PJN
ISSN 1680-5194

PAKISTAN JOURNAL OF NUTRITION

ANSInet
308 Lasani Town, Sargodha Road, Faisalabad - Pakistan
Mob: +92 300 3008585, Fax: +92 41 8815544
E-mail: editorpjn@gmail.com

Pakistan Journal of Nutrition 9 (5): 459-466, 2010
ISSN 1680-5194

Prevalence of Stunting, Underweight and Obesity in School Aged Children in Uyo, Nigeria

D.C. Opara[1], E.E. Ikpeme[2] and U.S. Ekanem[1]
[1]Department of Community Health, [2]Department of Paediatrics,
College of Health Sciences, University of Uyo, Uyo, Nigeria

Abstract: There is a paucity of data on the prevalence and trends of the risk factors associated with diet related chronic diseases in school-aged children in Nigeria. Using international reference standards, we determined the prevalence of underweight, stunting and obesity in school aged children in both privately owned and public schools in a fast growing state capital in the South-south region of Nigeria in a cross sectional prevalence survey. The height and weight measurements of 985 children aged 31-150 months (2½-14 years) were taken; food preference and socio-demographic characteristics of children were determined using a semi-structured questionnaire. BMI was calculated from the data. The results showed that the prevalence of underweight, stunting and obesity were 27.3, 17.1 and 11.1% respectively in the private schools and 39.4, 25.3 and 0.2% in the public schools. The food preference showed the predominance of refined highly processed foods. This study provides evidence of the co-existence of both undernutrition and obesity in the study population. While underweight and stunting remained high in the public schools, obesity existed alongside underweight and stunting in the privately owned schools, presumably patronized by the elite and medium or high socio-economic groups.

Key words: Underweight, stunting, obesity, school-aged children

INTRODUCTION

Anthropometric indices reflect the health and welfare of individuals and communities and can predict academic performance, health outcomes as well as reflect the socio-economic profile of the population (Prista *et al*., 2003; Chatuverdi *et al*., 1993; Cogil, 2003). Globally, studies on anthropometric profile of populations, suggest an increasing incidence of obesity and the co-existence of under nutrition and obesity in transitional countries (Thiam *et al*., 2006; Gales-Camus, 2006; Eggal and Lopriore, 2006; Shrimpton, 2006). In most developing countries of the world like Nigeria, the basic issues in nutrition are those of lack, inadequacy, undernutrition, micronutrient deficiencies and attendant high levels of communicable disease (NDHS, 2004; FMOH, 2005; Chizuru Nishida, 2006; WHO, 2005; Thiam *et al*., 2006; Cannon, 1996).

However among affluent individuals/groups, as well as the elite in developing countries, an increasing body of evidence, suggests that appropriate nutritional interventions are now needed to reduce morbidity and mortality from diet related chronic diseases. The emerging health crises due to the coalescing of the health effects of undernutrition and overnutrition in the same countries, communities and even households, has been termed the double burden of malnutrition (Thiam *et al*., 2006; Gales-Camus, 2006; Eggal and Lopriore, 2006; Shrimpton, 2006). This phenomenon has been attributed to the polarized model of epidemiological nutrition transition from stage 1 to stage 2, creating an obesogenic environment (Kennedy *et al*., 2007; Uauy and Solomons, 2006; Egger and Swinburn, 1997). To stem this current and projected epidemic of morbidities and premature mortalities due to diet-related chronic disease, there has been a call for the protection of foetal and childhood growth, which is central to the prevention of both under and over nutrition (Barker, 2004; Barker *et al*., 2005; Ene-Obong, 2001; McGuire, 1996; Tomkins, 1998; Tara Gopaldas, 1998; Bruno De Benoist and Yun Ling, 1998). There is a call for the surveillance of trends of the major risk factors for the double burden of mal-nutrition such as stunting, underweight, obesity, dietary patterns etc (Rolland-Cachera *et al*., 1997; Siervogel *et al*., 1991; Serdula *et al*., 1993; Shumei *et al*., 2002; Thiam *et al*., 2006).

Recently, consensus has emerged on the use of the modified BMI in the definition of childhood obesity (Cogil, 2003). This study was therefore undertaken to use the international reference standards to document the prevalence of stunting, underweight and obesity in school-aged children in a fast growing state capital in the south-south region of Nigeria. It is well established that health and nutrition of school-aged children is of critical importance in determining the prevalence of diet related chronic diseases in adulthood (Canning *et al*., 2004).

Corresponding Author: D.C. Opara, Department of Community Health, College of Health Sciences, University of Uyo, Uyo, Nigeria

MATERIALS AND METHODS

The study was a cross sectional prevalence survey, carried out in Uyo, capital city of Akwa Ibom State, in South-south region of Nigeria in March 2009. Akwa Ibom State has 31 local government areas, a population of 3,902,081 with more males than females. Sixty-five per cent of the population are youths aged 15-34 years and 85% of the population live in the rural areas. Uyo, the capital city is a fast growing metropolis with many public and privately owned primary schools. Due to systemic decay, the public schools are patronized by the urban poor, while the rich and the elite, patronize the privately owned schools.

Using random sampling 2 private and 2 public schools were chosen. Sample size was determined by the method of Snedecor and Chochran (1972):

$$n = pqz/d^2$$

Where z = 1.96 corresponding to 95% confidence level d at 5% acceptable margin of error p = .383 proportion of stunted Nigerian children (FMOH, 2005):

$$q = 1-p$$

This came to 385 per group and 500 children each were chosen from public and private schools to allow for drop out rate. Exclusion criteria included all selected pupils who were ill, had a limb deformity, whose ages could not be ascertained or who had attained puberty (breast development in girls and voice breaking in boys).

Using stratified random sampling (based on age and sex distribution in each class) 495 children (260 boys and 235 girls) were chosen from the private schools. While 490 (250 boys and 240 girls) were chosen from the public schools. Information on age was obtained from the class registers. (The schools insist on sighting birth certificates before admission of pupils). A semi structured questionnaire completed by parents/subjects was used to obtain information on; maternal level of education, parents socio-economic status (determined by the method of Oyedeji, 1985) birth order and food preference of the selected children.

Measures: The main variables studied were subjects weight, height, age, sex, socioeconomic status, birth order and food preference. Body adiposity was estimated using BMI (weight/height^2). measurements were made while observing standard precautions (Cogil, 2003).

Definitions of stunting, underweight and obesity (Cogil, 2003)

Stunting: was defined as <-2SD of the WHO 2003 reference standard height Z-score for age and sex.

Underweight: was defined as <-2SD of WHO 2003 reference BMI Z-score for age and sex.

Obesity: was defined as >+2SD of BMI Z-score for age and sex.

Statistical analysis: We examined the mean weight for age and sex, mean height for age and sex for the public and private schools. We calculated the BMI values. We then compared the mean BMI for age and sex and mean height for age and sex against the WHO reference standards BMI z-scores and height z-score, in order to apply the cut off definitions for underweight, stunting and obesity. Comparison of values between public/private, male/female was done using z test for two proportions. Pearson's correlation was used to determine association of variables with stunting, underweight and obesity. All calculations were performed on Statistical Package for Social Sciences (SPSS) version 15.0.

RESULTS

Sociodemographic characteristics of the surveyed children: There were 985 children. Of these 490 were in public schools while 495 were in private schools, made up as follows; 250 (25.4%) males and 240 (24.4%) females in the public schools, while there were 260 (26.4%) males and 235 (23.9%) females in the private schools. Majority (54.9%) of surveyed children were of medium socio-economic status. Of these 41.4% were in private schools, while 13.5% were children in public schools. Thirty-eight per cent of mothers had university education (or its equivalent), 5.1% of such mothers had their children in public schools, while 32.8% had their children in private schools. About 15% of mothers had primary education, 14.4% of them had children in public schools, while 0.9% had children in private schools. The children in public schools had higher mean birth orders (5.4 males; 5.8 females) than those in private schools (3.4 males; 3.2 females) Table 1.

Anthropometric profile of school-aged children: The youngest (31-40 months) girls had higher mean weight than boys and this pattern persisted until age 61-70 months. By 91-110 months girls recorded higher mean weights than boys. Thereafter boys almost always recorded higher mean weights than girls of the same age. For both sexes a fall in mean weight occurred, at age 111-120 months for girls and at age 141-150 months for boys.

In the private schools, the boys recorded higher mean weights than girls of the same age up to 61-70 months. At age 71-120 months, girls recorded higher mean weights than boys. A fall in weight occurred at age 111-120 in girls and at age 131 months and above in boys. The differences in weight by age and by type of school being attended was statistically significant ($p<0.05$).

The boys in public schools, recorded higher mean height values than girls of the same age in majority of the classes. There was a relative fall in mean height for

Table 1: Sociodemographic characteristics of surveyed school-aged children in public and private schools in Uyo, Nigeria (March 2009)

	Public		Private		Total
	Male n = 250 (25.4%)	Female n = 240 (24.4%)	Male n = 260 (26.4%)	Female n = 235 (23.9%)	985 (100.00%)
Parents (SES)					
Low	178 (17.1)	179 (18.3)	2 (0.2)	1 (0.1)	360 (36.5)
Medium	72 (7.3)	61 (6.2)	208 (21.1)	200 (20.2)	541 (54.9)
High	0	0	50 (5.1)	34 (3.5)	84 (8.5)
Maternal level of education					
Primary	70 (7.1)	72 (7.3)	5 (0.5)	4 (0.4)	151 (15.3)
Secondary	150 (15.1)	147 (14.2)	80 (8.1)	71 (7.3)	460 (46.7)
University	30 (3.0)	21 (1.2)	163 (16.5)	160 (16.2)	374 (38)
Mean birth order	5.4	5.8	3.4	3.2	
Age (months)	**n = 250**	**n = 240**	**n = 260**	**n = 235**	**985**
31-40	8	6	6	6	26 (2.63)
41-50	16	14	14	13	57 (5.79)
51-60	30	24	46	32	122 (15.4)
61-70	37	20	40	34	131 (13.3)
71-80	24	26	22	26	98 (9.33)
81-90	30	24	29	31	114 (11.6)
91-100	27	28	30	26	111 (11.3)
101-110	24	24	20	28	96 (9.74)
111-120	26	30	30	19	105 (10.7)
121-130	13	20	10	11	54 (5.5)
131-140	8	14	8	4	34 (3.5)
140-150	5	10	5	5	25 (2.5)
150-160	2	0	-	-	2 (0.2)
	250 (25.4)	240 (24.4)	260 (26.4)	235 (23.9)	985 (100.0)

Table 2: Distribution of surveyed school-aged children in public and private schools by age, mean (height and weight), Uyo, Nigeria (March 2009)

	Public school				Private school			
	Male		Female		Male		Female	
Age (Months)	Mean height (cm)	Mean weight (kg)	Mean height (cm)	Mean weight (kg)	Mean height (cm)	Mean weight (kg)	Mean height (cm)	Mean weight (kg)
31-40	100.5±4.6	13.3±2.9	100.5±4.6	13.9±4.1	98.6±5.0	13.8±1.6	98.0±3.6	13.6±0.8
41-50	97.7±2.3	13.1±4.3	97.0±3.8	14.5±3.8	103.1±3.5	16.1±1.9	101.1±4.7	15.3±0.9
51-60	108±3.2	14.5±1.2	105.7±2.8	15.7±3.5	109.9±4.5	18.8±2.6	104.4±19.7	17.0±2.0
61-70	113.9±3.0	17.5±0.6	111.8±0.9	16.6±1.9	114.8±6.7	22.5±1.6	117.1±5.3	21.4±3.9
71-80	115.5±4.9	18.8±11.8	114.2±3.1	17.6±3.0	120.9±5.2	22.5±3.5	122.6±5.1	24.1±3.4
81-90	122.6±4.7	21.5±3.1	121.0±6.2	21.0±3.7	125.1±4.9	23.7±3.5	126.3±6.1	23.9±3.2
91-100	125.4±4.1	22.9±2.2	125.7±6.7	23.3±4.2	132.8±6.3	29.2±5.0	130.7±10.4	28.1±6.8
101-110	127.2±3.9	23.7±4.4	135.1±7.5	28.8± 4.0	134.6±8.0	29.1±7.0	137.8±8.0	45.6±5.7
111-120	136.0±4.8	30.5±3.9	132.0±5.7	26.2±2.7	138.2±6.6	32.4±7.2	140.3±4.0	35.5±7.1
121-130	134.7±9.7	29.8±8.9	135.7±3.5	27.6±5.3	141.4±9.1	37.1±10.8	141.7±6.6	34.7±6.8
131-140	140.9±6.0	31.1±1.8	137.8±4.1	30.0±4.4	145.7±4.1	36.7±6.0	138.7±10.7	30.5±8.7
141-150	137.8±9.2	29.8±4.1	140.5±4.1	30.6±3.3	143.8±7.8	35.1±4.9	144.5±5.76	35.6±6.1
151-160	143.8±7.1	30.2±5.8	-	-	-	-	-	-

age at 141-150 months for boys and at age 110-120 months only for girls.

Among children in private schools, boys recorded higher mean height values than girls of the same age; except between ages of 61-90 months (23.1%). A relatively low value in mean height for age occurred for girls at 141-150 months and for boys at 150-160 months. The differences in height between boys and girls was statistically significant ($p<0.05$) as was the differences in height between public and private schools ($p<0.05$).

Prevalence of underweight: The prevalence of underweight was 39.4% in the public schools, being higher 23.1% in boys than girls (16.3%). The 51-76 months old were the worst affected, the least affected age groups was 91-100 months (21.8%) (Table 3).

The prevalence of underweight in the private schools was 27.3%, being higher in girls (15.6%) than boys (11.7%). The worst affected, were children aged 101-120 months while the least affected in the private schools were children aged 131-140 months (Table 3).

Sex and type of school being attended had the highest association with being underweight, while food preference had the least association (Table 4).

Prevalence of stunting: The prevalence of stunting was 25.3% in the public schools, with boys more affected (14.1%) than girls (11.2%). Children aged 91-100

Table 3: Prevalence of stunting, underweight and obesity in surveyed school-aged children in public schools in Uyo, Nigeria (March, 2009)

	Age in months							
Both sexes	31-40	41-50	51-60	61-70	71-80	81-90	91-100	Total
Total No.	14	30	54	57	50	54	55	490 (100.0)
No. of Stunted	4 (28.6)	81 (26)	17 (31.5)	13 (22.8)	15 (30)	9 (16.7)	18 (32.7)	124 (25.3%)
No. of underweight	5 (35.7)	10 (33.3)	30 (55.6)	28 (49.1)	18 (36)	20 (37)	12 (21.8)	193 (39.4%)
No. of obese	1	0	0	0	0	0	0	1 (0.2%)
Girls								
Total No.	6	14	24	20	26	24	28	240 (49%)
No. of Stunted	2	5	7	6	7	4	8	55 (11.2%)
No. of underweight	3	8	10	10	8	8	5	80 (16.3%)
No. of obese	1	0	0	0	0	0	0	1 (0.2%)
Boys								
Total No.	8	16	30	37	24	30	27	250 (51.0%)
No. of Stunted	2	3	10	7	8	5	10	69 (14.1%)
No. of underweight	2	2	20	18	10	12	7	113 (23.1%)
No. of obese	0	0	0	0	0	0	0	0 (0.0%)

	Age in months						
Both sexes	101-110	111-120	121-130	131-140	141-150	151-160	Total
Total No.	48	56	33	22	15	2	490 (100.0)
No. of Stunted	12 (25)	13 (24.5)	8 (24.2)	4 (18.2)	3 (20)	0	124 (25.3%)
No. of underweight	22 (45.8)	23 (43.4)	12 (36.4)	6 (27.3)	7 (46.7)	0	193 (39.4%)
No. of obese	0	0	0	0	0	0	1 (0.2%)
Girls							
Total No.	24	30	20	14	10	0	240 (49%)
No. of Stunted	6	5	3	1	1	0	55 (11.2%)
No. of underweight	10	10	4	2	2	0	80 (16.3%)
No. of obese	0	0	0	0	0	0	1 (0.2%)
Boys							
Total No.	24	26	13	8	5	20	250 (51.0%)
No. of Stunted	6	8	5	3	2	0	69 (14.1%)
No. of underweight	12	13	8	4	5	0	113 (23.1%)
No. of obese	0	0	0	0	0	0	0 (0.0%)

months were the most affected, while those aged 81-90 months were the least affected (Table 3). In private schools, the prevalence of stunting was (17.1%) with boys more affected (9.7%) than girls (7.9%). Children aged 121-130 months were the most stunted in private schools, while those aged 51-60 months were the least stunted (Table 4).

Prevalence of obesity: Obesity was near absent in public schools (0.2%) (Table 3). The prevalence in private schools was 11.1% with girls being more likely to be obese (6.9%) than boys (4.2%). The youngest age group 31-40 months were the most likely to be obese (25%), followed by those aged 101-110. There was no obesity in children aged 130 months and above (Table 3).

Food preference: Rice was the food most preferred by children in public schools (60.4%). This was followed by Garri and soup (22.2%), Beans (10.4%) and Noodles (2.2%). Among children in private schools, noodles was mentioned as the most preferred food (49.3%), this was followed by rice (23.8%), yam (8.5%) and bread and beverage (6.4%) (Table 6).

DISCUSSION

This study has shown that the children of higher socio-economic status and maternal education, had a better chance at education, since majority of such children were enrolled in private schools, where the facilities are better and the teachers are more committed, though not necessarily better paid (Chatuverdi *et al*., 1993; Tara Gopaldas, 1998; Studert and Soekirman, 1998; Prista *et al*., 2003). It was observed that even some children (5.1%) whose mothers had university education or its equivalent, were enrolled in public schools. This may have to do with prevailing unemployment situation in the country (FMOH, 2005). Previous studies suggest an association between socio-economic status/maternal education and anthropometric indices of children (Guthric and Picciano, 1995; English, 1998; Bruno De Benoist and Yun Ling, 1998; Ene-Obong, 2001; Armstrong *et al*., 2003; Schmidhuber and Shetty, 2008). This study revealed that the youngest girls in public schools recorded a higher mean weight than both their male counterparts and children of the same age and sex in private schools; who are of higher socio-economic status. This observation may be linked to the possibility that comparable children in private schools, may have

Table 4: Prevalence of stunting, underweight and obesity in surveyed school-aged children in private schools in Uyo, Nigeria (March, 2009)

	Age in months						
Both sexes	31-40	41-50	51-60	61-70	71-80	81-90	Total
Total No.	12	27	78	74	48	60	495 (100.0)
No. of Stunted	2 (16.7)	5 (18.5)	8 (10.3)	13 (17.7)	8 (16.7)	14 (23.3)	85 (17.1%)
No. of underweight	3 (25)	8 (29.6)	14 (17.9)	18 (4.3)	15 (31.3)	18 (30)	135 (27.3%)
No. of obese	3	5	8	2	4	8	55 (11.1%)
Girls							
Total No.	6	13	32	34	26	31	235 (47.5%)
No. of Stunted	2	3	5	8	4	6	39 (7.9%)
No. of underweight	1	5	7	10	9	10	77 (15.6%)
No. of obese	2	3	5	2	2	5	34 (6.9%)
Boys							
Total No.	6	14	46	40	22	29	260 (52.5%)
No. of Stunted	0	2	3	7	4	8	48 (9.7%)
No. of underweight	2	3	7	8	6	8	58 (11.7%)
No. of obese	1	2	3	0	2	3	21 (4.2%)

	Age in months							
Both sexes	91-100	101-110	111-120	121-130	131-140	141-150	151-160	Total
Total No.	56	48	49	21	12	10	-	495 (100.0)
No. of Stunted	11 (19.6)	9 (18.8)	6 (12.2)	5 (23.8)	2 (16.7)	2 (2.0)	-	85 (17.1%)
No. of underweight	13 (23.2)	18 (37.5)	19 (38.8)	5 (23.8)	2 (16.7)	2 (2.0)	-	135 (27.3%)
No. of obese	8	11	4	2	0	0	-	55 (11.1%)
Girls								
Total No.	26	28	19	11	4	5	-	235 (47.5%)
No. of Stunted	3	3	2	1	1	1	-	39 (7.9%)
No. of underweight	8	10	10	3	2	2	-	77 (15.6%)
No. of obese	4	7	3	1	0	0	-	34 (6.9%)
Boys								
Total No.	30	20	30	10	8	5	-	260 (52.5%)
No. of Stunted	8	6	4	4	1	1	-	48 (9.7%)
No. of underweight	5	8	9	2	0	0	-	58 (11.7%)
No. of obese	4	4	1	1	0	0	-	21 (4.2%)

Table 5: Pearson correlation (r) of factors associated with underweight, stunting and obesity

	Underweight	Stunting	Obesity
Age	0.26	0.48	0.04^{S}
Sex	0.56	0.68	0.62^{S}
Food preference	0.26	0.01	0.07^{NS}
Maternal education	0.2	0.31	0.08^{S}
Parents socio-economic status	0.25	0.28	0.15^{S}
Type of school	0.57	0.53	0.26^{S}

Significant level = $p<0.05$

been attending school longer than those in public schools, this will translate to higher energy expenditure. The observation in this study that at certain ages, girls recorded higher weights than boys of the same age/school may be explained by differentials in physical activity pattern and maturation rate of both sexes. Similar differences in weight by sex has been observed in other studies (English, 1998; Wang *et al*., 2002; Cordeiro *et al*., 2006; Salih and Abdel-Aziz, 2007).

The observation in this study of an age related fall in mean heights and weights for both sexes could not be explained. It could be postulated that the younger children may be exhibiting a higher height potential than older children which may then be linked to improving levels of socio-economic development. Further research is needed to explain this finding, in our setting, though there are existing theories of post infancy nadir of BMI (Rolland-Cachera *et al*., 1997; Siervogel *et al*., 1991; Serdula *et al*., 1993).

Underweight, stunting and obesity: The observed prevalence of underweight and stunting (39.4% and 25.3% respectively) is near the figures reported elsewhere in Nigeria (FMOH, 2005). Sex and age related variation found in this study had been reported by other authors (English, 1998; Wang *et al*., 2002; FMOH, 2005; Cordeiro *et al*., 2006). However, the existence of underweight and stunting (27.3% and 17.1% respectively) in private schools was an unexpected finding, since these schools are patronized by the elite, the middle class and the rich. The finding may be a reflection of the tendency of the middle class families to 'over-school' their children, while cutting down on food intake. It can further be attributed to poor social services and poor health services in developing economies, alluded to by other authors (Thiam *et al*., 2006; Wang *et al*., 2002; Dewey, 2006; Gales-Camus, 2006). Stunting

Table 6: Food preference of surveyed school-aged children in Uyo, Nigeria (March 2009)

Public schools		Private schools	
Rice	296 (60.4%)	Indomie noodles	244 (49.3)
Garri and soup	10 (22.2%)	Rice	118 (23.8)
Beans	51 (10.4%)	Plantain	22 (4.4)
Indomie	11 (2.2%)	Yam	42 (8.5)
Pap	7 (1.4%)	Beans	19 (3.8)
Others like plantain, yam, rice and beans, ekpang	4 (0.8%) each	Beans and rice	1 (0.2)
		Garri and soup	1 (1.2)
		Ekpang nkukwo	3 (0.6)
		Bread and beverage	32 (6.4)
		Spaghetti	3 (0.6)
		Potato/potato chips	10 (2.0)
Total	100%		100%

and underweight are recognized as risk factors for diet related chronic diseases in adulthood (Uauy and Solomons, 2006, Barker *et al*., 2005; Barker, 2004).

Co-existence of obesity, underweight and stunting: This study provides evidence of the co-existence of both obesity and underweight/stunting even among the poor, though, a low (0.2%) in children enrolled in public schools. The prevalence of obesity was higher among children of the educated, middle and high socio-economic classes, who were enrolled in the private schools (11.1%). WHO (2005) reported that 10-20% of men and 15-45 of women in West Africa were either overweight or obese. In this study, the prevalence of obesity was higher in girls (6.9%) than boys (4.2%) and was highest (12.5%) in the youngest children (31-40 months). These findings are consistent with those of other authors (Eggal and Lopriore, 2006; Shumei *et al*., 2002; Armstrong *et al*., 2003; Chizuru Nishida, 2006). This study found high levels of underweight (39.4%, public schools and 27.3% in private schools) and stunting (23.3% in public and 17.1% in private schools). The co-existence of under and over nutrition in the same population, is postulated to bring about a potentiation of their adverse health effects, translating to rising morbidities and premature mortalities from diet-related chronic disease (Reilly *et al*., 1999; WHO/FAO, 2003; Armstrong *et al*., 2003; Canning *et al*., 2004; Tremblay *et al*., 2002; Schmidhuber and Shetty, 2008). Obesity in childhood is believed to persist into adulthood (Vaska and Volkmer, 2004; Serdula *et al*., 1993; Thornburn, 2005), leading to an increasing incidence of certain types of cancers, osteoarthritis, hypertension, Type 2 Diabetis, cardio vascular Disease, etc. stunting in childhood predisposes to obesity in adulthood due to metabolic changes.

The presence of obesity in this population of school aged children may be attributed to their food preference. Even among the low socio economic status children enrolled in public schools, but more especially among children in private schools where highly processed foods such as noodles, rice, bread and beverage were the most preferred and eaten foods. Sometimes constituting the three main meals in the 24 hr dietary recall. The traditional foods such as Beans, Garri and soup, Ekpang Nkwukwo (a native dish made from cocoyam tubers, leaves and sea foods) were the least mentioned as preferred or eaten. Similar findings were reported by Anyika and Uwaeghute (2005) on the snacks and nutrient intake of secondary school girls. Nutritional transition to the "western diet" and the emergence of an obesogenic environment in urban poor and in developing countries has been associated with the double burden of malnutrition (Kennedy *et al*., 2007; Rolland-Cachera *et al*., 1997; Siervogel *et al*., 1991).

Food preference and dietary patterns are associated with many factors such as, parental influences, home environment, food insecurity, media influence, globalization of the food industry (Campbell *et al*., 2007; Hood *et al*., 2000; Birch and Fisher, 1998; Sharma, 1996; Shrimpton, 2006; Feinberg *et al*., 2008; Ene-Obong, 2001).

We conclude that the findings of these study suggest an escalation of the present and projected epidemic of diet-related chronic diseases in Nigeria, where 24% of the disease burden is attributed to chronic disease (WHO, 2005). It is therefore recommended that already established remedies (Reilly *et al*., 1999; Gales-Camus, 2006; Thiam *et al*., 2006; Dewey, 2006; Lobstein *et al*., 2004; Rudiger Von Kries *et al*., 1999) be put in place to contain this upsurge.

ACKNOWLEDGEMENTS

The authors acknowledge the cooperation of the administrators, principals, head mistress/head master, parents, staff and pupils of the participating schools.

REFERENCES

Anyika, J.V. and A.C. Uwaeghute, 2005. Frequency of Consumption and Nutrient content of some snacks eaten by adolescent female secondary and university students in Abia State. Nig. J. Nutr. Sci., 26: 10-15.

Armstrong, I., I. Dorosty, J. Reilly, J. Emmet and Child Health Information Team, 2003. Coexistence of social inequalities in undernutrition and obesity in preschool children: Population based cross sectional study. Arch. Dis. Children, 88: 671-675.

Barker, D.J.P., 2004. The developmental origins of adult disease. J. Am. College Nutr., 23: 5885-5955.

Barker, D.J., C. Osmond, T.J. Forsen, E. Kajalee and J.G. Rickson, 2005. Trajectories of growth among children who have coronary events as adults. N. Engl. J. Med., 353: 1802-1809.

Birch, L.L. and J.O. Fisher, 1998. Development of eating behaviour among children and adolescents pediatrics. March, 101: 539-549.

Bruno de Benoist and Yun Ling, 1998. Anaemia in school-aged children in UNSCN 18.

Campbell, K.J., D.A. Crawford, J. Salmon, A. Carver, S.P. Garnett and L.A. Baur, 2007. Associations between the home food environment and obesity promoting eating behaviour in Adolescents. Obesity (Silver Spring) March, 15: 719-730.

Canning, P., M.L. Courage and M. Frizell, 2004. Prevalence of overweight and obesity in a provincial population of Canadian preschool children. Can. Medical Assoc. J., 171: 240-242.

Cannon, G., 1996. Food and Health experts agree in the global burden of disease. C. Murray and A. Lopez eds. Cambridge, Harvard University Press.

Chatuverdi, S., U. Kapil and N. Gnanasekaran, 1993. Nutrient intake among adolescent girls belonging to poor socio-economic group of rural area of Rajasthan. In. Paediatrics, 33: 197-201.

Chizuru Nishida, 2006. Global food and nutrition strategies for addressing the Double Burden of Malnutrition and other emerging issues in SCN News No. 33.

Cogil, B., 2003. Anthropometric. Indicators measurement guide. Food and Nutrition Technical Assistance (FANTA) Project, Academy of Education Development Washington DC.

Cordeiro, L.S., S. Lamstein, Z. Mahmud and F.G. Levinson, 2006. Adolescent Malnutrition in developing countries in Adolescence a pivotal stage in the life cycle UNSCN News 31.

Dewey, K.G., 2006. Tackling the double burden of malnutrition, what actions are needed at the individual and family level in SCN News. Tackling the double burden of Malnutrition. A Global Agenda. SCN News. No. 32.

Eggal, F. and C. Lopriore, 2006. Agriculture/Health collaboration: The Key to fighting malnutrition in all its forms. In Diet related chronic diseases and the double Burden of malnutrition in West Africa. SCN News No. 33.

Egger, G. and B. Swinburn, 1997. An ecological approach to the obesity pandemic. Br. Medical J., 315: 477-480.

Ene-Obong, H.N., 2001. Eating right (a nutrition guide) Calabar, The University of Calabar Press.

English, R., 1998. Nutrition of School-aged children in Mongolia in UNSCN 18.

Feinberg, D., P.L. Karanagh, R.L. Young and N. Prudent, 2008. Pediatrics, 122: e854-860.

FMOH, 2005. Nigeria Health nutrition and population country status report. Vol. 2.

Gales-Camus, C.U., 2006. Nutrition: an input and foundation for Health Diet. Tackling the double burden of Malnutrition. A global Agenda. SCN News. No. 32.

Guthric, H.A. and M.F. Picciano, 1995. Human Nutrition. New York, McGraw Hill.

Hood, M.U., L.L. Moore, A. Sundarajun-Ramamurti, M. Singer, L.A. Cuppies and R.C. Elison, 2000. Parental eating attitude and the development of obesity in children. The Framingham children's study. Int. J. Obesity Related Metals Disord., 24: 1319 -1325.

Kennedy, A., G. Nantel and P. Shetty, 2007. Assessment of the double burden of malnutrition in six case study countries. Nutrition planning, assessment and evaluation service, food and agricultural organization of the United Nations. (Available on internet accessed on 01-10-07).

Lobstein, L., L. Baur and R. Uauy, 2004. Obesity in children and young people. A crisis in public health. Obesity Rev., 5 (suppl. 1): 4-85.

McGuire, J., 1996. Best Practices in addressing Micronutrient malnutrition. Washington, The World Bank.

Nigerian Demographic and Health Survey, 2004. National Population Commission and ORC Macro 2004.

Oyedeji, G.A., 1985. Socioeconomic and cultural background of hospitalized children Olusanya Social class in Illesha. Nig. J. Paediatrics, 12: 111-117.

Prista, A., Maia Jar, A. Damasceno and C. Beuren, 2003. Anthropometric indicators of nutritional status. Implications for fitness, activity and health in school-aged children and adolescents from Maputo Mozambique. Am. J. Clin. Nutr., 77: 952-950^{++}. The World Bank Group, African Region Human Development and the FMOH Nigeria.

Reilly, J.R., A.R. Dorosty and P.M. Emmet, 1999. Prevalence of overweight and obesity in British Children, cohort study. Br. Med. J., 319-1039.

Rolland-Cachera, M., M. Deheerger and M. Guilloud-Bataille, 1997. Tracking the development of adiposity from one month of age to adulthood. Ann. Human Biol., 14: 219-229.

Rudiger Von Krieis, Berthold Koletzko, Thorsten Sauerwald, Erika Von Mutius, Dietmar Barnet, Veit Grunert and Hubertus Von Voss, 1999. Breast feeding and obesity: cross sectional study. BMJ, 199: 319; 147-150.

Salih, Osama Awad and Abdel Aziz, 2007. Prevalence of underweight , overweight and obesity among adolescents Sudanese secondary school children of Khartoum State.

Schmidhuber, J. and P. Shetty, 2008. Nutrition Transition, Obesity and on communicable diseases; drivers, outlook and concerns in UNSCN overweight and obesity, a new nutrition emergency, pp: 13-19.

Serdula, M.K., D. Ivery, R.J. Coates, D.S. Freedman, D.F. Williamson and T. Byers, 1993. Do obese children become obese adults. A review of the literature. Prev. Med., 22: 167-177.

Sharma, I., 1996. Trends in intake of ready-to-eat food among urban school children in Nepal in UNSCN News No. 16.

Shrimpton, R., 2006. Life Cycle and Gender Perspective on the Double Burden of Malnutrition and the prevention of Diet Related Chronic diseases in Diet-related Chronic diseases and the double burden of malnutrition in West Africa SCN News No. 33.

Shumei Sun Guo, Wei Wu, William Cameron Chumlea and F. Alex Roche, 2002. Predicting overweight and Obesity in adulthood from body mass index values in children and adolescence. Am. J. Nutr., 76: 653-658.

Siervogel, R.M., A.F. Roche, G.S. Mukherjee and W.C. Chumlea, 1991. Patterns of change in weight/stature from 2-18 years. Findings from long-term serial data for children in the Fels longitudinal growth study. Int. J. Obesity, 15: 479-485.

Snedecor, G.W. and W.A. Cochran, 1972. Statistical Methods. IOWA, IOWA State University Press.

Studert, L. and Soekirman, 1998. School feeding in Indonesia; a community based programme for child, School and community development in UNSCN, 18.

Tara Gopaldas, 1998. Indias National Programme of Nutritional Supports to Primary Education Programme in UNSCN 18.

Thiam, I., K. Samba and D. Iwanga, 2006. Diet related Chronic diseases in the west African Region in DIET-related chronic disease and the Double Burden of Malnutrition in West Africa. UNSCN News 33.

Thornburn, A.W., 2005. Prevalence of Obesity in Australia. The International Association for the study of obesity. Obesity Renews, 6: 187-189.

Tomkins, A., 1998. Malnutrition among school children in industrialized countries in UNSCN 18 July 1998.

Tremblay, M.S., P.T. Katzmarzyk and J.D. Williams, 2002. Temporal Trends in Overweight and Obesity in Canada. 1981-1996 Int. J. Obesity Related Metals Disor., 26: 538-543.

Uauy, R. and N.W. Solomons, 2006. The role of the international community: Forging a common agenda in tackling the DBM in Tackling the Double Burden of malnutrition: A Global Agenda. SCN News No. 32.

Vaska, V.L. and R. Volkmer, 2004. Increasing prevalence of obesity in South Australian 4 year olds 1995-2002. J. Paediatric Child Health, 40: 353-355.

Wang Youfa, Monteiro Carlos and Barry Mpopkin, 2002. Trends of obesity and underweight in older children and adolescents in the United States, Brazil, China and Russia. Am. J. Clin. Nutr., 75: 971-977.

WHO/FAO, 2003. Diet, Nutrition and the prevention of Chronic disease. A report of a Jout WHO/FAO expert consultation Technical Report series 916 WHO Geneva.

WHO, 2005. Preventing Chronic diseases: A vital investment WHO, Geneva.