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Prevalence of obesity, body fatness and its correlation with BMI and waist to hip ratio in rural children of Dharwad taluk

S JAYASHREE and RAMA K NAIK *

Krishi Vigyan Kendra (DK), Kankanady, Mangalore
***College of Rural Home Science, University of Agricultural Sciences**
Krishi Nagar, Dharwad 580005
Email for correspondence: jayashreess.2007@rediffmail.com

ABSTRACT

A total of 362 children belonging to 3-12 years of age were covered for prediction of obesity based on anthropometric measurements in rural area of Dharwad. The prevalence of abdominal obesity was high in both 3- 6 (23.48% Vs 6.08%) and 7-12 years (25.97% vs 11.05%) compared to general obesity. Abdominal obesity was also found in the absence of general obesity. All the computed body fat components using body mass index in obese children were higher in comparison to normal children. However, waist circumference could not accurately determine the body fat components in children.

Keywords: Abdominal obesity, body fat components, general obesity

INTRODUCTION

Obesity is often considered a condition of affluence. Certainly in affluent nations obesity is highly prevalent and in most poor countries it is much less common. However obesity or overweight is common in both adults and children even among the poor in some non-industrialized countries particularly the middle income nations. Hence an attempt was made to study the prevalence of obesity in rural children of Dharwad taluk, the correlation between body mass index and waist circumference and the body fat composition characteristics.

METHODOLOGY

A total of 362 children belonging to 3-12 years were covered for the study. The parameters viz height, weight, waist and hip circumference were studied under the investigations. Later the Z-scores (Cachera et al 1991) and waist to hip ratio were computed to screen children for general and

abdominal obesity respectively. Body mass index and waist circumference were considered to compute body fat components using the prediction formulae as given by Vanltallie et al (1990) and Lean et al (1995) only for general obese and for equal number of normal children in each age group.

The correlation coefficients were calculated to find out the degree of relationship between body mass index and body fat components viz per cent body fat, fat mass (kg), fat mass index and fat free mass (kg).These were also calculated between waist circumference and body fat components to know the degree of relationship between them.

RESULTS

Prevalence of general obesity was more (11.05%) in higher age group ie 7-12 years compared to 3-6 years group (6.08%). However the prevalence of abdominal obesity was still high in the same age groups ie 23.48 per cent in 3-6 years and 25.97 per cent in 7-12 years. Females registered a higher prevalence for both general obesity and abdominal obesity compared to their gender counterparts (Table1).

The data on number of children with high WHR (abdominal adiposity) by Z-score criterion is documented in Table 2. Higher per cent prevalence of abdominal obesity was found among normal children of both the age groups. A higher per cent prevalence of abdominal obesity was found in females in all the three Z-scores criteria compared to males. The prevalence of abdominal obesity was higher in 7-12 year group compared to 3-6 years group both in normal and obese children. Similar trend was not noticed in underweight children.

The data on components of body fat of children computed based on body mass index are presented in Table 3. The per cent body fat, fat mass and fat mass index of obese children were higher compared to the normal children except for fat-free mass in obese children. A significant positive correlation was evident between body mass index and body fat components ie per cent body fat, fat mass and fat mass index except for fat mass in normal children of 3-6 years group, 3-6 year female children and for fat mass index in female obese children of 3-6 years. However only a significant negative correlation was noted for fat free mass in obese female children of 3-6 years (Table 3).

Body fat components computed based on waist circumference exhibited little difference among normal and obese children of both the age groups (Table 4).

Nevertheless a significant positive correlation was also noticed between waist circumference and body fat components viz per cent body fat, fat mass and fat mass index except for fat free mass.

Table 1. Prevalence of general and abdominal obesity in children

N=362

Criteria	Age groups (years)					
	3-6			7-12		
	Male	Female	Gender combined	Male	Female	Gender combined
General obesity ('Z' score)	10 (2.76)*	12 (3.31)	22 (6.08)	17 (4.70)	23 (6.35)	40 (11.05)
Abdominal obesity (Waist to hip ratio)	25 (6.91)	60 (16.57)	85 (23.48)	8 (2.21)	86 (23.76)	94 (25.97)

*Figures in parentheses indicate per cent values

DISCUSSION

A prevalence rate of over 6 per cent was evident in 3-6 years group and 11 per cent in 7-12 years group. Similar to our observation a prevalence of general obesity over 4 per cent has been reported in pre-school children in developing countries such as Barbados, Honduras, Lesotho, Bolivia, Trinidad, Tobago, Iran and Mauritius (Shetty 1999).

Higher prevalence of abdominal obesity compared to general obesity may be because of syndrome 'x' which is explained by 'Starvation Gene Theory' (Mishra and Bezbaruam 2001). It is related to the starvation gene factor in Indians caused by prolonged drought over the years. So Indian genes had adapted to survive long periods of drought by consuming fats and carbohydrates slowly to make them last longer. Now though our bodies get adequate supplies of food these genes are still in action as they take long time to adapt and food consumed continues to be metabolized slowly resulting in the dysfunctional biochemical profile that constitutes syndrome x.

Since obese children are in general advanced in both size and development over the average and the more so as compared with the normal children it is scarcely surprising that the obese and normal children differ in the body fat components (Forbes 1987). Some part of the greater fat free mass of obese children (Table 3) even when fat mass is higher could possibly be a direct consequence of the greater mass they carry. Fat-free mass may simply be a product of the dimensional and developmental advancement associated with hyper nutrition. Sex effects were less pronounced for body fat composition computed based on body mass index

Table 2. Number of children with high WHR (abdominal adiposity) by Z-scores criterion

Details	Z-scores	Number of children											
		3-6 years						7-12 years					
		Male		Female		Gender combined		Male		Female		Gender combined	
		Obese	Non-Obese	Obese	Non-Obese	Obese	Non-Obese	Obese	Non-Obese	Obese	Non-Obese	Obese	Non-Obese
Underweight	-2Z	7 (1.93)*	1 (0.28)	12 (3.31)	2 (0.55)	19 (5.25)	3 (0.83)	-	6 (1.66)	6 (1.66)	6 (1.66)	6 (1.66)	12 (3.31)
Normal	-2Z to +2Z	18 (4.97)	24 (6.63)	42 (11.60)	8 (2.21)	60 (16.57)	32 (8.84)	8 (2.21)	66 (18.23)	68 (18.78)	26 (7.18)	76 (20.99)	92 (25.41)
Obese	>+2Z	-	10 (2.76)	6 (1.66)	6 (1.66)	6 (1.66)	16 (4.42)	-	17 (4.70)	12 (3.31)	11 (3.04)	12 (3.31)	28 (7.73)
Total		25 (6.91)	35 (9.67)	60 (16.57)	16 (4.42)	85 (23.48)	51 (14.09)	8 (2.21)	89 (24.58)	86 (23.76)	43 (11.88)	94 (25.97)	132 (36.46)

WHR: Waist to hip ratio

*Figures in parentheses indicate per cent values

Table 3. Body fat composition characteristics of children based on body mass index

Study areas	Body fat composition							
	Body fat (%)		Fat mass (kg)		Fat mass index		Fat free mass	
	Male	Female	Male	Female	Male	Female	Male	Female
3-6 years								
Normal	17.37±1.97	20.62±1.33	2.47±0.38	2.81±0.62	2.67±0.47	3.06±0.36	11.82±1.77	10.94±2.94
'r' value	0.96**	0.86**	0.60NS	0.03NS	0.98**	0.96**	-0.31NS	-0.24NS
Obese	23.36±2.10	25.96±3.53	4.12±2.05	3.70±0.67	4.54±1.15	4.83±1.29	13.07±3.61	10.79±2.83
'r' value	0.97**	0.99**	0.94**	0.14NS	0.99**	1.00NS	0.79NS	-0.54*
7-12 years								
Normal	12.69±1.94	15.95±1.93	2.79±0.75	3.48±0.74	1.85±0.42	2.30±0.41	19.15±3.68	18.35±3.28
'r' value	0.83**	0.78**	0.89**	0.80**	0.93**	0.91**	0.46NS	0.30NS
Obese	17.22±5.19	20.20±4.53	4.39±1.67	4.64±1.65	3.17±1.56	3.59±1.34	20.79±4.71	18.06±4.57
'r' value	0.98**	0.97**	0.86**	0.78**	0.97**	0.98**	0.09NS	0.18NS

Note: Values are mean± SD

*Significant at 5 per cent level

** Significant at one per cent level

NS: Non significant

Table 4. Body fat composition characteristics of children based on waist circumference

Study areas	Body fat composition							
	Body fat (%)		Fat mass (kg)		Fat mass index		Fat free mass	
	Male	Female	Male	Female	Male	Female	Male	Female
3-6 years								
Normal	0.80±1.05	14.82±1.90	0.12±0.16	2.08±0.69	0.12±0.15	2.20±0.33	14.18±1.84	11.68±2.89
'r' value	0.99**	0.99**	0.98**	0.67*	0.99**	0.92**	0.20NS	0.36NS
Obese	1.41±0.88	14.39±1.61	0.24±0.16	2.11±0.63	0.27±0.16	2.62±0.25	16.95±5.19	12.39±2.79
'r' value	0.99**	0.99**	0.80**	0.61*	0.96**	0.61*	-0.03NS	0.22NS
7-12 years								
Normal	3.02±2.24	17.11±0.99	0.67±0.51	3.78±1.04	0.44±0.34	2.45±0.48	21.27±3.99	18.05±3.01
'r' value	0.99**	0.99**	0.93**	0.47*	0.99**	0.44*	-0.14NS	-0.23NS
Obese	2.26±1.88	18.02±2.64	0.63±0.59	4.10±1.25	0.42±0.36	3.07±0.63	24.54±5.16	18.60±4.86
'r' value	0.99**	0.99**	0.95**	0.47*	0.98**	0.44*	0.54*	-0.23NS

Note: Values are mean± SD
*Significant at 5 per cent level
** Significant at one per cent level
NS: Non significant

demonstrating the fact that in children the differences in body composition between the sexes are small compared with adults (Deurenberg et al 1991).

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