

Original Article

Prevalence of Obesity and Associated Risk Factors Among School Children in Primary Schools in Lusaka, Zambia

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Abstract

Objectives: To determine the prevalence of obesity and associated risk factors among primary school children in Lusaka, Zambia.

Methods: This was a cross-sectional study done in day primary schools in Lusaka District, Zambia, between October 2017 and March 2018. The study was conducted in fourteen schools, using a stratified multistage sampling. Two schools, one government and one private were selected randomly from each of the seven constituencies of Lusaka district. The pupils in each school were selected randomly using a probability proportionate to size sampling strategy. Information collected included anthropometric measurements, school head teacher reported, parent/guardian-reported, and child-reported questionnaires on lifestyle, diet and physical activity.

Results: A total of 556 pupils were selected. The prevalence of obesity was 8.8 percent and overweight 12.6 percent with the burden increasing with age [adjusted Odds Ratio = 1.35, 95percent Confidence Interval (CI)= 1.05- 1.74, P- value= 0.02]. The mean age of the pupils was 10.5 years (SD= 1.47). Boys had on average 38percent reduced odds for overweight/obesity compared to girls [Adjusted Odds Ratio (OR) = 0.62, 95percent Confidence Interval (CI) = 0.40 – 0.97, P-value =

0.034]. Pupils in private schools had on average twice increased odds for overweight/obesity (OR = 2.26, CI = 1.47 – 3.48, P-value < 0.001) than pupils in government schools. Pupils who watched TV for less than an hour had on average 55percent reduced odds for overweight/obesity (OR = 0.45, CI = 0.25 – 0.81, P-value = 0.007), than those that watched TV for more than 1 hour.

Conclusion: The prevalence of obesity and overweight among primary school going children was 8.8 percent and 12.6 percent respectively. The risk factors associated with obesity include female gender, enrolment in a private school and prolonged watching of television.

INTRODUCTION

According to the World Health Organisation, obesity is a condition of abnormal or excessive fat accumulation that may impair health.¹ Obesity has become an epidemic in many parts of the world but our understanding of the problem in children is limited due to lack of data from different countries. Varying criteria for defining obesity does not make our understanding of the problem in children any easier.¹

The modern life style has contributed to increasing levels of obesity. Fast foods are readily available for consumption at any moment and more people have a life of less physical activity. In addition, there is ease of transportation as opposed to walking and many

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hours are spent on a desk in classroom. Thus, the high consumption of readily available fast foods and a life style of less physical activities have created a new phenomenon of obesity in nearly all societies.

Children have not been spared by the escalating obesity levels in the world. Available statistics indicate a growing trend in childhood obesity, particularly in primary schools.² In Zambia, the overall childhood obesity remains at 1 percent since 1992 and the percentage of children under the age of 5 years is 8 percent.³ No studies have been conducted targeting primary school going children in Zambia. Available studies have focused on obesity in the adult population.^{4,5} Childhood obesity is of an interest for several reasons: firstly, it has been recognised that correcting the problem of obesity in childhood is much more effective and thus ultimately escapes the risk factors associated with obesity in later adult life. Secondly, corrective measures are equally attainable such as through adherence to correct dietary intakes and physical activities in school programmes.^{6,7}

The purpose of this study therefore, was to investigate the prevalence of obesity and associated risk factors among primary school going children in Lusaka, Zambia.

METHODS

A prospective cross-sectional study was conducted including all eligible pupils aged between 7 and 12 years old in day primary schools of Lusaka. The study was conducted in 14 schools, using a stratified multistage sampling. Two schools were selected randomly from each of the seven constituencies of Lusaka district, comprising one private and one government. The pupils in each school were selected randomly using a probability proportionate to size sampling strategy. The sample size was 556, calculated using EPI info version 3. Data was collected over a 6 month period (October, 2017 to March, 2018) using school head teacher reported, parent/guardian-reported, and child-reported questionnaires on lifestyle, diet and physical activity and anthropometric measurements. Data was

analysed using a Statistical Package for Social Sciences (SPSS) version 21.0.

RESULTS

During the study period, a total of 556 pupils were recruited from day primary schools in Lusaka in grades 2, 3, 4, 5, 6 and 7. A total of 14 schools surveyed during the study, of which 7 were private schools and 7 were government schools. There were 206/ 556 (37.1percent) pupils from private schools and 350/556 (62.9percent) pupils from government schools selected for this study. The mean age of the pupils was 10.5 years (SD = 1.47). A greater proportion of the pupils were girls 320/556 (57.6 percent) while 236/556 (42.4 percent) were boys. This difference in proportion between the sexes was statistically significant ($P < 0.001$). There was no significant difference in mean age between boys and girls ($P = 0.23$). There were 316/556 pupils (56.8percent) who ate breakfast every day before school, 152/556 (27.3percent) who ate most days, and 88/556 (15.8percent) who never ate breakfast before school. There were 392/556 (70.5percent) pupils that had no any physical education (PE) classes and 164/556 (29.5percent) that had one or more PE classes per week at their school.

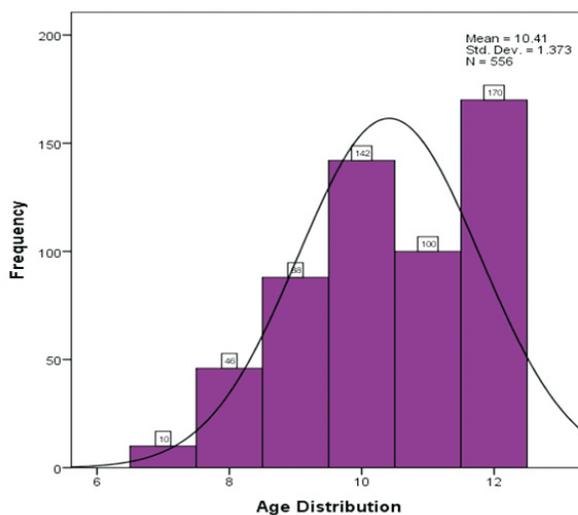


Figure 1: Age Distribution

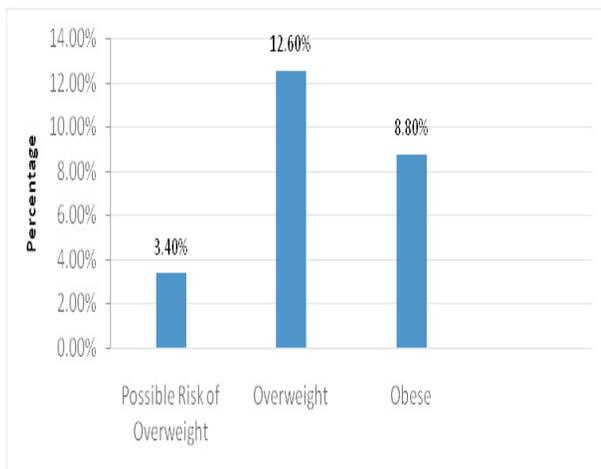


Figure 2: **Figure 2: BMI for age of Pupils**

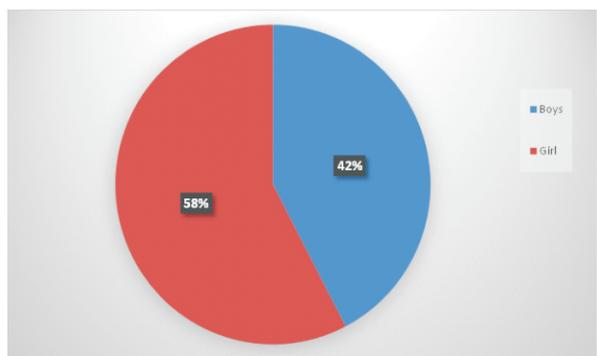


Figure 3: **Figure 3: Sex distribution of the study group**

There were 19/556 pupils (3.4percent) with possible risk of being overweight (Z-score >+1), 70/556 (12.6percent) were overweight (Z-score >+2), and 49/556 (8.8percent) were obese (Z- score >+3).

There were 164/556 (29.5percent) pupils that did not engage in any kind of sport after school in a week, while 94/556 (16.9percent) did engage in sport once a week, 164/556 (29.5percent) engaged in sport 2 or 3 times a week, and 134/556 (24.1percent) engaged in sport 4 or more times in a week. There were 102/556 (18.3percent) pupils with a television (TV) in their bedroom, 14/556 (2.5percent) with a DVD or video player, 38/556 (6.8percent) with a computer, and 52/556 (9.4percent) with a games console. A greater majority, 350/556 (62.9percent), did not have any of these items in their bedrooms. There

were only 20/556 (3.6percent) pupils who did not spend any time watching TV each day, while 148/556 (26.6percent) watched TV for < 1 hour each day, 206/556 (37.1percent) spent between 1 and 3 hours, 76/556 (13.7percent) spent between 3 and 5 hours, and 106/556 (19.1percent) spent over 5 hours watching TV each day. There were 264/556 (52.3percent) families that owned cars and 226/556 (44.8percent) who did not, and this proportional difference was not statistically significant (P=0.09). A slightly greater proportion of the guardian respondents had below tertiary education, 287/556 (56.8percent), compared to 218/556 (43.2percent) with tertiary education and this proportional difference was statistically significant (P=0.002).

Most families 333/556 (59.9percent) ate fast food at least once a week, 172/556 (30.9percent) ate fast foods once to three times a week, and 51/556 (9.2percent) ate fast foods daily. Though not statistically significant in the bivariate analysis, most pupils that ate fast foods more than three times a week were obese (P=0.44).

The prevalence of obesity was 8.8percent and that of overweight children was 12.6percent, with risk of being obese and overweight increasing with age (OR= 1.35, CI= 1.05- 1.74, P- value = 0.02). In addition, there was a significant association of obesity and overweight with the type of school. The proportion of overweight/obese pupils was greater in private schools compared to government schools (OR= 3.34, CI 1.62- 7.24, P = 0.001). Compared to pupils in government schools, pupils in private schools had on average twice increased odds for overweight/obese weight (OR = 2.26, CI = 1.47- 3.48, P-value<0.001).

Sex was significantly associated with obesity (P = 0.02). Girls had a higher proportion for being overweight/obese compared to boys. Boys had on average 38percent reduced odds for overweight/obese weight compared to girls [Adjusted Odds Ratio (OR) = 0.62, 95percent Confidence Interval (CI) = 0.40 – 0.97, P-value = 0.034].

Other variables significantly associated with overweight and obesity were frequency of physical education (PE) classes per week ($P = 0.001$); presence of electronics in the bedroom ($P < 0.01$); time spent watching television ($P < 0.01$); whether

or not the family owned a car ($P = 0.02$) and age of the pupil. ($P = 0.004$). Most of children with obesity had fast- foods more than three times a week. Though this was not statistically significant (P -value 0.44)

Table 1: Demographic characteristics of study subjects

Variables	Frequency	Percentage
Sex		
Boys	236	42.4
Girls	320	57.6
Type of School		
Private School	7	50.0
Government school	7	50.0
Pupil distribution by school type		
Private School	206	37.1
Govt School	350	62.9
Eat breakfast before school		
Every day	316	56.8
Most days	152	27.3
Never	88	15.8
PE Classes per week		
No PE Class	392	70.5
One or more PE Class	164	29.5
Frequency eating fast-food		
More than 3 times a week	51	9.2
1-3 times a week	172	30.9
Less than once a week	333	59.9
After school sport in a week		
None	164	29.5
1-time	94	16.9
2 or 3 times	164	29.5
4 or more times	134	24.1
Have in bedroom		
TV	102	18.3
DVD or video player	14	2.5
Home computer	38	6.8
Games console	52	9.4
None of these	350	62.9
Time spent watching television		
None	20	3.6
< 1 hour	148	26.6
Between 1 – 3 hours	206	37.1
Between 3 – 5 hours	76	13.7
Over 5 hours	106	19.1
Family own car		
Yes	264	52.3
No	226	44.8
Missing response	15	3.0
Respondent guardian education level		
Tertiary	218	43.2
Below tertiary	287	56.8

Table 2: Bivariate analysis for association with obesity/overweight

Variables	Normal		Overweight		Obese		P-value
	n	percent	n	percent	n	percent	
Sex							
Boys	180	81.4percent	19	8.6percent	22	10.0percent	0.02 ^c
Girls	224	74.2percent	51	16.9percent	27	8.9percent	
Pupil distribution by school type							
Private School	136	68.7percent	30	15.2percent	32	16.2percent	<0.001 ^c
Govt School	268	82.5percent	40	12.3percent	17	5.2percent	
Eat breakfast before school							
Every day	231	77.8percent	41	13.8percent	25	8.4percent	0.83 ^c
Most days	112	78.3percent	17	11.9percent	14	9.8percent	
Never	61	73.5percent	12	14.5percent	10	12.0percent	
Physical education classes per week							
No PE Class	295	79.7percent	52	14.1percent	23	6.2percent	0.001 ^c
One or more PE classes	109	71.2percent	18	11.8percent	26	17.0percent	
Frequency of eating fast food							
More than 3 times a week	6	11.8percent	16	31.4percent	29	56.9percent	0.44 ^c
1-3 times a week	113	65.7percent	47	22.7percent	12	11.6percent	
Less than once a week	318	95.5percent	7	2.1percent	8	2.4percent	
After school sport in a week							
None	120	75.9percent	27	17.1percent	11	7.0percent	0.61 ^c
1-time	67	77.0percent	12	13.8percent	8	9.2percent	
2 or 3 times	117	77.5percent	18	11.9percent	16	10.6percent	
4 or more times	100	78.7percent	13	10.2percent	14	11.0percent	

Have in bedroom							
TV or DVD	78	72.2percent	12	11.1percent	18	16.7percent	<0.01 ^c
Home computer	28	73.7percent	0	0.0percent	10	26.3percent	
Games console	42	84.0percent	4	8.0percent	4	8.0percent	
None of these	256	78.3percent	54	16.5percent	17	5.2percent	
Time spent watching TV							
< 1 hour	128	81.5percent	19	12.1percent	10	6.4percent	<0.01 ^c
Home computer	28	73.7percent	0	0.0percent	10	26.3percent	
Games console	42	84.0percent	4	8.0percent	4	8.0percent	
None of these	256	78.3percent	54	16.5percent	17	5.2percent	
Time spent watching TV							
< 1 hour	128	81.5percent	19	12.1percent	10	6.4percent	<0.01 ^c
Between 1 - 3 hours	147	76.2percent	19	9.8percent	27	14.0percent	
Between 3 - 5 hours	64	88.9percent	6	8.3percent	2	2.8percent	
Over 5 hours	65	64.4percent	26	25.7percent	10	29.9percent	
Family own car							
Yes	166	70.6percent	42	17.9percent	27	11.5percent	0.02 ^c
No	213	81.0percent	28	10.6percent	22	8.4percent	
Respondent guardian education level							
Tertiary	146	74.9percent	32	16.4percent	17	8.7percent	0.28 ^c
Below tertiary	258	78.7percent	38	11.6percent	32	9.8percent	
Age (mean, SD)	10.5, 1.44		10.0, 1.46		10.7, 1.62		0.004 ^a

^c=Chi-Square Independence Test; ^a=One-way Analysis of Variance (ANOVA)

Table 3: Multivariate logistic regression analysis predicting overweight/obesity

Variables	Unadjusted Odds Ratio (95percent CI)	Adjusted Odds Ratio (95percent CI)	P-value
Sex			
Girls	1	1	
Boys	0.21 (0.15 - 0.29)	0.62 (0.40 - 0.97)	0.034
Type of School			
Government school	1	1	
Private school	2.21 (1.47 - 3.34)	2.26 (1.47 - 3.48)	<0.001
Time spent watching TV			
Over 5 hours	1	1	
< 1 hour	0.21 (0.14 -0.31)	0.45 (0.25 -0.81)	0.007
Between 1 - 3 hours	0.29 (0.21 0.40)	0.54 (0.32 -0.93)	0.026
Between 3 - 5 hours	0.12 (0.06 - 0.25)	0.22 (0.09 - 0.50)	<0.001

Compared to pupils who watched television for more than 5 hours; pupils who watched TV for less than an hour had on average 55percent reduced odds for overweight/obese weight (OR = 0.45, CI = 0.25-0.81, P-value = 0.007), whereas pupils who watched television between 1-3 hours had on average 46percent reduced odds for overweight/obese weight (OR = 0.57, CI = 0.32-0.93, P-value = 0.026), and pupils who watched television between 3-5 hours had on average 78percent reduced odds for overweight/obese (OR = 0.22, CI = 0.09-0.50, P-value < 0.001).

DISCUSSION

The overall prevalence of obesity, including overweight, among the pupils enrolled in the study was 21.4percent; 12.6percent for overweight and 8.8percent for obesity. One of the most striking results is the clear difference between the private and Government schools. The proportion of obese and overweight children in private schools was significantly greater than in Government schools.

Of those that participated in the study, 236/556 (42.4percent) were boys and 320/556 (57.6percent) were girls. The participants were drawn from seven private schools and seven government schools. The mean age of the pupils was 10.5 years (SD= 1.47). Of the obese children, 65.3percent (32/49) were from private schools as compared to those from government schools 34.7percent (17/49). The findings of this study were similar to a study done by Aduama, in which more obese pupils were in private schools than in public schools.⁹ Most children in private schools come from families of high socio-economic status. In addition, schools that did not offer health education programmes and a variety of healthy food had a higher prevalence of obesity among the pupils. Thus, pupils were predisposed to buy high caloric foods such as chips, crisps, sausages, burgers and carbonated drinks. Consumption of too much calories increases the chances of having excess fat.

Only nine of 14 surveyed schools had an active after school sports programme and most of the pupils

were not involved in sporting activities after class. Several studies have shown that physical inactivity is a significant predictor and cause of obesity in children, independent of nutritional habits. A study done by Nelson *et al*, found that less than 30 minutes of physical activity or active play per day was associated with an increased risk of overweight and obesity (OR 1.80; 95percent CL 1.1.0-2.94) in children in the United States.¹⁰ In this study, doing sport was not associated with being overweight.

Whilst in school, obese children face a lot of challenges. They are affected emotionally, and they become vulnerable to social domains, thereby reducing the quality of life. Obese children are discriminated and face a lot of negative stereotype making it difficult for these children to participate in regular activities.

A higher parental education status is associated with an increase in the prevalence of overweight and obesity among their children. The risk of childhood overweight and obesity significantly increases if the parents are university graduates.¹¹ This may be due to the parent's education level affecting their job and lifestyle. They have more disposable income and less time to monitor their children's diet. However, in this study, there was no significant relationship between the level of education of the parents with obesity in children.

It was observed that children from a family owning a car were at risk of overweight and obesity (P=0.02). Obesity and overweight are more prevalent among children belonging to the upper and middle-income class in society than the lower income group which has minimal purchasing power. This is similar to a study conducted by Javed *et al*, in Pakistan where of all obese children, 70 percent belonged to the higher socioeconomic status group.¹²

It has been noted that there is an imbalance between energy intake and expenditure in school going children. Parenting styles also has a role to play in the reduction or prevention of childhood obesity. It was found that 51 of 556 (9.2percent) of parents take their children more than three times a week to eat

fast foods. Often parents are working and unable to concentrate on cook a balanced nutritional food for their children. They find it easier to let their children eat fast foods which are readily available.

Most children are driven to school unlike riding their bikes or walking to school to encourage physical exercise, the reason is that most parents want to ensure safety of their children and feel it is convenient for their children. Furthermore, the distance from home to school also has an effect on the need to take children to and from children.

In this study, prevalence of childhood obesity was higher among girls than boys. Boys had on average 38percent reduced odds for overweight/obese pupils compared to girls and similar to a study done by Muhihiet *al*(adjusted odds ratio = 2.6, 95percent CL=1.4- 4.9) in Dar-es-Salaam Tanzania.¹³ Other studies conducted in Africa have reported similar gender difference in the prevalence of child obesity.¹⁴ In the South African study by Armstrong *et al*, it was found that the prevalence of obesity within the sample was 3.2 percent for boys and 4.9 percent for girls, whereas overweight prevalence was 14.0 percent for boys and 17.9 percent for girls.¹⁴ The prevalence of obesity and overweight is much high as compared to neighbouring countries in the region.¹⁵

After adjusting for other independent variables, age, female gender, school type, socio- economic status and time spent watching TV were the most significant independent risk factors of obesity in this population of primary school children. Analysis showed that the prevalence of overweight and obesity increased with age.

As found in other studies, those children who watched TV for a longer period had greater odds of being obese.¹⁶ Compared to pupils who watched television for more than 5 hours, pupils who watched television for less than an hour had on average 55 percent reduced odds for overweight/obesity (OR= 0.45 CI=0.35= 0.81, P- value= 0.0007). This is due to the fact that watching TV for many hours may be associated with less physical

activity and increased food intake whilst watching television. This was seen in those with television and game consoles in the bedroom than those who did not have any. Eating food while watching TV causes one to be distracted, resulting in consumption of more food. On average, it was noted that many pupils in the study exceeded the 2- hour television limit recommended by the American Academy of Paediatrics (AAP).¹⁷

Furthermore, food advertising on TV has been associated with an increase in childhood obesity. In a systemic review done by Carter in Australia found that childhood obesity rates had tripled since 1985, coupled with an increase in consumption of energy-dense foods and advertising of these foods on children's television programmes.¹⁸

Most pupils attributed their inactivity to lack of a safe playground and being confined to their home after they knock off from school. Physical inactivity has a prime role in the development of overweight and obesity, including the development of chronic diseases such as diabetes and hypertension in later life.

CONCLUSION AND RECOMMENDATIONS

The prevalence of obesity and overweight among primary school going children was 8.8 percent and 12.6percent respectively. Following backward multivariate analysis, significant risk factors associated with obesity include female gender, enrolment in a private school and prolonged watching of television.

School-based programs provide an ideal setting for improving dietary patterns and patterns of physical activity among children. This can be of high impact in that this where most the pupils can be reached. Parents and guardians should encourage more physical activity in relation to screen time and promote healthy nutrition. Policies are needed to encourage physical education classes in every school to promote physical activity.

In addition, further studies need to be done to increase our understanding of predictors of

childhood obesity, including genetic factors because early interventions on the modifiable risk factors are likely to decrease the rate of childhood obesity and obesity in the general population thereby reducing the burden of obesity and its co-morbidities on the national health budget.

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REFERENCES

1. World Health Organisation (WHO). Available from : <www.who.int/mediacentre/factsheets/fs311/en/>. [Accessed 18 March 2016].
2. Yuca S.A., Yilmaz C., Cesur Y., Dogan M., and Kaya A., Basaranoglu M. Prevalence of overweight and obesity in children and adolescents in eastern Turkey. *Journal of Clinical research in Paediatric Endocrinology*. 2010; 2: 159- 63.
3. Zambia Demographic Health Survey (ZDHS) 2013-14; pg 155- 61.
4. Rudatsikira E., Muula A.S., Mulenga D., and Siziya S. Prevalence and correlates of obesity among Lusaka residents, Zambia: a population-based survey. *International Archives of Medicine*. 2012 Vol 5:14 doi: 10.1186/1755-7682-5-14.
5. Zyambo C., Babaniyi O., Songolo P., Muula A.S., Rudastikira E, Mukonka VM, and Siziya S. Prevalence and Determinants for Overweight and Obesity among Residents of a Mining Township in Kitwe, Zambia, in 2011: A population-based Survey. *iMedPub Journals* 2012, Vol4, No 1:1, doi:10.3823/102
6. Harris K.M., Gordon-Larsen P, Chantala K, Udry J.R., Longitudinal trends in race/ ethnic disparities in leading health indicators from adolescence to young adulthood. *Archives of Paediatric Adolescent Medicine*. 2006 January; 160(1):74- 81.
7. Fox K.,R. Childhood obesity and the role of physical activity. *Journal of the Royal Society for the promotion of Health*. 2003; 124(1): 34- 39.
8. Glaser J.B, Hammerschlag M.R. and McCormack W.M., Epidemiology of Sexually Transmitted Diseases in Rape Victims. *Journal of views of Infectious Diseases*. 1989 Mar-Apr; 11(2): 246-54.
9. Aduama S. Obesity in primary school children in Accra Metropolis. Master's thesis 2004. University of Ghana.
10. Nelson, Jennifer & Carpenter, Kathleen & Chiasson, Mary. Diet, Activity, and Overweight Among Preschool-Age Children Enrolled in the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC). *Preventing chronic disease*. 2006; 3: A49.
11. Al Alawi S, Abdulatif F, Al Dhubaib D, Mohammed H, Al Ansari A. Prevalence of overweight and obesity across preschool children from four cities of the Kingdom of Bahrain. *Int J Med Sci Public Health* 2013; 2:529-532.
12. Warraich H.J., Javed F, Faraz-ul-Haq M., Khawaja B.F., and Saleem S. Prevalence of Obesity in School- Going Children of Karachi. 2009. *PLoS ONE* 4(3): e 4816, doi: 10.1371/journal.pone.0004816.
13. Alfa J. Muhihi A.J., Mpembeni R.N.M., Njelekela M.A., Anaeli A., Chilo O., Kubhoja S., Lujani B., Maghembe M., and Ngarashi D. Prevalence and determinants of obesity among primary school children in Dar es salaam, Tanzania. *Archives of public health* 2013, 71:26. <http://www.archpublichealth.com/content/71/1/26>

14. Armstrong M.E.G., Lambert M.I., Sharwood K.A., and Lambert EV. Obesity and overweight in South African primary school children- the Health of the Nation Study. *South African Medical Journal* 2006; 96: 439- 444.
15. Martorell R., Khan K.L. and Grummer-Srawn L.M. Overweight and obesity in preschool children from developing countries. *International Journal of Obesity*. 2000;24: 959- 967. American Academy of Pediatrics. Committee on Public Education. Children, adolescents, and television. *Pediatrics* 2001 Feb;107(2):423-6
16. Monasta L, Batty G.D., Cattaneo A., Lutje V, Ronfani L., van Lenthe F.J., and Brug J. Early-life determinants of overweight and obesity: a review of systemic reviews. *Obesity Reviews*, March 2010. Doi: 10.1111/j.1467-789X.2010.00735.x. Source: PubMed.
17. American Academy of Pediatrics. Committee on Public Education. Children, adolescents, and television. *Pediatrics* 2001 Feb;107(2):423-6.
18. Carter O.B., The weighty issue of Australian Television Food Advertising and childhood obesity. *Health promotion journal Australia*. 2006;17: 5- 11.