل هذا السن باستخدام الطرق الغذائية لتحديد المشاكل الغذائية المنتشرة بينهم.