Journal of Medical and Biomedical Sciences

VOLUME 2, ISSUE 3, JULY 2013

ORIGINAL ARTICLES

Journal of Medical and Biomedical Sciences (2013) 2(3): 1-7

doi: http://dx.doi.org/10.4314/jmbs.v2i3.1

ORIGINAL ARTICLE

Association between breakfast skipping and adiposity status among civil servants in the Tamale metropolis

V. Mogre[1], J. A. Atibilla[2] and B. N-A. Kandoh[2]

[1]Department of Human Biology, [2]Department of Community Nutrition, School of Medicine and Health Sciences, University for Development Studies, Tamale, Ghana

Breakfast meal contributes at least 25% of the daily requirements of an individual making it crucial for healthy growth and development. The aim of this study was to assess breakfast skipping and its association to adiposity among civil servants in the Tamale metropolis. A cross-sectional design was used to assess a sample of 235 civil servants working in the Tamale metropolis. Breakfast eating patterns were assessed by means of a questionnaire that was self-administered. Breakfast consumption was classified into breakfast eaters and skippers. Weight and height was measured to determine participants' adiposity status by means of body mass index cut-off points. Participants were within the age range of 20-60 years. Approximately half of the studied population (50.6%, n=119) were within the 20 - 29 age group. Among the studied population, 52.3% of the participants were breakfast eaters while 47.7% were breakfast skippers. More female participants skipped breakfast (57.8%; n= 52; p=0.016) as compared to males. Almost 30% (33/112) of the studied participants skipped breakfast for lack of time, 32.1% (36/112) for no appetite and 29.5% (33/112) for not feeling hungry. Breakfast skippers were significantly more likely to be overweight (57.3% vs. 42.6%) and obese (59.7% vs. 40.3%) compared to breakfast eaters. Skipping of breakfast was associated with obesity. Health strategies should be put in place by the Ghana Health Service to encourage individuals to regularly eat breakfast.
Journal of Medical and Biomedical Sciences (2013) 2(3), 1-7

Keywords*:* Adiposity, BMI, Breakfast Consumption, Breakfast skipping, Civil servants, Tamale, Ghana

INTRODUCTION

Breakfast is crucial to all humans since it is the first meal of the day. It contributes to at least 25% of the daily nutritional requirements of an individual. Consumption of breakfast is essential for cognitive development and performance, as well as healthy growth for both children and adults (Croll *et al.*, 2001; Nicklas *et al.*, 2004; Pollitt *et al.*, 1998; Rampersaud *et al.*, 2005). Healthy breakfast eating contributes to an overall sense of well-being and is important in preventing a number of diseases (Kushi *et al.*, 2006).

Some individuals perceive breakfast to be less important and time wasting, and thus skip it. This compels them to binge during lunch and supper or snack in between meals predisposing them to obesity. Cross-sectional studies have shown that breakfast skipping is associated with increased prevalence of overweight and obesity (Croezen *et al.*, 2009; Dubois *et al.*, 2009; Ma *et al.*, 2003; Marin-Guerrero *et al.*, 2008). The consumption of breakfast is associated with lower risk of weight gain (Cho *et al.*, 2003). Research has shown that subjects who regularly skipped breakfast had 4.5 times risk of developing obesity than those who consumed breakfast regularly (Mota *et al.*, 2008). However, contradictory findings have also been reported on the association of breakfast skipping to body mass index (BMI) (Williams, 2007) or to overweight/ obesity (Mota *et al.*, 2008).

Over 30% of civil servants in Ghana have been found to be either overweight or obese in recent times (Aryeetey *et al.*, 2011; Mogre *et al.*, 2012). Sed-

Correspondence: Mr. Victor Mogre, Department of Human Biology, School of Medicine and Health Science, University for Development Studies, Tamale, Ghana E-mail: mogrevictor@yahoo.com

entary lifestyles, urbanization and nutritional transition (Aryeetey *et al.*, 2011; Popkin *et al.*, 1998) have been attributed to the current situation. Furthermore, there is paucity of data on breakfast consumption patterns of Ghanaians. This study investigated the prevalence of breakfast skipping and its association to adiposity status among civil servants in Tamale, Ghana.

MATERIALS AND METHODS

Participants

This cross-sectional study was conducted between January and July, 2011. Participants comprised 235 adult civil servants within the Tamale Metropolis of the Northern Region of Ghana. All personnel from the 13 civil service departments in the Tamale Metropolis were eligible to participate in the study. Participants who were on medication known to modify serum lipid or carbohydrate metabolism were excluded from the study. Participants were selected using a proportionate random sampling technique that included more participants from larger departments, with the help of random number statistical tables. From each department, a proportionately determined number of participants were selected from the list of potential participants in that department. The inclusion of participants was voluntary and informed consent was obtained from each participant. The study was approved by the Ethics Committee of the University for Development Studies, School of Medicine and Health Sciences.

Anthropometric variables

Anthropometric measurements such as height and weight were taken. The weights of subjects were measured to the nearest 0.1 kg using the UNICEF electronic scale manufactured by SECA. All scales used were calibrated with a standard weight prior to use. The heights of participants without shoes on were measured using a wall-mounted microtoise calibrated to the nearest 0.1 m. The adiposity status of participants was determined using Body Mass Index (BMI) which was obtained by dividing their weights in kilogram (kg) by the square of their heights in metres (m). The WHO normative standards for the adult classification of body weight were followed in which underweight was considered to be a BMI < 18.5 kg/m^2, normal weight: BMI 18.5–24.9 kg/m^2, overweight (pre-obese): BMI 25–29.9 kg/m^2 and Obese: BMI > 30 kg/m^2 (WHO, 2000)

Breakfast eating patterns

A semi-structured, self-administered, 25–item questionnaire was employed to assess socio-demographic data and breakfast eating patterns. Breakfast was defined as "the first meal of the day that was taken in the morning, before going to work or at the workplace before 12:00 pm (Gajre *et al.*, 2008)". The breakfast eating patterns of participants were classified into breakfast eaters and breakfast skippers. Breakfast eaters were participants who ate breakfast at least 4 days in a week. Breakfast skippers were participants who skipped breakfast at least 4 days in a week. Type of breakfast consumed by participants was classified into "light" breakfast and "heavy" breakfast. Light breakfast included food considered to be low in energy e.g. tea, coffee, vegetables and fruits. Heavy breakfast included high energy foods such as rice and beans (Waakye), Tuo-zaafi, Banku and Kenkey.

Statistical Analysis

The results were expressed as proportion and compared using Fischer's exact test. A p-value of <0.05 was considered as statistically significant. GraphPad Prism version 5.00 (GraphPad software, San Diego California USA, www.graphpad.com) for windows was used for all statistical analysis.

RESULTS

Table 1 indicates the general characteristics of the studied population stratified by gender. This comprised of 145 males and 90 females with ages ranging between 20 to 60 years. Approximately half of the studied population (50.6%, n=119) were within the 20 - 29 age group. Among the studied population, 52.3% of the participants were breakfast eaters while 47.7% were breakfast skippers. More female participants skipped breakfast (57.8%; n= 52; p=0.016) as compared to males.

Among the breakfast skippers, 29.5% (33/112) skipped breakfast for lack of time, 32.1% (36/112)

for no appetite and 29.5% (33/112) for not feeling hungry. When reasons for skipping breakfast were stratified by gender however, the differences were not significant.

Table 2 assesses participant's knowledge on the health benefits of breakfast consumption in which 64.7% said the consumption of breakfast provides one with energy and 8.9% said the consumption of breakfast prevents one from getting ulcer. A few respondents 11.5% (27/235) said they did not have any knowledge on the health benefits of breakfast consumption. There was no significant difference when the participant's knowledge on the health benefits of breakfast consumption was stratified based on gender.

Table 1: General characteristics of the studied population

Variable	Total (n = 235)	Male (n= 145)	Female (n= 90)	P value
Age (years)				
20-29	119 (50.6%)	70 (48.2%)	49 (54.4%)	0.421
30-39	61 (26.0%)	41 (28.3%)	20 (22.2%)	0.359
40-49	26 (11.1%)	14 (9.7%)	12 (13.3%)	0.399
50-59	25 (10.6%)	17 (11.7%)	8 (8.9%)	0.664
60+	1 (0.4%)	1 (0.7%)	0 (0.0%)	1.000
Breakfast eating patterns				
Breakfast Eaters	123 (52.3%)	85 (58.6%)	38 (42.2%)	0.016
Breakfast Skippers	112(47.7%)	60(41.4%)	52(57.8%)	
Participants' reasons for Skipping breakfast	**n = 112**	**n = 60**	**n = 52**	
Lack of time	36 (32.1%)	22 (36.7%)	14 (26.9%)	0.314
Lack of appetite	33 (29.5%)	20 (33.3%)	13 (25.0%)	0.408
Not feeling hungry	33 (29.5%)	20 (33.3%)	13 (25.0%)	0.408
Too early to eat	5 (4.5%)	3 (5.0%)	2 (3.8%)	0.622
Religious reasons	3 (2.7%)	2 (3.3%)	1 (1.9%)	1.000
Health Reasons	2 (1.8%)	2 (3.3%)	0 (0.0%)	0.498

Data was presented as proportion and analyzed using Fischer's exact test

Majority of the breakfast eaters took light food (71.5%) largely within the hour of 4-8 am (59.3%) as shown in Table 2. The estimated mean BMI was 27.7 kg/m^2, with the mean BMI of males being 26.9 kg/m^2 and 29.1 kg/m^2 for female participants. The prevalence of obesity was 28.5% (67/235) and higher ($p=0.017$) in females (37.8%) than in males (22.8%).

The comparison between breakfast eating patterns, remedy for skipping breakfast and body weight are presented in Figure 1. Participants who skipped breakfast were significantly more likely to be overweight (57.3% vs. 42.6%) and obese (59.7% vs. 40.3%) compared to participants who ate breakfast. With regards to remedy for skipping breakfast, participants who snacked were significantly more likely

Table 2: General Characteristics of the studied population

Variable	Total (n = 235)	Male (n= 145)	Female (n= 90)	P value
Knowledge on the health benefits of breakfast (n = 235)				
Has no idea	27 (11.5%)	17 (11.7%)	10 (11.1%)	1.000
Gives me energy and boost attention	152 (64.7%)	94 (64.8%)	58 (64.4%)	1.000
Promotes good health and development	35 (14.9%)	22 (15.2%)	13 (14.4%)	1.000
Prevents Ulcer	21 (8.9%)	13 (9.0%)	8 (8.9%)	1.000
Kind of breakfast taken (n = 123)				
Light	88 (71.5%)	60 (70.6%)	28 (73.7%)	0.830
Heavy	35 (28.5%)	25 (29.4%)	10 (26.3%)	
Time of breakfast (n = 123)				
4am-8am	73 (59.3%)	50 (58.8%)	17 (44.7%)	0.173
8am-12pm	50 (40.7%)	35 (41.2%)	21 (55.3%)	
Adiposity status (n = 235)				
Normal	67 (28.5%)	46 (31.7%)	21 (23.3%)	0.183
Overweight	101 (43.0%)	66 (45.5%)	35 (38.9%)	0.345
Obesity	67 (28.5%)	33 (22.8%)	34 (37.8%)	0.017

Data was presented as proportion and analyzed using Fischer's exact test

to be overweight and obese compared to those who overeat during lunch (p=0.0232).

DISCUSSION

From this study, 47.7% of the studied participants skipped breakfast. Although the range of definitions used for breakfast skipping as well as the paucity of data in Sub-Saharan Africa may complicate comparisons, the rate of breakfast skippers in this study is among the highest reported in literature. A study among Taiwanese adults estimated a breakfast skipping rate of 8% (Huang *et al.*, 2010). In a study of free living adults in the US, 20.05% skipped breakfast (Mezrich *et al.*, 2003). Another survey in Finland reported a breakfast skipping rate of 40.2% and 29% in men and women respectively (Keski-Rahkonen *et al.*, 2003). About 30% of breakfast skipper's did not eat breakfast because of lack of time, appetite or not feeling hungry. These reasons coincide with several other studies in adults (Letsa, 2011; Moy *et al.*, 2009; Nicklas *et al.*, 2004).The observed 52.3% breakfast eaters from this study is in agreement with the 53% observed among an adult population in Turkey (Memis *et al.*, 2010) and the 51.2% and 48.8% reported in Taiwanese men and women respectively (Huang *et al.*, 2010).

Another important finding from this study is the higher rate of obesity among breakfast skippers as compared to the breakfast eaters. These results are in agreement with data from Spanish adults (Marin-Guerrero *et al.*, 2008); Taiwanese (Huang *et al.*, 2010) and several other populations where skipping breakfast has been associated with a higher BMI and obesity (Cho *et al.*, 2003; Keski-Rahkonen *et al.*, 2003; Ma *et al.*, 2003). Also, the prevalence of obesity was found to be higher among females as compared to the male participants. This could probably be attributed to the findings that more females skipped breakfast, which has been shown to be associated with obesity in this study. Data on breakfast skipping and obesity in sub-Saharan Africa is limited, however; studies in developed countries have shown a decreasing trend in breakfasting but an increasing trend in the prevalence of obesity (Kant *et al.*, 2006). It is therefore not surprising that

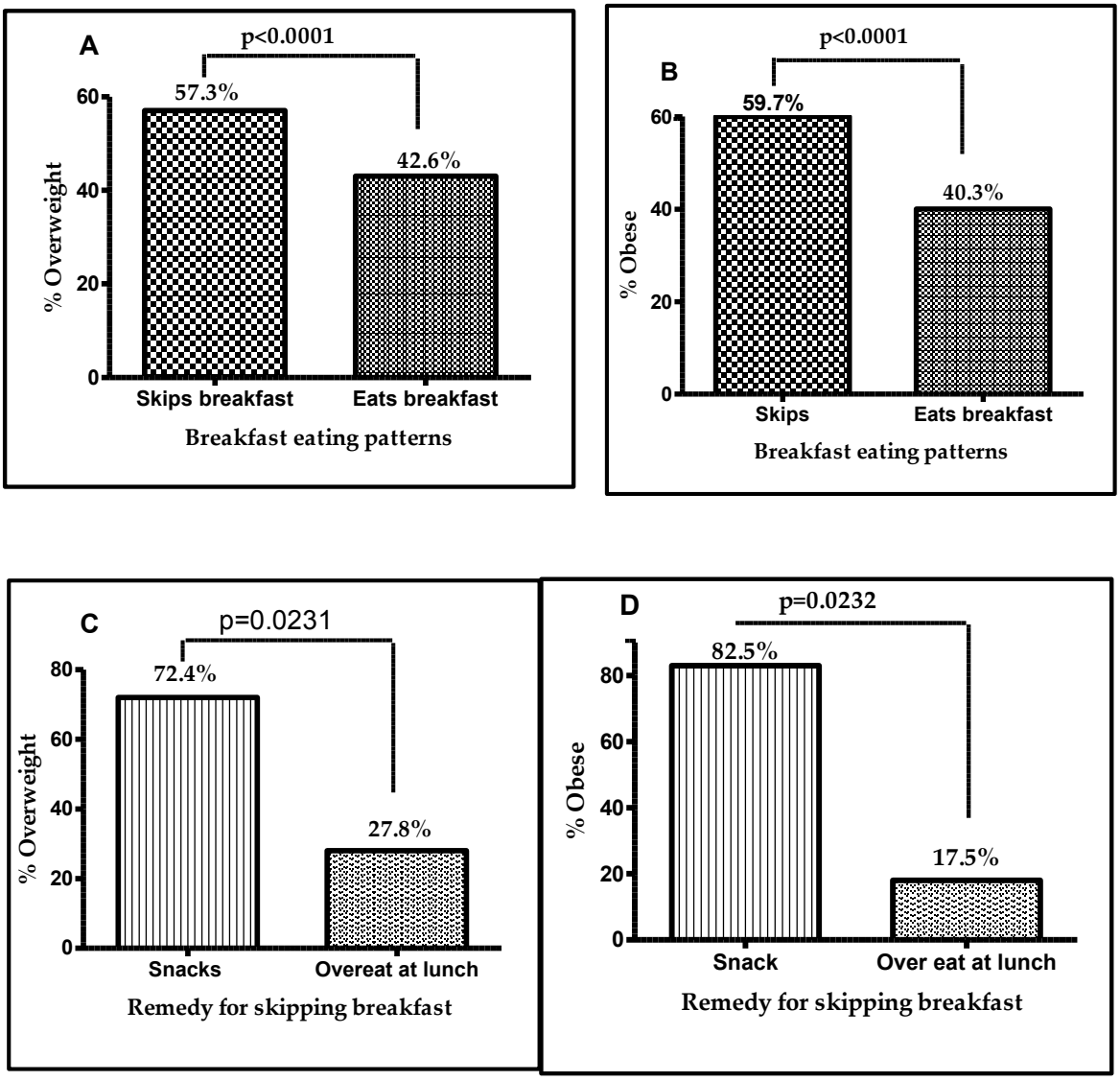

Figure 1: Comparison between breakfast eating patterns and overweight **(A),** between breakfast eating patterns and Obesity **(B),** between remedy for skipping breakfast and overweight (**C)** and between remedy for skipping breakfast and obesity **(D).** *Data was analyzed using Fischer's exact test.*

a high prevalence of 28.5% of obesity have been found in this study with a breakfast skipping prevalence of 47.7%. Promotion of regular breakfast consumption should be included in the development of programmes to address obesity.

It is unclear the mechanisms by which breakfast skipping contributes to the development of obesity from this study. However, several potential mechanisms have been suggested including decreased energy expenditure, increased daily total energy intake and increased energy storage (Gwinup *et al.*, 1963; Jenkins *et al.*, 1989; Wadhwa *et al.*, 1973; Young *et al.*, 1972).

One limitation of this study is that it did not consider other factors such as physical activity levels, total daily energy intake and dieting that are known to influence body weight. However, the study has demonstrated an association between breakfast skipping and BMI status.

CONCLUSION

The prevalence of both overweight and obesity was higher in breakfast skippers than in breakfast eaters. Female participants were more likely to skip breakfast and more likely to be obese than their male participants. Further research is needed to determine whether breakfast skipping has a causal relation to overweight and obesity. Family health promotion strategies should be put in place by the health authorities to encourage individuals to eat breakfast regularly to help reduce the high prevalence of obesity.

COMPETING INTERESTS

The authors declare that they have no competing interests.

REFERENCES

Aryeetey, R, Ansong, J (2011) Overweight and hypertension among college of health Sciences employees in Ghana. *Africa Journal of Food, Agriculture and Nutrition and Development* 11(6): 5444-5456.

Cho, S, Dietrich, M, Brown, CJ, Clark, CA, Block, G (2003) The effect of breakfast type on total daily energy intake and body mass index: results from the Third National Health and Nutrition Examination Survey (NHANES III). *J Am Coll Nutr* 22(4): 296-302.

Croezen, S, Visscher, TL, Ter Bogt, NC, Veling, ML, Haveman-Nies, A (2009) Skipping breakfast, alcohol consumption and physical inactivity as risk factors for overweight and obesity in adolescents: results of the E-MOVO project. *Eur J Clin Nutr* 63(3): 405-412.

Croll, JK, Neumark-Sztainer, D, Story, M (2001) Healthy eating: what does it mean to adolescents? *J Nutr Educ* 33(4): 193-198.

Dubois, L, Girard, M, Potvin Kent, M, Farmer, A, Tatone-Tokuda, F (2009) Breakfast skipping is associated with differences in meal patterns, macronutrient intakes and overweight among pre-school children. *Public Health Nutr* 12(1): 19-28.

Gajre, NS, Fernandez, S, Balakrishna, N, Vazir, S (2008) Breakfast eating habit and its influence on attention-concentration, immediate memory and school achievement. *Indian Pediatr* 45(10): 824-828.

Gwinup, G, Byron, RC, Roush, WH, Kruger, FA, Hamwi, GJ (1963) Effect of Nibbling Versus Gorging on Serum Lipids in Man. *Am J Clin Nutr* 13: 209-213.

Huang, CJ, Hu, HT, Fan, YC, Liao, YM, Tsai, PS (2010) Associations of breakfast skipping with obesity and health-related quality of life: evidence from a national survey in Taiwan. *Int J Obes (Lond)* 34(4): 720-725.

Jenkins, DJ, Wolever, TM, Vuksan, V, Brighenti, F, Cunnane, SC, Rao, AV, Jenkins, AL, Buckley, G, Patten, R, Singer, W, et al. (1989) Nibbling versus gorging: metabolic advantages of increased meal frequency. *N Engl J Med* 321(14): 929-934.

Kant, AK, Graubard, BI (2006) Secular trends in patterns of self-reported food consumption of adult Americans: NHANES 1971-1975 to NHANES 1999-2002. *The American journal of clinical nutrition* 84(5): 1215-1223.

Keski-Rahkonen, A, Kaprio, J, Rissanen, A, Virkkunen, M, Rose, RJ (2003) Breakfast skipping and health-compromising behaviors in adolescents and adults. *Eur J Clin Nutr* 57(7): 842-853.

Kushi, LH, Byers, T, Doyle, C, Bandera, EV, McCullough, M, McTiernan, A, Gansler, T, Andrews, KS, Thun, MJ (2006) American Cancer Society Guidelines on Nutrition and Physical Activity for cancer prevention: reducing the risk of cancer with healthy food choices and physical activity. *CA Cancer J Clin* 56(5): 254-281; quiz 313-254.

Letsa, WC (2011) Importance of Breakfast to the Business Executive. In: *The Mirror*, p 10. Accra.

Ma, Y, Bertone, ER, Stanek, EJ, 3rd, Reed, GW, Hebert, JR, Cohen, NL, Merriam, PA,

Ockene, IS (2003) Association between eating patterns and obesity in a free-living US adult population. *Am J Epidemiol* 158(1): 85-92.

Marin-Guerrero, AC, Gutierrez-Fisac, JL, Guallar-Castillon, P, Banegas, JR, Rodriguez-Artalejo, F (2008) Eating behaviours and obesity in the adult population of Spain. *Br J Nutr* 100(5): 1142-1148.

Memis, E, Sanlier, N (2010) Analysis of Nutrition Habits of the Teachers and Nurses. *Pakistan Journal of Nutrition* 9(12): 1176-1182.

Mezrich, JD, Yamada, K, Lee, RS, Mawulawde, K, Benjamin, LC, Schwarze, ML, Maloney, ME, Amoah, HC, Houser, SL, Sachs, DH, Madsen, JC (2003) Induction of tolerance to heart transplants by simultaneous cotransplantation of donor kidneys may depend on a radiation-sensitive renal-cell population. *Transplantation* 76(4): 625-631.

Mogre, V, Mwinlenaa, PP, Oladele, J, Amalba, A (2012) Impact of physical activity levels and diet on central obesity among civil servants in Tamale metropolis. *Journal of Medical and Biomedical Sciences* 1(2).

Mota, J, Fidalgo, F, Silva, R, Ribeiro, JC, Santos, R, Carvalho, J, Santos, MP (2008) Relationships between physical activity, obesity and meal frequency in adolescents. *Ann Hum Biol* 35(1): 1-10.

Moy, FM, Johari, S, Ismail, Y, Mahad, R, Tie, FH, Wan Ismail, WMA (2009) Breakfast Skipping and Its Associated Factors among Undergraduates in a Public University in Kuala Lumpur. *Mal J Nutr* 15(2): 165 - 174.

Nicklas, TA, O'Neil, C, Myers, L (2004) The Importance of Breakfast Consumption to Nutrition of Children, Adolescents, and Young Adults. *Nutr Today* 39(1): 30-39.

Pollitt, E, Mathews, R (1998) Breakfast and cognition: an integrative summary. *Am J Clin Nutr* 67(4): 804S-813S.

Popkin, BM, Doak, CM (1998) The obesity epidemic is a worldwide phenomenon. *Nutr Rev* 56(4 Pt 1): 106-114.

Rampersaud, GC, Pereira, MA, Girard, BL, Adams, J, Metzl, JD (2005) Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents. *J Am Diet Assoc* 105(5): 743-760; quiz 761-742.

Wadhwa, PS, Young, EA, Schmidt, K, Elson, CE, Pringle, DJ (1973) Metabolic consequences of feeding frequency in man. *Am J Clin Nutr* 26(8): 823-830.

WHO (2000) Obesity: preventing and managing the global epidemic, WHO (ed). Geneva: WHO.

Williams, P (2007) Breakfast and the diets of Australian children and adolescents: an analysis of data from the 1995 National Nutrition Survey. *Int J Food Sci Nutr* 58(3): 201-216.

Young, CM, Hutter, LF, Scanlan, SS, Rand, CE, Lutwak, L, Simko, V (1972) Metabolic effects of meal frequency on normal young men. *J Am Diet Assoc* 61(4): 391-398.

ISSN 2026-6294

Journal of Medical and Biomedical Sciences (2013) 2(3): 8-16

doi: http://dx.doi.org/10.4314/jmbs.v2i3.2

ORIGINAL ARTICLE

Links among motivation, socio-demographic characteristics and low physical activity level among a group of Nigerian patients with type 2 diabetes

A.F. Adeniyi[1], O.O. Ogwumike[1], C.G. John-Chu[1], A.A. Fasanmade[2] and J.O. Adeleye[2]

[1]Department of Physiotherapy, [2]Department of Medicine, College of Medicine, University of Ibadan, Ibadan, Oyo State, Nigeria

While many studies blame low physical activity (PA) among patients with type 2 diabetes mellitus (T2DM) on lack of motivation, others have inconsistently linked it with socio-demographic characteristics. This study investigated the associations among motivation, socio-demographic characteristics and low level participation in physical activity among a group of Nigerian patients with T2DM. A consenting sample of 326 T2DM patients attending diabetes clinics of the two largest hospitals in Ibadan participated in this cross-sectional study. Motivation types and PA levels were assessed using the Motivation for Physical Activity Questionnaire and International Physical Activity Questionnaire respectively. Socio-demographic data were also documented. Regression analysis was used to determine associations at $p<0.05$. A total of 245 (75.2%) of the participants were intrinsically motivated towards PA but only 108 (33.1%) were active at moderate-to-high levels. Motivation and duration of diagnosis were not linked with low PA while being female (OR=1.57; 95%CI =1.22-4.19), age > 60 (OR=2.42; 95%CI =1.91-3.77), no education (OR=2.21; 95%CI =1.64-4.33), retirement (OR=3.89; 95%CI =2.72-6.35) and being married (OR=1.63; 95%CI =1.14-3.66) conferred increased risks of low PA. The Nigerian T2DM patients were appropriately motivated but PA was below recommended levels. Low PA was significantly linked with more of the socio-demographic characteristics than motivational factors.

Journal of Medical and Biomedical Sciences (2013) 2(3), 8-16

Keywords*:* Type 2 diabetes; Physical activity; Motivation; Psychological factors; Physical exercise

INTRODUCTION

A large number of individuals who present with chronic illnesses find it difficult to commence most of the healthcare habits that have been found to be beneficial to their overall health and when they are able to commence the activities, most of them find it difficult to maintain such habits (Amico, 2011). This assertion is also supported by Dunbar-Jacobe and Mortimer-Stephen (2011) who claimed that almost two thirds of persons with chronic illnesses do not follow their treatment prescriptions. One of the prescriptions in the line of management of these patients as shown by systematic reviews is the adoption of regular physical activity at moderate intensities and this has been shown to reduce the risk of having type 2 diabetes mellitus (T2DM) (Jeon *et al.,* 2007).

Physical activity of moderate intensity for at least 150 minutes in a week or at least 90 minutes/week of vigorous aerobic exercise is recommended to enhance cardio-metabolic health of patients with T2DM (Sigal *et al.,* 2006). In spite of the benefits and the laid down prescriptions, most patients with diabetes are inconsistent with their physical activities (Mori *et al.,* 2011). Research findings have also indicated that physical activity is the least maintained of all the self-care efforts (Shigaki *et al.,* 2010). There appears to be a myriad of factors militating against the participation of patients with T2DM in regular physical activity and exercises. Some of the factors include lack of social support (Korkiakangas *et al.,* 2009; Adeniyi *et al.,* 2012), lack

Correspondence: Dr. A.F. Adeniyi, Department of Physiotherapy, College of Medicine, University of Ibadan, Ibadan, Nigeria, E-Mail: adeniyifatai@yahoo.co.uk, fadeniyi@comui.edu.ng

of knowledge of the types of exercise to perform, health problems, pain/difficulty taking part in exercise, lack of local exercise facilities, aversion to exercising in poor weather (Korkiakangas *et al.,* 2009) and a host of other socio-demographic factors (Barrett *et al.,* 2007; Morrato *et al.,* 2007; Huebschmann *et al.,* 2011). However, evidence has also consistently shown that motivation is an important factor in adhering to physical exercises among both healthy and chronically ill populations (Ryan and Deci, 2000; Trost *et al.,* 2004; Biddle and Nigg, 2000; Plotnikoff *et al.,* 2010; Shigaki *et al.,* 2010). This present study therefore presents the physical activity levels of a group of Nigerian patients with T2DM and describes how low physical activity level is associated with the socio-demographic characteristics of the patients and the type of motivation that is being exhibited by the patients.

MATERIALS AND METHODS

Study sites

Participants in this cross-sectional study were consenting patients with type 2 diabetes attending the diabetes clinics of the University College Hospital and Ring Road State Hospital, both in Ibadan, Nigeria. The University College Hospital, owned by the Federal Government of Nigeria is a tertiary health care provider and it is the teaching hospital for the training of medical and allied health students. It is also a postgraduate professional medical training centre for resident doctors and other healthcare professionals. The Ring Road State Hospital, owned by the Oyo State Government is a secondary health care provider and it also serves as a source of referral to the University College Hospital. Both hospitals run dedicated diabetes clinics on specific days of the week.

Participants

The patients were selected based on pre-set criteria. The criteria included being in the age range of 15 to 69 years, having been diagnosed of T2DM for at least six months and without any known disorder or disability that may prevent them from undertaking regular physical activity..Patients who had advanced stage of diabetic foot ulceration, those who had lower limb amputations, those who were blind and those who were instructed by their physicians to stay away from regular physical activity were excluded. A total of 326 out of the 418 patients receiving treatment in the two hospitals during the data collection period participated in the study. Ethical approval for the study was sought and obtained from the University of Ibadan/University College Hospital Research Ethics Committee (Protocol ID: UI/EC/12/0117).

Procedure for questionnaire translation and data collection

The Motivation for Physical Activity Questionnaire, the International Physical Activity Questionnaire (IPAQ) as well as the questionnaire to document the socio-demographic characteristics of the participants was translated into Yoruba language using a forward-backward translation process. The translation process was undertaken for the benefit of Yoruba speaking participants who did not understand or speak English. Socio-demographic characteristics comprising age, sex, occupation, level of education and marital status were also documented.

Assessment of motivation for physical activity

The Motivation for Physical Activity Questionnaire developed by Deci and Ryan was used to assess the motivation for physical activity among the T2DM patients (Deci and Ryan, 2004; Fitness Management, 2012). The questionnaire is a sixteen-item measure which was designed to classify patients' motivation for physical activity as either intrinsic or extrinsic using factors such as external regulation, introjected regulation, identified regulation, and intrinsic motivation to qualify the type of motivation that spurs the patient into physical activity. An average was taken for each of these factors and these averages were used to calculate the Relative Autonomy Index (RAI) which specifies if the patient is either intrinsically or extrinsically motivated for physical activity. If the value of RAI obtained is negative then, it shows the patient is extrinsically motivated. On the other hand, if the value of RAI calculated is positive then, it means the patient is intrinsically motivated. Intrinsic motivation is defined as the doing of an activity for its inherent

satisfactions rather than for some separable consequence while extrinsic motivation is a construct that pertains whenever an activity is done in order to attain some separable outcome (Ryan and Deci 2000). The RAI was calculated thus:

The RAI = External regulation x (-2) + Introjected regulation x (-1) + Identified regulation x (1) + Intrinsic motivation x (2) (Deci and Ryan, 2004; Fitness Management, 2012).

Assessment of physical activity: Physical activity was assessed using the International Physical Activity Questionnaire (IPAQ). The questionnaire is aimed at measuring health related physical activity levels in different populations as well as obtaining internationally comparable data on health-related physical activity. There are two forms of the questionnaire, the long and short forms. For this study, the short self-administered form of this questionnaire was used (International Physical Activity Questionnaire, IPAQ, 2012). It is made up of 7 items and 4 domains which cover domestic and yard gardening activity, transport-related activity, leisure time activity and work-related activity. It records the activity in four intensity levels namely vigorous-intensity activity, moderate-intensity activity, walking (low intensity activity) and sedentary. The validity of this instrument has been proven over time by a lot of researches including the 12-country reliability and validity test (Kurtze *et al.,* 2008). It has also been recommended as a cost effective method to assess physical activity (Lee *et al.,* 2011).

Data Analysis
Descriptive statistics of frequencies and percentages were used to summarize the data and are presented in tables and charts. Logistic regression analyses were carried out on the data of the participants who presented with low physical activity levels. In the analyses, the odds ratio and 95% confidence intervals for having low physical activity were determined based on motivation type, duration of diagnosis of diabetes and the socio-demographic characteristics. Level of significance was set at $p < 0.05$.

RESULTS

Socio-demographic characteristics

A total of 326 patients with T2DM participated in this survey. The mean age of the participants was 53.8 ± 7.4 years and more than one third of the participants (38.3%) were in the age range of 60 to 69 years (Table 1). Female participants (56.1%) were more than the male participants and most of them were diagnosed within 10 years and below (mean duration of diagnosis = 6.9 ± 5.7 years). Table 1 presents other data on level of educational attainment, occupation and marital status of the participants.

Table 1: Descriptive characteristics of the participants

Variable	Frequency (%)
Age	
< 40	26 (8.0)
40-49	81 (24.9)
50-59	94 (28.8)
60-69	125 (38.3)
Sex	
Male	143 (43.9)
Female	183 (56.1)
Level of education	
Primary level	54 (16.6)
Secondary level	76 (23.3)
Tertiary level	103 (31.6)
Postgraduate level	42 (12.9)
No formal education	51 (15.6)
Occupation	
Gainfully employed	177 (54.3)
Retiree	98 (30.1)
Unemployed	51 (15.6)
Marital status	
Single	11 (3.4)
Married	249 (76.4)
Widow/widower/separated	66 (20.2)
Duration of diagnosis (in years)	
≤ 10	207(63.5)
11-20	66 (20.2)
21-30	38 (11.7)
31-40	7 (2.1)
≥ 41	8 (2.5)

Motivation and physical activity levels

The type of motivation for physical activity being exhibited by the participants is presented in Figure 1A. The figure shows that most of the participants (75.2%) were intrinsically motivated to participate in physical activity programmes, with only 81 (24.8%) of them exhibiting the extrinsic form of motivation. To compute the total scores for the short IPAQ a summation of the duration (in minutes) and frequency (in days) of walking, moderate-intensity and vigorous activities were carried out. The scores are expressed in Metabolic Equivalent (MET)-minutes/ week and are defined as:

walking MET-minutes/week = 3.3 x walking minutes x walking days;

moderate MET-minutes/week = 4.0 x moderate intensity activity minutes x moderate days and

vigorous MET-minutes/week = 8.0 x vigorous intensity activity minutes x vigorous intensity days.

Total physical activity MET minutes/week = sum of walking + moderate + vigorous MET minutes/week scores.

The participants were categorized into three levels: *Category 1 (Low activity level)* means no activity was reported OR some activity was reported but not enough to meet categories 2 and 3. For *Category 2 (Moderate activity level)* means a) three or more days of vigorous-intensity activity of at least 20 minutes per day OR b) five or more days of moderate-intensity activity and/or walking of at least 30 minutes per day OR c) five or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total physical activity of at least 600 MET-minutes/week. In *Category 3 (High activity level),* it is vigorous-intensity activity on at least three days, achieving a minimum total physical activity of at least 1500 MET-minutes/week OR seven or more days of any combination of walking, moderate-intensity or vigorous-intensity activities achieving a minimum total physical activity of at least 3000 MET-minutes/week (IPAQ, 2012). Figure 1B presents the physical activity levels of the participants. About two thirds of the participants (66.9%) presented with low physical activity levels while only 96 (29.4%) presented with moderate level of physical activity.

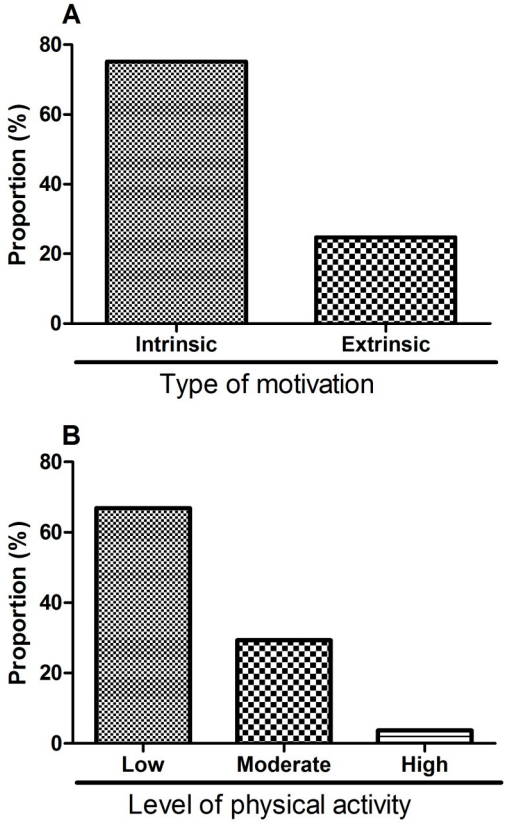

Figure 1: Types of motivation exhibited by the participants **(A)** as well as the levels of physical activity of participants **(B).**

Association between physical activity and each of motivation and socio-demographic characteristics

As shown in table 2, being extrinsically motivated slightly increased the risk of having low physical activity level but this was not statistically significant (OR = 1.18; 95% CI = 0.71-1.36) for the group of patients that participated in this study. However, being 60 years and above showed the highest risk of low physical activity when compared with those who were younger than 40 years (OR = 2.42; 95% CI = 1.91-3.77). On the other hand, it was observed that having a tertiary level of education reduced the risk of low physical activity (OR = 0.52; 95% CI = 0.21-0.86) while lack of education increased the risk (OR = 2.21; 95% CI = 1.64-4.33). The duration of diagnosis did not significantly pre-

dict low level of physical activity, although those who were diagnosed 11 years and over were seen to have higher risk of low physical activity levels.

Table 2: Odds Ratio and 95% confidence intervals of low physical activity level by motivation and socio-demographic characteristics

Variable	Low physical activity n = 218 OR (95% CI)
Motivation	
Intrinsic	1
Extrinsic	1.18 (0.71, 1.36)
Age (in years)	
< 40	1
40-49	1.16 (0.87, 1.98)
50-59	1.55 (1.32, 1.85)*
> 60	2.42 (1.91, 3.77)*
Sex	
Male	1
Female	1.57 (1.22, 4.19)*
Level of education	
Primary level	1
Secondary level	0.83 (0.75, 1.44)
Tertiary level	0.52 (0.21, 0.86)*
No formal education	2.21 (1.64, 4.33)*
Occupation	
Gainfully employed	1
Retiree	3.89 (2.72, 6.35)*
Unemployed	2.15 (1.38, 4.28)*
Marital status	
Single	1
Married	1.63 (1.14, 3.66)*
Widow/widower/ separated	1.36 (1.11, 1,78)*
Duration of diagnosis (in years)	
≤ 10	1
≥ 11	1.29 (0.85, 1.41)

Significant at p < 0.05

DISCUSSION

This study was conducted to identify the level of physical activity among a group of Nigerian patients with T2DM and to know whether this was influenced by the type of motivational and socio-demographic characteristics that the participants presented with. The findings from this study showed that most of the participants presented with low level of physical activity notwithstanding the fact that most of them were intrinsically motivated towards physical activity. It was also observed that the low level of physical activity presented by this group of patients was not significantly linked with the type of motivation presented by the participants but was significantly linked with the socio-demographic characteristics.

Regular physical activity is generally known to benefit patients with T2DM and this has enjoyed a generous reportage from previously conducted studies. For instance, regular physical activity at moderate to vigorous levels is known to decrease rates of chronic disease and premature mortality (Sigal *et al.,* 2006; Centre for Disease Control and Prevention, CDCP 2008; O'Dougherty *et al.,* 2010). It is however noticed that most of the patients who took part in this study were yet to be physically active at recommended levels in spite of the large amount of evidence to this effect. This observation can be described as the general outlook of events among the general population of which T2DM patients are part of. It has been reported that despite an abundance of evidence surrounding the health benefits associated with physical activity, a large proportion of the adult population continue to lead sedentary and unhealthy lifestyles (O'Dougherty *et al.,* 2010; Caperchione *et al.,* 2012).

The fact that most of the patients presented with intrinsic motivation for physical activity as against extrinsic motivation was an exciting finding because it revealed that the patients were properly motivated to undertake physical activity for the benefit of their overall health. This observation might have originated from the fact that most of them had been diagnosed with T2DM for a few years, a situation that might have given them the opportunity to

develop the right motivation towards physical activity. During this period, the patients may have progressed from the pre-action stage of physical activity to the maintenance stage and specifically, individuals who progressed through these stages would have increased and maintained their levels of self-determined motivation (Fortier *et al.,* 2012).

That most of the participants were appropriately motivated to undertake physical activity without a proportionate increase in their physical activity level shows the likelihood of an action disconnect between motivation and the actual performance of the action. This shows that being motivated in itself may not be enough for the T2DM patients to be physically active and it means that some other factors apart from motivation could be responsible. The information-motivation-behavioural skills (IMB) model links performance of health behaviours to the extent to which someone is well informed about the behaviour, motivated to perform the behaviour and has the requisite skills to execute the behaviour (Osborn *et al.,* 2010). Applying the IMB model, the observation from this present study suggests that there is a problem at the motivation-behaviour inter-phase, with the behaviour in this case being the physical activity. It is not impossible that the socio-demographic characteristics of the participants had served as the moderating factors at this inter-phase.

The IMB model also considers information as vital in determining the behaviour of an individual. However, since the participants in this study demonstrated a high level of motivation, it can be fairly concluded that they were adequately informed because their motivation must have been driven by some information. Hence the need to explore other potential contributing factors. According to Egede and Osborn (2010), it is expected that one who is well informed and motivated to act is likely to develop the skills necessary to drive the behaviour and is likely to benefit maximally. A previous study among patients with diabetes had also reported a disconnection between the information about physical activity and the actual performance of the physical activity. According to a study by Lawton *et al.,* (2006), virtually all the respondents reported awareness about taking regular physical activity as part of diabetes care with most of them describing how they had been encouraged by health professionals to go out for regular walks and sometimes also to swim. However, whilst information about the need to undertake physical activity had clearly been received, only 21.8% of them claimed to have made a conscious and sustained effort to increase/maintain their physical activity (Lawton *et al.,* 2006). This also implies that some other factors apart from information may be responsible.

Whilst motivation type was not significantly linked, it was observed that the socio-demographic variables (age, sex, occupation, marital status and level of educational attainment) were individually linked significantly with low physical activity among the T2DM patients. The reasons for this observation may not be completely known, but it is possible that the socio-demographic characteristics compared to motivation exert more influence on the low level of physical activity of the T2DM patients making most of them present with low level of physical activity in spite of the appropriate motivation. The socio-demographic variables plausibly have authority over motivation when it comes to physical activity performance and may have contributed to the reasons why a number of studies have reported significant links between physical activity and socio-demographic characteristics. For instance, it was reported that men with T2DM participate in more leisure time physical activity than women do, and those from the highest income group participate in more activity than low- or middle- income groups (Barrett *et al.,* 2007; Huebschmann *et al.,* 2011), while patients with higher education were also reported to be more active (Morreto *et al.,* 2007).

The clinical application of this study lies in the fact that it has helped to show that the issue of motivation, undoubtedly very important among the plethora of reasons why patients with T2DM may not be physically active, may not be the most important barrier to be tackled when it comes to the task of making patients with T2DM from Nigeria to be more physically active. By this, it has helped to broaden the focus of physical activity experts on

what should be looked out for in patients with T2DM who are not physically active. The study further shows that the physical activity of this group of patients may be improved upon if some other factors other than amotivation are identified and given due considerations. With one major reason for physical inactivity now placed in proper perspectives, it will allow for more focus on how to tackle other likely reasons for physical inactivity among Nigerian patients. From this study and as previously observed by other studies, it appears that socio-demographic characteristics of the T2DM patients will need to be considered seriously if physical activity is to be improved. While it is certain that some of these socio-demographic variables such as age and sex are not modifiable, the idea is that, identifying patients based on these and other potential barriers will provide additional impetus to look closely into strategies of getting patients who fall into these categories to adopt recommended physically activity programmes.

This study has some shortcomings that are worthy of note. The study did not explore the roles of other potential moderators such as the psychosocial confounders. Physical activity of T2DM patients had been observed to be significantly influenced by a combination of psychosocial constructs including the social support, perceived barriers and self-efficacy (Adeniyi *et al.,* 2012). Also, this study did not assess depressive symptoms among the patients and this has been reported to impede self-care behaviours including physical activity (Shahar, 2008; Egede and Osborn, 2010). Because the study sample was hospital based, it is recommended that caution should be exercised in generalizing the findings as the participants in this study may not accurately represent the entire population of patients with diabetes who may not have presented in the hospitals. This is because unlike the non-hospital patients, the patients visiting the hospitals may have had access to a variety of health education on self-care efforts which may have influenced their motivation and physical activity levels. These weaknesses notwithstanding, the strength of this study lies in the fact it has shown the need to consider other factors in order to physically work up patients with T2DM even when they present with the appropriate motivations.

CONCLUSIONS AND RECOMMENDATIONS

The Nigerian patients with T2DM are appropriately motivated to do physical activity but their physical activity is largely below recommended levels. Although motivation is very important when it comes to physical activity participation, this study has brought to the fore that there is also the need to look into other issues outside motivation, such as the socio-demographic characteristics of the patients with T2DM in order to achieve an increase in their physical activity to the recommended levels. Since physical activity level and all variables that influence participation are never static, the challenge is for the healthcare workers in this field to identify the dynamics of physical activity and inactivity as relates to many other aspects of life of a patient with T2DM. We recommend longitudinal studies that will look into the dynamism of the multiple life events of patients with T2DM in order to identify those that improve or reduce their physical activity levels.

ACKNOWLEDGEMENT

Our special thanks to the T2DM patients of the University College Hospital and Ring Road State Hospital, Ibadan, Nigeria for their kind patience in filling our questionnaires.

COMPETING INTERESTS

The authors declare that they have no competing interests.

REFERENCES

Adeniyi, A.F., Idowu, O.A., Ogwumike, O.O., and Adeniyi, C.Y. (2012). Comparative influence of self-efficacy, social support and perceived barriers on low physical activity development in patients with type 2 diabetes, hypertension or stroke. Ethiopian Journal of Health Sciences, 22, 113-119.

Amico, K.R. (2011). A situated-Information Motivation Behavioral Skills Model of care initiation and maintenance (sIMB-CIM): an

IMB Model based approach to understanding and intervening in engagement in care for chronic medical conditions. Journal of Health Psychology, 16, 1071–1081.

Barrett, J.E., Plotnikoff, R.C., Courneya, K.S., and Raine, K.D. (2007). Physical activity and type 2 diabetes: exploring the role of gender and income. The Diabetes Educator, 33, 128 -143.

Biddle, S.J.H., and Nigg, C.R. (2000). Theories of exercise behavior. International Journal of Sport Psychology, 31, 290–304.

Caperchione, C.M., Vandelanotte, C., Kolt, G.S., Duncan, M., Ellison, M., George, E. et al. (2012). What a man wants: understanding the challenges and motivations to physical activity participation and healthy eating in middle-aged Australian men. American Journal of Mens Health, 6, 453–461.

Center for Disease Control and Prevention (2008). 2008 Physical Activity Guidelines for Americans Fact Sheet for Health Professionals on Physical Activity Guidelines for Adults. http://www.cdc.gov/nccdphp/dnpa/physical/pdf/PA_Fact_Sheet_Adults.pdf Retrieved 14 March, 2013, 6:45 pm.

Deci, E.L., and Ryan, R.M. (2004). Exercise Self-Regulation Questionnaires. Self-Determination Theory: An Approach to Human Motivation and Personality—The Self-Regulation Questionnaires. http://selfdeterminationtheory.org/questionnaires/10- questionnaires/48; Accessed 14 December, 2012; 4:40 pm.

Dunbar-Jacobe, J., and Mortimer-Stephens, M.K. (2001). Treatment adherence in chronic disease. Journal of Clinical Epidemiology, 54, S57–S60.

Egede, L.E. and Osborn, C.Y. (2010). Role of motivation in the relationship between depression, self-care, and glycemic control in adults with type 2 diabetes. The Diabetes Educator, 36, 276-283.

Fitness Management (2012) Module B: specific leaning outcomes. www.edu.gov.mb.ca/k12/cur/physhlth/frame_found.../4_fm.pdf; Accessed 6 March, 2012; 7:30 pm

Fortier, M.S., Sweet, S.N., Tulloch, H., Blanchard, C.M, Sigal, R.J., Kenny, G.P. et al (2012). Self-determination and exercise stages of change: results from the Diabetes Aerobic and Resistance Exercise Trial. Journal of Health Psychology, 17, 87–99.

Huebschmann, A.G., Crane, L.A., Belansky, E.S., Scarbro, S., Marshall, J.A., and Regensteiner, J. G. (2011). Fear of injury with physical activity is greater in adults with diabetes than in adults without diabetes. Diabetes Care, 34, 1717–1722.

International Physical Activity Questionnaire (2012) www.ipaq.ki.se/contact/html; Retrieved at 6:34 pm on 21/2/2012.

Jeon, C.Y., Lokken, R.P., Hu, F.B., and van Dam, R. M. (2007). Physical activity of moderate intensity and risk of type 2 diabetes. a systematic review. Diabetes Care, 30, 744–752.

Korkiakangas, E.E., Alahuhta, M.A., and Laitinen, J.H. (2009). Barriers to regular exercise among adults at high risk or diagnosed with type 2 diabetes: a systematic review. Health Promotion International, 24, 416–427.

Kurtze, N., Rangul, V., and Hustvedt, B. (2008). Reliability and validity of the international physical activity questionnaire in the Nord-Trøndelag health study (HUNT) population of men. *BMC Medical Research Methodology,* 8, 63 doi:10.1186/1471-2288-8-63.

Lawton, J., Ahmad, N., Hanna, L., Douglas, M., and Hallowell, N. (2006). 'I can't do any serious exercise': barriers to physical activity amongst people of Pakistani and Indian origin with Type 2 diabetes. Health Education Research, 21, 43–54.

Lee, P.H., Macfarlane, D.J., Lam, T.H., and Stewart, S.M. (2011). Validity of the international physical activity questionnaire short form (IPAQ-SF): A systematic review. *International Journal of Behavioral Nutrition and Physical Activity,* 8, 115 doi:10.1186/1479-5868-8-115.

Mori, D.L., Silberbogen, A.K., Collins, A.E., Ulloa, E.W., Brown, K.L. and Niles, B.L. (2011).

Promoting physical activity in individuals with diabetes: telehealth approaches. Diabetes Spectrum, 24, 127-135.

Morrato, E.H., Hill, J.O., Wyatt, H.R., Ghushchyan, V., and Sullivan, P.W. (2007). Physical activity in U.S. adults with diabetes and at risk for developing diabetes. Diabetes Care, 30, 203–209.

O'Dougherty, M., Kurzer, M.S., and Schmitz, K.H. (2010). Shifting motivations: young women's reflections on physical activity over time and across contexts. Health Education and Behaviour, 37, 547-567.

Osborn, C.Y., Amico, K.R., Fisher, W.A., Egede, L.E. and Fisher, J.D. (2010). An Information Motivation-Behavioral skills analysis of diet and exercise behavior in Puerto Ricans with diabetes. Journal of Health Psychology, 15, 1201–1213.

Plotnikoff, R.C., Brez, S., and Hotz, S.B. (2010). Exercise behavior in a community sample with diabetes: understanding the determinants of exercise behavioral change. The Diabetes Educator, 26, 450–459.

Ryan, R.M., and Deci, E.L. (2000). Intrinsic and extrinsic motivations: classic definitions and new directions. Contemporary Educational Psychology, 25, 54–67.

Shahar, J. (2008). Helping your patients become active. Diabetes Spectrum, 21, 59-62.

Shigaki, C., *Kruse, R.L.*, *Mehr, D.*, Sheldon, K.M., Ge, B., Moore, C. et al. (2010). Motivation and diabetes self-management. Chronic Illness, 6, 202–214.

Sigal, R.J., Kenny, G.P., Wasserman, D.H., Castaneda-Sceppa, C., and White, R.D. (2006). Physical Activity/Exercise and Type 2 Diabetes: A consensus statement from the American Diabetes Association. *Diabetes Care,* 29, 1433-1438.

Trost, S.G., Pate, R.R., Sallis, J.F., Freedson, P.S., Taylor, W.C., Dowda, M. et al (2002). Age and gender differences in objectively measured physical activity in youth. Medicine and Science in Sports and Exercise, 34, 350 –355.

ISSN 2026-6294

Journal of Medical and Biomedical Sciences (2013) 2(3): 17-20

doi: http://dx.doi.org/10.4314/jmbs.v2i3.3

CASE REPORT

Management of severe pelvic injury following road traffic accident in a resource-limited setting

C. B. Kuubiere, A. Alhassan and S. F. Majeed

Department of Human Biology, School of Medicine and Health Sciences, University for Development Studies, Tamale, Ghana

A 34 year old woman involved in road traffic accident with severe anterior and posterior pelvic fractures with associated soft tissue injury was referred from Wa Regional Hospital 18 hours after the accident to Tania Specialist Hospital in Tamale. Emergency resuscitative measures such as catheterization and management of pain with analgesics were initiated. Computed topography (CT scan) or Magnetic resonance imaging has been recommended as the appropriate tools for risk assessment in such cases however none of this was available at the time of the accident. The only assessment tool available was the C-arm machine which was used to X-ray the pelvis in the following plane; anterio – posterior pelvic - inlet and pelvic – outlet. Early internal reduction and stabilization of pelvis was immediately carried out using the procedure of open reduction and internal fixation (ORIF). Approximately 2 weeks after the operation, radiographs showed signs of healing and the patient was discharged on partial body weight bearing. Upon second review 12 weeks post operatively, complete recovery was accomplished.
Journal of Medical and Biomedical Sciences (2013) 2(3), 17-20

Keywords*:* Anatomy, pelvic injury, motor accident, resource-limited setting, Ghana

INTRODUCTION

Pelvic fractures are severe injuries associated with varied morbidities. Mortality rates range from 10% to 50% depending on the severity of pelvic fracture, bleeding and the presence of associated injuries to the brain, thorax and abdomen (Tile, 1988; Dalal *et al.*, 1989; Gonzalez *et al.*, 2002).

Treatment options have increased from simple pelvic slings and postural reduction to more complex internal and external fixations (Pohlemann *et al.*, 1994). Early effective management of severe pelvic trauma with modern medical devices such as CT-scan and MRI and techniques contributes significantly to survival to these patients (Ghanayem *et al.*, 1995; Durkin *et al.*, 2006). Computed topography and magnetic resonance imaging have been shown to be a very sensitive means of detecting pelvic fracture and associated injuries that often accompany pelvic fracture and have become indispensable in the care of these patients. However in places where such modern medical devices are unavailable or inadequate, effective treatment may be compromised. This report presents the management of severe anterior and posterior pelvic fractures with associated soft tissue injury following road traffic accident with the aid of C arm machine in a resource limited setting.

Correspondence: *Dr. C. B. Kuubiere, Department of Human Biology, School of Medicine and Health Sciences, University for Development Studies, Tamale, Ghana*

CASE REPORT

A 34 year old woman reported to the Tania Specialist Hospital situated in Tamale, the Northern Regional capital of Ghana upon referral from the Wa Regional Hospital in the Upper West region 18 hours after a road traffic accident with severe waist pain, inability to sit, stand or urinate. No history of loss of consciousness, amnesia and headache was reported but the patient complained of severe waist pain. There was no clinical evidence of abdominal, chest or head injuries. The patient had a soft and tender lower abdominal mass, about the size of a 16 weeks pregnancy and was moderately pale. Pelvic compression tenderness was positive both laterally and antero-posteriorly. Upon examination of the

lower limbs, power in the left leg was grade 1 with a proximal one-third loss of sensation and that in the right leg was grade 4 with no sensory loss. Ankle and foot pulses were intact.

Radiological examination using Ultrasound revealed a full urinary bladder which was emptied by catheterization. No other abdomino-pelvic organ abnormality was detected. The pelvis was x-rayed in the anterio–posterior plane as well as pelvic - inlet and pelvic – outlet planes. Diagnosis of the AO Type-C pelvic fracture with neurological deficit in the left leg (Butterfly–like anterior pelvis and left Malgaigne fracture), compressed bladder and left monoplegia were made (Figure 1).

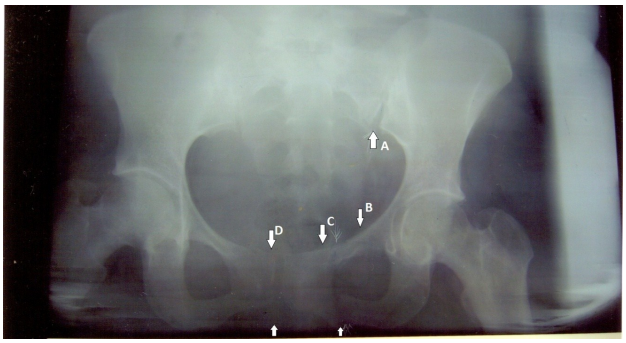

Figure 1: Pre-operative pelvic X–ray (A-P view); (A-dislocation of the sacroiliac joint; B, C, D, E shows butterfly–like fracture of the pelvis.

Prior to surgery, the patient's blood haemoglobin level was 8.0 g dL^{-1} and as such was pre-operatively haemo-transfused with compatible whole blood. An open reduction and internal fixation (ORIF) operation on the anterior pelvis and intra-operative manual reduction of the dislocation in the left sacro–iliac joint was conducted on the patient (Figure 2).

Post-operative recovery was excellent, urethral catheter was removed after 72 hours and on the 4th post-operative day, sensation and power in the legs were almost completely restored and patient started to walk with the aid of shoulder crutches. All stitches were removed on the 8th post-operative day.

Two weeks following the operation the patient was discharged and was reviewed after six weeks (Figure 3) and a second review 12 weeks post-operatively. By the twelfth week, the patient was able to walk without crutches and pelvic/vaginal examination showed adequate stability of the pelvic girdle.

Figure 2: Post-operative X-ray film of the pelvis after internal reduction and fixation

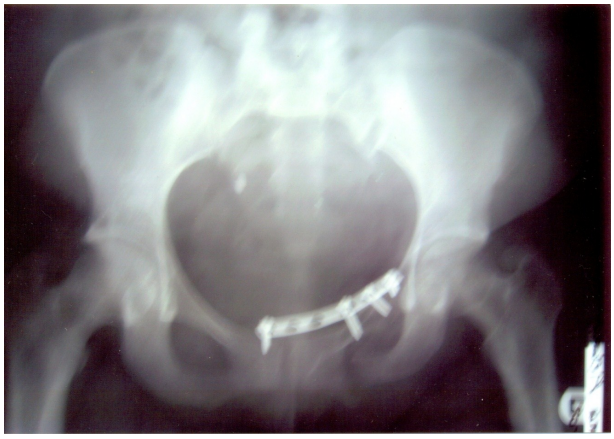

Figure 3: X–ray showing healed fractures (6 weeks after operation)

DISCUSSION

Fractures of the pelvic ring have been reported to comprise 2% to 8% of all skeletal injuries and are often associated with high-energy trauma, most commonly, motor vehicle accidents and falls from a height (Pennal *et al.*, 1979; Burgess *et al.*, 1990). Studies have shown that vehicular accident such as vehicles crashing into pedestrians, passengers being thrown out of moving vehicles, causes about 60% of pelvic fractures (Inaba *et al.*, 2004; McCormack *et*

al., 2010). Among multiply injured patients with blunt trauma, about 20% have pelvic injuries (McCormack *et al.*, 2010). The incidence of pelvic fracture appears to be increasing secondary to increases in the number of high-speed motor vehicle accidents and the number of patients surviving these accidents due to airbags and safer car designs (Poole and Ward, 1994). In Northern Ghana the incidence of complex fractures including pelvic injuries are on the rise due to the poor state of the roads, indiscipline road users poor vehicle maintenance culture and over-aged vehicles (Afukaar *et al.*, 2003).

In the management of pelvic fracture, Pohlemann *et al* (1994) advocates stabilization of the sacro-iliac joint with ORIF (plates and/or screws). However this patient recuperated very well without the posterior pelvic ORIF. The early mobilization of the patient from 4th post-operative day may have prevented further complications such as development of thromboembolism.

The fundamental challenge for clinicians evaluating and managing patients with pelvic fracture in resource limited settings in Africa is the determination of immediate threats to life and to control such threats (Inaba *et al.*, 2004). Approaches to treatment vary depending on whether the main threat arises from pelvic fracture hemorrhage, or associated injuries, or both. The long term functional outcomes depend on the quality of the rigid fixation of the fracture, as well as management of associated pelvic neural and visceral injuries. Use of modern imaging technologies like CT-scan, MRI and C-Arm X-ray is essential for the achievement of quality management (Poole and Ward, 1994; Durkin *et al.*, 2006). The absence of some of this equipment in Northern Ghana complicates appropriate management of severe pelvic injury cases. The lack of CT-scan/MRI in Northern Ghana explains why investigations of posterior pelvic structures were not done prior to surgery in this case. Effective management of pelvis fracture is very critical to future economic and social activity of the patient especially in women of reproductive age since improper management may hamper vaginal delivery in such women although a history of pelvic fracture does not exclude vaginal delivery.

CONCLUSION

In resource limited settings such as Northern Ghana effective management of severe pelvic fracture with good functional outcome is possible even without the appropriate modern medical equipments such as CT scan and MRI which have been stated as indispensable in such cases.

COMPETING INTERESTS

The authors declare that they have no competing interests.

REFERENCES

Afukaar F.K., Antwi P. and Ofosu-Amaah S. (2003) Pattern of road traffic injuiries in Ghana: Implication for control. *Injuiry Control and Safety Promotion* 10, 69-76.

Burgess A.R., Eastridge B.J. and Young J.W. (1990) Pelvic ring disruptions. Effective classification system and treatment protocols. *J. Trauma* 30.

Dalal S.A., Burgess A.R. and Siegel J.H. (1989) Pelvic fractures in multiple trauma: classification by mechanism is key to pattern of organ injury. Resuscitative requirements outcome. *J. Trauma* 29, 981-1002.

Durkin A., Sagi H., Durham R. and Flint L. (2006) Contemporary management of pelvic fractures. *Am J Surg* 192, 211-223.

Ghanayem A.J., Stover M.D., G and oldstein J.A. (1995) Emergent treatment of pelvic fractures. Comparison of methods for stabilization. *Clin Orthop Relat Res* 318, 75-80.mmb

Gonzalez R.P., Fried P.Q. and Bukhalo M. (2002) The utility of clinical examination in screening for pelvic fracture in blunt trauma. *J Am Coll Surg* 194, 121-125.

Inaba K., Sharkey P.W. and Stephen D.J. (2004) The increasing incidence of severe pelvic injury in motor vehicle collisions. *Injury* 35, 759-765.

McCormack R., Strauss E.J., Alwattar B.J. and Tejwani N.C. (2010) Diagnosis and management of pelvic fractures. . *Bull NYU Hosp Jt Dis* 68, 281-291.

Pennal G.F., Tile M., Waddal J.P. and Garside H.

(1979) Assessment and classification. . *Clin. Orthop* 151.

Pohlemann T., Bosch U., Gansslen A. and Tscheme H. (1994) The Hannover experience in management of pelvic fractures. *Clin Orthop*, 69-80.

Poole G.V. and Ward E.F. (1994) Causes of mortality in patients with pelvic fractures. *Orthopedics* 17, 691-696.

Tile M. (1988) Pelvic ring fractures: should they be fixed? *J Bone Joint Surg Br.* 70, 1-12.

ISSN 2026-6294

Journal of Medical and Biomedical Sciences (2013) 2(3): 21-25

doi: http://dx.doi.org/10.4314/jmbs.v2i3.4

ORIGINAL ARTICLE

Positive malignant margins in clinically diagnosed and excised benign breast lumps: a five year retrospective study at the Korle-Bu teaching hospital, Ghana

E M. Der[1], J. N. Clegg-Lamptey[2], R. K. Gyasi[1] and J.T. Anim[1]

[1]Department of Pathology, [2]Department of Surgery, University of Ghana Medical School, P.O Box 4236, Korle-Bu, Accra, Ghana

This study was aimed at utilizing retrospective descriptive data to evaluate the percentage of clinically benign breast lumps that turned out to be histologically malignant and the prevalence of positive tumour margins among the malignant cases. A total of 2,917 registered cases of excised breast lump at the Department of Pathology spanning January 2005 to December 2009 were reviewed to evaluate the presence of malignancy and positive margins. Three hundred and twenty-two (11.0%) of the excised breast lumps were found to contain malignant tumours, out of which 142(44.1%) had positive tumour margins. Size of primary tumour (p=0.001) and histologic subtype (p=0.002) showed significant positive and negative associations in relation to positive tumour margins respectively. No significant association was observed between the positive tumour margins and histologic grade (p=0.363).The study showed that clinically benign breast lumps could be malignant and not completely excised, therefore increasing the risk of local recurrence. Thus, it is recommended that all women with breast lumps have the triad (diagnostic workup) of clinical and radiological assessment, followed with histological studies.
Journal of Medical and Biomedical Sciences (2013) 2(3), 21-25

Keywords*:* Breast cancer, Excision biopsy, recurrence, positive margins

INTRODUCTION

Simple excision biopsy is a standard surgical treatment procedure performed for clinically benign breast lumps, such as fibroadenoma, fibrocystic change and duct ectasia. Unfortunately, some of these lumps tend to be malignant, and not completely excised thus giving rise to the phenomenon of positive margins. There is no consensus as to what constitutes a positive or negative margin (Arriagada *et al.*, 2002; Blichert-Toft *et al.*, 1992). While there is debate about 1 or 2 mm margins, most will accept a margin of 3 mm as being negative (Kurtz, 1992). Published rates of positive margins in lumpectomies vary widely, ranging from 4% to 31% (Elkhuizen *et al.*, 1998; Kurtz *et al.*, 1989; Voogd *et al.*, 2001; Vrieling *et al.*, 2003).

Correspondence: Dr E.M Der, Department of Pathology University of Ghana Medical School, Accra, Ghana P.O Box 4236, Korle-Bu, Accra, Ghana. E-mail: maadelle@yahoo.com

Positive margins are associated with certain clinico-pathologic factors; such as age at diagnosis, size of the primary tumour, histologic subtype and histologic grade (Barthelmes *et al.*, 2003; Blichert-Toft *et al.*, 1992; Malik *et al.*, 2000).

In Ghana, there is no published literature on the prevalence of positive tumour margins among surgically excised breast lumps. This retrospective study was conducted to evaluate the percentage of clinically benign breast lumps that are histologically malignant, and to determine the prevalence of positive tumour margins among these cancerous lumps and also offer recommendations for the managements of early breast cancers.

MATERIALS AND METHODS

Study site and design

All data were collected from the Department of Pathology, University of Ghana Medical School. The department receives surgical specimens from

Korle-Bu Teaching Hospital, Greater Accra Metropolis, and neighboring towns and Districts outside Accra, as well as other regions of the country. The study reviewed all cases of excised breast lumps that were clinically benign from January 2005 to December 2009.

Sampling technique, Sample size and Sample processing

A total of 2,917 (71.0%) out of 4,109 breast specimens diagnosed clinically as benign were reviewed between January 2005 and December 2009. For each registered case, patient age, clinical characteristics of the breast cancer, histologic findings and margin status were recorded. Investigations were done on paraffin-embedded breast tissue stained with haematoxylin and eosin (H&E).

Classification of breast tumours

Histologic sub-typing of tumours was based on the architecture and cytologic features of the tumour and grading was done according to the modified Bloom-Richardson grading (Bloom, 1950). Breast lumps diagnosed as clinically benign such as; fibroadenoma, fibrocystic change, duct ectasia, benign phyllodes tumour and duct papilloma in females were included. Positive margin was also defined as: tumour cells within 2 mm of one or more resection margins; tumour cells within one or more inked margins or tumour extendind to one or more resection margins as stated by the pathologist. Breast lumps diagnosed in females as clinically malignant but had simple excision or wide local excisions were excluded from the study.

Statistical analysis

Data was collected by the first author and cross checked by the third author. Categorical data were presented as proportion whilst continuous data were presented as mean±SD. Association was assessed using Pearson's product moment correlation. All data entry and cleaning were done using Microsoft Excel 2010 (Microsoft corporation) and statistical analyses performed using GraphPad Prism v6.0 (GraphPad software, San Diego California USA, www.graphpad.com). In all analyses, $p<0.05$ was considered as statistically significant.

RESULTS

Characteristics of clinically benign breast lumps that are histologically malignant

From January 2005 to December 2009, 4,109 breast specimens were received in the Department of Pathology, of which 2,917(71.0%) were excised clinically benign breast lumps. Three hundred and twenty-two (11.0%) of the clinically benign breast lumps contained, malignant tumours. The ages of women with the malignant breast lumps ranged from 14 to 86 years, with a mean age of 49.1±14.0 years. Majority 97(31.1%) of these women were within the 40 -49 years age group (Table 1). The macroscopic size of the malignant tumours within the breast lumps at the time of histological diagnosis ranged from 0.4 to 15 cm in size, with a mean of 3.8±2.3 cm. About half 132(51.1%) of the malignant lesions were within 3-5 cm (Table 1). Of the 71(22.1%) women who had symptoms at presentation, many27 (38.0%) of them reported within 6-12 months of noticing the lump. Information on the laterality of the breast lumps were recorded for 294(91.3%) cases of which 163(55.4%) were on the left breast.

Table 1: Characteristics of clinically benign lumps that was found histologically to be malignant

Variable	Proportion
Age (yrs)	
<40	73(23.4%)
40-49	97(31.1%)
50-59	74(23.7%)
>60	68(21.8%)
Main symptoms	
Breast lump	388(98.7%)
Nipple discharge	5(1.3%)
Duration (months)	
1-2	15(21.2%)
3-5	17(23.9%)
6-12	27(38.0%)
>12	12(16.9%)
Tumour size (cm)	
≤2	65(25.3%)
3-5	132(51.4%)
>5	60(23.3%)

Histologic characteristics of excised breast lumps that are malignant

A total of 311(96.6%) breast tumours were epithelial cancers, with 11 mesenchymal cancers. Majority 300 (96.5%) of the epithelial cancers were invasive, with 11 non-invasive cancers (ductal carcinoma insitu; DCIS). More than two-thirds 257(85.7%) of the invasive cancers were invasive ductal carcinoma not otherwise specified (NOS). A total of 200(77.8%) of the NOS had combined Bloom-Richardson grading, of which many 89(44.5%) were grade 2 (Table 2). Fifty-seven of the NOS were not graded due to poor preservation and loss of cytologic features. We found that a total of 142(44.5%) of the clinically benign breast lumps that were histologically malignant had positive margins and thus, not completely excised) (Table 2).

Table 2: Histologic characteristics of invasive epithelial breast cancers

Variable	Proportion
Histologic type (n = 300)	
Invasive duct (NOS)	257(85.7%)
Lobular	11(3.7%)
Mucinous	6(2.0%)
Micropapillary	10(3.3%)
Medullary	4(1.3%)
Apocrine	2(0.7%)
Tubolo-lobular	2(0.7%)
Neuroendocrine	1(0.3%)
Others	7(2.3%)
Histologic grade (n=200)	
Grade I	58(29.0%)
Grade II	89(44.5%)
Grade III	53(26.5%)
Positive margins	142(44.5%)

Associations between positive malignant tumour margins and other tumour variables

Using Pearson's correlation, there was a significant positive association between positive tumour margins and the size of the primary tumour (r=0.14, p=0.002) and a negative association with the histologic type of tumour (r=-0.13, p=0.003) (Table 3).

Table 3: Association between positive tumour margins, tumour size, histologic type of tumour and tumour grade using Pearson correlation

Variables	Histologic type	Tumour grade	Positive margins
Tumour Size (cm)	0.14(0.001)	0.01(0.095)	0.14(0.002)
Histologic type		0.05(0.314)	-0.13(0.001)
Tumour grade			0.05(0.363)

KEY: r-value(p-value)

DISCUSSION

During the five year period of review (2005-2009), 11.0% of all the clinically benign breast lumps submitted to our institution contained malignant tumours. About 45% of the tumours were not completely excised and thus had positive tumour margins. This rate is high compared to published rates of positive margins in lumpectomies which is said to vary from 4% to 31% (Elkhuizen *et al.*, 1998; Kurtz *et al.*, 1989; Voogd *et al.*, 2001; Vrieling *et al.*, 2003). The observed difference could be due in-part to the difference in the definition of positive margins as well as the reason for the removal of the lump. Whereas in this study the lumps were removed for diagnostic purpose, in the available data, the lumps were removed for the treatment of histologically confirmed early breast cancer. Therefore, there was no initial diagnostic work-up (triad) (consisting of clinical, radiologic and pathological assessments) which could have enhance the suspicion of malignancy and thus a wide local excision with axillary lymph nodes dissection offered.

For the authors, the big question that readily comes to mind is; what is the fate of this ≈45% of women with positive margins? Studies have shown that positive margin is a major risk factor for local recurrence (Asgeirsson *et al.*, 2003; Borger *et al.*, 1994; Fourquet *et al.*, 1989; Jobsen *et al.*, 2003) and systemic disease (Clarke *et al.*, 1985). The likely options for these women are re-excision and mastectomy**.** Moreover, re-admissions for re-excision to obtain clear margins or for mastectomy will bring increase cost and emotional distress for patients, as well as the potential for more scaring and defor-

mation at the surgical site.

Women who with clinically benign breast lumps that were histologically malignant were young with mean age of 49.0 years (SD=14.0). The youngest age at diagnosis from this study with carcinosarcoma is 14 years old. This is in agreement with available reports among breast cancer patients in Ghana (Clegg-Lamptey *et al.*, 2009; Stark *et al.*, 2010).

From this study, about half of the malignant tumour size were between 3.0-5.0 cm. The size of the tumour was also directly associated with the positive tumour margins but inversely with the histologic type of tumour. Although this study was based on simple excised breast lumps, it is in agreement with some published literature on positive tumour margins in lumpectomies (Fourquet *et al.*, 1989; Voogd *et al.*, 2001; Vrieling *et al.*, 2003).

Majority (71.0%) of the NOS that had modified Bloom-Richardson grading were of high grade, similar to available data in Ghana (Edmund *et al.*, 2013). The lack of association between positive tumour margins and tumour grade from this study is contrary to studies that found tumour grade as a risk factor for positive (Barthelmes *et al.*, 2003; Malik *et al.*, 2000) but agrees with studies that found grade not to be risk factor for positive margins (Cao *et al.*, 2005; Dooley and Parker, 2005; Keskek *et al.*, 2004).

CONCLUSION

This study showed that 11.0% of clinically benign breast were histologically malignant. Of this number, about 45.0% had positive margins (not completely excised), and hence the risk of local recurrence. Since primary breast tumours in Ghanaian women are large and show association with positive tumour margins, it is recommended that all women with breast lumps have the triad (diagnostic workup) of clinical and radiological assessment follow with histological studies. This will enable surgeons offer the best management to reduce positive margins and local recurrence and if in doubt, patient should be offered wide excision.

ACKNOWLEDGEMENT

The authors wish to express their sincere gratitude to the technical staff, of the Department of pathology. Much thanks also to colleagues in the department for their support.

COMPETING INTERESTS

The authors declare that they have no competing interests.

REFERENCES

Arriagada, R, Le, MG, Contesso, G, Guinebretiere, JM, Rochard, F, Spielmann, M (2002) Predictive factors for local recurrence in 2006 patients with surgically resected small breast cancer. *Ann Oncol* 13(9): 1404-1413.

Asgeirsson, KS, McCulley, SJ, Pinder, SE, Macmillan, RD (2003) Size of invasive breast cancer and risk of local recurrence after breast-conservation therapy. *Eur J Cancer* 39(17): 2462-2469.

Barthelmes, L, Al Awa, A, Crawford, DJ (2003) Effect of cavity margin shavings to ensure completeness of excision on local recurrence rates following breast conserving surgery. *Eur J Surg Oncol* 29(8): 644-648.

Blichert-Toft, M, Rose, C, Andersen, JA, Overgaard, M, Axelsson, CK, Andersen, KW, Mouridsen, HT (1992) Danish randomized trial comparing breast conservation therapy with mastectomy: six years of life-table analysis. Danish Breast Cancer Cooperative Group. *J Natl Cancer Inst Monogr*(11): 19-25.

Bloom, HJ (1950) Further studies on prognosis of breast carcinoma. *Br J Cancer* 4(4): 347-367.

Borger, J, Kemperman, H, Hart, A, Peterse, H, van Dongen, J, Bartelink, H (1994) Risk factors in breast-conservation therapy. *J Clin Oncol* 12 (4): 653-660.

Cao, D, Lin, C, Woo, SH, Vang, R, Tsangaris, TN, Argani, P (2005) Separate cavity margin sampling at the time of initial breast lumpectomy significantly reduces the need for reexcisions. *Am J Surg Pathol* 29(12): 1625-1632.

Clarke, DH, Le, MG, Sarrazin, D, Lacombe, MJ, Fontaine, F, Travagli, JP, May-Levin, F, Contesso, G, Arriagada, R (1985) Analysis of local-regional relapses in patients with early breast cancers treated by excision and radio-

therapy: experience of the Institut Gustave-Roussy. *Int J Radiat Oncol Biol Phys* 11(1): 137-145.

Clegg-Lamptey, JN, Aduful, HK, Yarney, J, Adu-Aryee, NA, Vanderpuye, V, Kyereh, M, Nkansah, A, Edwin, A (2009) Profile of breast diseases at a self-referral clinic in Ghana. *West Afr J Med* 28 (2): 114-117.

Dooley, WC, Parker, J (2005) Understanding the mechanisms creating false positive lumpectomy margins. *Am J Surg* 190(4): 606-608.

Edmund, DM, Naaeder, SB, Tettey, Y, Gyasi, RK (2013) Breast cancer in Ghanaian women: what has changed? *Am J Clin Pathol* 140(1): 97-102.

Elkhuizen, PH, van de Vijver, MJ, Hermans, J, Zonderland, HM, van de Velde, CJ, Leer, JW (1998) Local recurrence after breast-conserving therapy for invasive breast cancer: high incidence in young patients and association with poor survival. *Int J Radiat Oncol Biol Phys* 40(4): 859-867.

Fourquet, A, Campana, F, Zafrani, B, Mosseri, V, Vielh, P, Durand, JC, Vilcoq, JR (1989) Prognostic factors of breast recurrence in the conservative management of early breast cancer: a 25-year follow-up. *Int J Radiat Oncol Biol Phys* 17(4): 719-725.

Jobsen, JJ, van der Palen, J, Ong, F, Meerwaldt, JH (2003) The value of a positive margin for invasive carcinoma in breast-conservative treatment in relation to local recurrence is limited to young women only. *Int J Radiat Oncol Biol Phys* 57(3): 724-731.

Keskek, M, Kothari, M, Ardehali, B, Betambeau, N, Nasiri, N, Gui, GP (2004) Factors predisposing to cavity margin positivity following conservation surgery for breast cancer. *Eur J Surg Oncol* 30(10): 1058-1064.

Kurtz, JM (1992) Factors influencing the risk of local recurrence in the breast. *Eur J Cancer* 28(2-3): 660-666.

Kurtz, JM, Jacquemier, J, Torhorst, J, Spitalier, JM, Amalric, R, Hunig, R, Walther, E, Harder, F, Almendral, A, Brandone, H, et al. (1989) Conservation therapy for breast cancers other than infiltrating ductal carcinoma. *Cancer* 63 (8): 1630-1635.

Malik, HZ, Wilkinson, L, George, WD, Purushotham, AD (2000) Preoperative mammographic features predict clinicopathological risk factors for the development of local recurrence in breast cancer. *Breast* 9(6): 329-333.

Stark, A, Kleer, CG, Martin, I, Awuah, B, Nsiah-Asare, A, Takyi, V, Braman, M, Quayson, SE, Zarbo, R, Wicha, M, Newman, L (2010) African ancestry and higher prevalence of triple-negative breast cancer: findings from an international study. *Cancer* 116(21): 4926-4932.

Voogd, AC, Nielsen, M, Peterse, JL, Blichert-Toft, M, Bartelink, H, Overgaard, M, van Tienhoven, G, Andersen, KW, Sylvester, RJ, van Dongen, JA (2001) Differences in risk factors for local and distant recurrence after breast-conserving therapy or mastectomy for stage I and II breast cancer: pooled results of two large European randomized trials. *J Clin Oncol* 19(6): 1688-1697.

Vrieling, C, Collette, L, Fourquet, A, Hoogenraad, WJ, Horiot, JC, Jager, JJ, Bing Oei, S, Peterse, HL, Pierart, M, Poortmans, PM, Struikmans, H, Van den Bogaert, W, Bartelink, H (2003) Can patient-, treatment- and pathology-related characteristics explain the high local recurrence rate following breast-conserving therapy in young patients? *Eur J Cancer* 39(7): 932-944.

ISSN 2026-6294

Journal of Medical and Biomedical Sciences (2013) 2(3): 26-34

doi: http://dx.doi.org/10.4314/jmbs.v2i3.5

ORIGINAL ARTICLE

Determinants of childhood obesity among basic school children aged 6 – 12 years in Tamale Metropolis

N. Amidu[1], W. K. B. A. Owiredu[2], M. Saaka[3], L. Quaye[1], M. Wanwan[3], P. D. Kumibea[3], F. M. Zingina[3] and V. Mogre[4]

[1]Department of Biomedical Laboratory Science, [3]Department of Community Nutrition, [4]Department of Human Biology, School of Medicine and Health Sciences, University for Development Studies, Tamale, Ghana; [2]Department of Molecular Medicine, School of Medical Sciences, College of Health Sciences, Kwame Nkrumah University of Science and Technology, Kumasi, Ghana

This study was conducted to assess the prevalence of childhood overweight/obesity and its association with type of school (private vs. public), parental education and other lifestyle factors among school-aged children (6–12 years) in the Tamale Metropolis. This cross-sectional school-based study was conducted from November 2012 to June 2013 in the Tamale Metropolis of Ghana. Using multi-stage random sampling, 400 children aged 6-12 years were selected from 4 schools. Anthropometric measurements of age, height and weight were measured with appropriate tools. Cut-off points for BMI defining obese and overweight for gender and age were calculated in accordance with the CDC growth charts. Percentage body fat (%BF) of the studied children was also calculated using appropriate formulas. The prevalence of childhood overweight and obesity were 9.8% and 7.5% respectively. Significantly, obese children were more likely to have parents who had attained high educational level compared to normal weight children (83.3% vs. 46.8%). As 76.7% of obese children went to school by means car/motor bike, 64.4% of normal weight children went to school by means of walking/riding a bicycle. A significant proportion of overweight and obese children compared to normal weight children played computer games, took food to school and ate food at the school's canteen. The prevalence of overweight (15.0% vs. 4.5% p= 0.0006) and obesity (12.5% vs. 2.5%, p=0.0002) as determined by BMI was higher in children from the private schools than children from the public schools. By %BF more children in the private schools than in the public schools were obese (14.5% vs. 3.0%, p<0.0001). High prevalence of obesity/overweight was associated with attending a private school, high level of parental education, playing computer/video games and eating food at the school canteen.
Journal of Medical and Biomedical Sciences (2013) 2(3), 26-34

Keywords*:* Adiposity, BMI, children, physical activity, educational level, Tamale, Ghana

INTRODUCTION

Childhood obesity in recent times is emerging as a global epidemic (Lobstein *et al.*, 2004) with a WHO report in 2008 estimating that around 1.5 billion people above the age of 20 years and 43 million children under the age of 5 years being overweight worldwide (WHO, 2008). Obesity is often simply defined as a condition of abnormal or excessive fat accumulation in adipose tissue to the extent that health may be impaired (Garrow, 1988). It is estimated that 25% of children in the US are overweight and 11% are obese (Parsons *et al.*, 1999; Whitaker *et al.*, 1997) and the prevalence rate of childhood obesity in developing countries is lower as compared to that of developed countries. Notwithstanding these facts, the proportion of obese in children is rising in both cases (Livingstone, 2001; Peltzer *et al.*, 2011) and to date, almost all the developed and developing countries are experiencing an epidemic of obesity but great variation is found between and within countries (WHO/FAO,

Correspondence: Nafiu Amidu, Department of Biomedical Laboratory Science, School of Medicine and Health Science, University for Development Studies, Tamale, Ghana E-mail: anafiu@uds.edu.gh

2002). The prevalence of sex-specific obesity among South African children aged 3 to 16 years was found to be 3.2% for boys and 4.9% for girls with overweight being 14% and 17.9% for boys and girls respectively (Armstrong *et al.*, 2006). Another study in Southern Nigeria among children aged 5 to 18 years found the prevalence of overweight and obesity to be 11.4% and 2.8% respectively (Ene-Obong *et al.*, 2012).

Childhood obesity is related to an increased risk of high blood pressure, diabetes, respiratory disease and orthopaedic disorders during childhood as well as adverse effects of psychosocial development and academic performance (Datar *et al.*, 2004; McDonald *et al.*, 2009). With such risks rising continuously with increasing weight, there is much overlap between the prevention of obesity and the prevention of a variety of chronic diseases, especially type 2 diabetes (WHO/FAO, 2002). The most important long-term consequence of childhood obesity is its persistence into adulthood, with all the associated health risks. Furthermore, obesity is more likely to persist when its onset is in late childhood or adolescence and when the obesity is severe (Abraham *et al.*, 1971) with (Serdula *et al.*, 1993) estimating a 3.9 to 6.5 times risk of this occurrence.

Childhood obesity has been linked to both social and economic factors such as the place of residence or school, parents' cultural background, socio-economic status of the family and family income levels (Lazzeri *et al.*, 2011; Renzaho *et al.*, 2006). Furthermore lower physical activity levels (Janssen *et al.*, 2005; Janssen *et al.*, 2004), higher sedentary behaviour (playing video/computer games and television viewing times) and dietary behaviour such as eating foods away from home (Gillis *et al.*, 1997), among others are associated factors of childhood obesity.

There is paucity of data on the prevalence of childhood overweight and obesity in Ghana. Furthermore, the demographic, socioeconomic, dietary factors and indicators of physical activity that are associated with childhood overweight/obesity have not been extensively studied in Ghana. This study was therefore aimed at assessing the prevalence of childhood obesity and its association with the type of school and other lifestyle factors among basic school children in Tamale, Ghana.

MATERIALS AND METHODS

Participants

This cross-sectional study was carried out from November 2012 to June 2013 within the Tamale metropolis which is the capital city of the Northern region of Ghana. It lies between latitude 9°22' N and longitude 0°50' W covering an area of about 922 km^2. A total of 400 basic school children aged 6-12 years were selected from 4 schools within the Tamale metropolis through a multi-stage random sampling technique. To have a random distribution of selected children in a particular school, a random number statistical table was used to select a proportionate random sample that included more participants from larger classes. Prior permission was obtained from the administration of the four selected schools after thorough introduction and explanation of the study. Participation in the study was voluntary and consent forms with information sheet were handed out to the students a week before the start of the study to be filled and signed by their parents/guardians.

Questionnaire

Selected children completed a 23-item self-administered, semi quantitative questionnaire on demography, socioeconomic and educational status of subjects' parents/guardians. Parents/guardians were eligible to answer the questionnaires on behalf of children below the ages of 10 years.

Age and Anthropometric variables

Information on age were extracted from the information sheet filled on behalf of the selected children by thier parents/guardians. Weight and height of the selected children were measured at the school premises. By means of a UNICEF electronic scale (SECA, mother/child electronic with a capacity of 150 kg) weight was measured to the nearest 0.5 kg. Height was measured to the nearest 0.1 m without shoes using a wall mounted microtoise (SECA).

Exclusion criteria
All children found to be <6, >12 years of age, children whose exact birth date was not available on the information sheet, children without written informed consent and those with height and weight error during data management were excluded from the data analysis.

Definition of overweight and obesity
The children were categorized into four groups: underweight (<5th percentile), normal (>5th percentile, <85th percentile), overweight (≥85th percentile) and obese (>95th percentile) using age- and sex-specific percentiles of BMI. Percentage of body fat (%BF) was calculated by using the formula: (1.51 × BMI) − (0.70 × Age) − (3.6 × Sex) + 1.4, where sex was coded as 1 for males and 0 for females (Deurenberg *et al.*, 1991). Males with %BF <24 were classified as normal and those with %BF ≥25 were classified being obese. Females with %BF<29 were classified as normal and those with %BF≥29 were classified as being obese.

Statistical analysis
All data entry and cleaning were done using Microsoft Excel 2010 (Microsoft corporation) and statistical analyses performed using GraphPad Prism v6.0 (GraphPad software, San Diego California USA, www.graphpad.com). In all analyses, a level of $p<0.05$ was considered as statistically significant.

RESULTS

The general characteristics of the enrolled children stratified by type of school are presented in Table 1. The mean age of all the enrolled children was 10.1± 1.7 years with children from the public schools being significantly older (10.4 ± 1.7 years) compared to their counterparts from the private schools (9.9 ± 1.6 years). On examining parental/guardian educational level, a greater percentage of fathers' of children from the private schools were more likely to have SHS (27.0% vs. 10.5%) and tertiary (54.5% vs. 11.5%) education compared to fathers' of children from public school who either had no education (49.5% vs. 8.5%) or basic level (28.5% vs. 10.0%) education. Likewise, mothers' of children from the private schools were more likely to have SHS (36.5% vs. 7.0%) and tertiary education (53.5% vs. 6.0%) compared to mothers' of children from the public schools who were more likely to either have no education (2.0% vs. 67.5%) or basic (8.0% vs. 19.5%) level education.

By the means through which the children get to school, a greater percentage of the children in public school (81.0%) were more likely to get to school on foot compared to 9.0% of the children in the private schools. Contrarily, the children attending the private schools were more likely to get to school in a car (70.5%) compared to their counterparts in the public schools (2.5%) with a significant difference. An analysis on the use of bicycle and motorcycle as a mode of transportation to school showed no significant difference between children attending private schools and their counterparts in the public schools.

Questions on the use of computer games was utilized to assess the level of sedentary lifestyle lived by the children. Overall, 65.0% of the children from the private schools were significantly more likely to play computer games compared to their counterparts from the public schools. Increases in calorie intake was assessed on three levels by asking the children whether they bring food to school, bring lunch money to school or eat from the school canteen. Children from the private school (65.0%) take food to school and are more likely to eat from the school canteen (48%) compared to their colleagues from the public schools and the differences in percentages were statistically significant. As to whether the children bring lunch money to school, no significant difference was observed when the proportion of children in the private schools were compared to the proportion of colleagues from the public schools.

Table 2 indicates the anthropometric measurements of the enrolled children stratified by type of school. Children from the private schools were more likely to be taller (1.4 ± 0.1 m) than their counterparts from the public schools ((1.3 ± 0.1 m) but no significant differences were observed from a compari-

Table 1: General characteristics of the studied population stratified by type of school

Variables	Total (n=400)	Private (n=200)	Public (n=200)	P Value
Age (years)	10.1 ± 1.7	9.9 ± 1.6	10.4 ± 1.7	0.0052
Fathers' Educational Level				
None	116(29.0%)	17(8.5%)	99(49.5%)	< 0.0001
Basic	78(19.5%)	20(10.0%)	57(28.5%)	< 0.0001
SHS	75(18.7%)	54(27.9%)	21(10.5%)	< 0.0001
Tertiary	131 (32.8%)	109(54.5%)	23(11.5%)	< 0.0001
Mothers' Education Level				
None	139(34.8%)	4(2.0%)	135(67.5%)	< 0.0001
Basic	55(13.8%)	16(8.0%)	28(14.0%)	0.0012
SHS	87(21.7%)	73(36.5%)	14(7.0%)	< 0.0001
Tertiary	119(29.7%)	107(53.5%)	12(6.0%)	< 0.0001
School-going mode				
Foot	180(45.0%)	18(9.0%)	162(81.0%)	< 0.0001
Bicycle	63(15.8%)	35(17.5%)	28(14.0%)	0.41
Motorcycle	11(2.7%)	6(3.0%)	5(2.5%)	1.0000
Car	146(36.5%)	141(70.5%)	5(2.5%)	< 0.0001
Playing computer games				
Yes	141(35.3%)	130(65.0%)	11(5.5%)	< 0.0001
Bringing food to school				
Yes	137(34.3%)	121(60.5%)	16(8.0%)	< 0.0001
Bringing lunch money to school				
Yes	342(85.5%)	168(84.0%)	174(87.0%)	0.4779
Eating from the school canteen				
Yes	96(24.0%)	96(48.0%)	0(0.0%)	< 0.0001

Data are presented as proportion and compared using Fischer's exact test. SHS – senior high school

Table 2: Anthropometric measurements of the studied population stratified by type of school

Variables	Total (n=400)	Private (n=200)	Public (n=200)	P Value
Height (m)	1.4 ± 0.13	1.4 ± 0.12	1.3 ± 0.14	0.001
Weight (kg)	33.2 ± 10.29	32.6 ± 9.78	33.8 ± 10.78	0.250
BMI (kg m^{-2})	17.3 ± 3.11	17.6 ± 3.17	17.0 ± 3.03	0.065
% Body Fat	18.7 ± 4.82	19.2 ± 4.78	18.2 ± 4.82	0.036

Data are expressed as means±SD. P-value defines the level of significance when private was compared to public (unpaired t-test)

son of weights among the children drawn from both institutions. Furthermore, an analysis of BMI showed no statistically significant difference between children from the two classes of schools. The mean %BF in children from the private schools (19.2 ± 4.78 %) was significantly higher when compared to that of children from the public schools (18.2 ± 4.82 %; p=0.036).

Table 3 presents the general characteristics of the enrolled children stratified by BMI classifications based on age-and-sex specific percentiles. The overall prevalence of overweight and obesity among the selected children drawn from the private and public schools was 9.8% (39/400) and 7.5% (30/400) respectively. A greater percentage of overweight and obese children were likely to have their father's having either SHS or tertiary level education and likewise the same trend was observed when mother's educational level was assessed.

On assessing the mode by which the children were going to school, overweight (41.0%) and obese (70.0%) children were more likely to go to school in cars. Playing computer games was utilized as an indicator of sedentary lifestyle and reduced physical activity. It was observed that there was a significant steady rise in the proportion of children who played computer games with overweight children comprising 38.5% and obese children 70.0%.

Increased caloric intake was assessed on three levels including bringing food to school, bringing lunch money to school and eating from the school canteen. A significant trend was observed in the proportion of children who brought food to school with overweight (66.7%) and obese (60.0%) children ranking the highest. Likewise, a similar trend was observed in children who ate from the school canteen with overweight (46.2%) and obese (70.0%) children ranking highest. Bringing lunch money to school did not show any significant trend in the overweight and obesity status of the children enrolled in the study.

Figure 1 presents a comparative analysis of the BMI status of the selected children based on the type of school they attend. A greater percentage of the children in the private schools (15.0%) were more likely to be overweight when compared to their counterparts from the public schools (4.5%; p = 0.0006) and the difference was statistically significant. Likewise, more children from the private schools (12.5%) happened to be obese compared to their counterparts from the public school (2.5%; p = 0.0002).

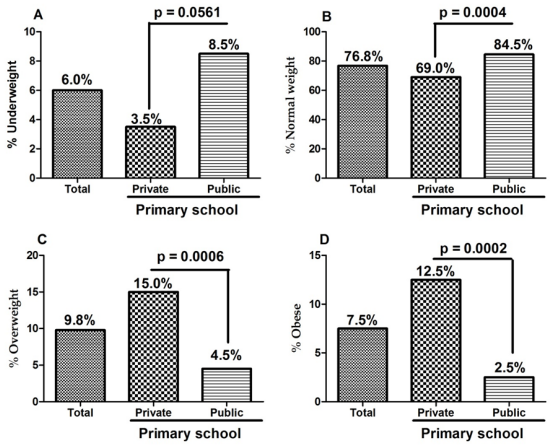

Figure 1: Comparative analysis of BMI status and type of school

Shown in figure 2 is a comparison of type of school based on body weight as determined by % body fat. As more children in the public schools had normal weight (97.0% vs. 85.5%, p<0.0001), more children in the private schools were obese (14.5% vs. 3.0%, p<0.0001).

DISCUSSION

The estimated prevalence of overweight and obesity among the enrolled children in this study was 9.8% and 7.5% respectively. This prevalence rate is higher than the 4.98% and 2.24% quoted for overweight and obesity respectively by Mahajan *et al.,* (2011) in children age 6 to 12 years in the Union territory of Puducherry. In a study in Kerala, the

Table 3: General characteristic of the studied population stratified by BMI classifications

Variable	Underweight n= 24(%)	Normal n=307(%)	Overweight n=39(%)	Obese n=30(%)	P-value
Fathers' Educational Level					
None	8(33.3)	99(32.3)	6(15.4)	3(10.0)	
Basic Level	9(37.5)	64(20.9)	3(7.7)	2(6.7)	
SHS	4(16.7)	49(15.9)	12(30.8)	10(33.3)	
Tertiary	3(12.5)	95(30.9)	18(46.2)	15(50.0)	
Mothers' Educational Level					
None	13(54.2)	113(36.8)	9(23.1)	4(13.3)	
Basic Level	3(12.5)	46(15.0)	5(12.8))	1(3.3)	
SHS	3(12.5)	59(19.2)	15(38.5)	10(33.3)	
Tertiary	5(20.4)	89(28.9)	10(25.6)	15(50.0)	
School-going mode					
Foot	14(58.3)	152(49.5)	10(25.6)	4(13.3)	
Bicycle	4(16.7)	46(14.9)	10(25.6)	3(10.0)	
Motorcycle	0(0.0)	6(2.0)	3(7.7)	2(6.7)	
Car	6(25.0)	103(33.6)	16(41.0)	21(70.0)	
Playing computer games					
Yes	3(12.5)	102(33.2)	15(38.5)	21(70.0)	< 0.0001
Bringing food to school					
Yes	6(25.0)	87(28.3)	26(66.7)	18(60.0)	< 0.0001
Bringing lunch money to school					
Yes	19(79.2)	263(85.7)	35(89.7)	25(83.3)	0.6820
Eating from the school canteen					
Yes	6(25.0)	51(16.6)	18(46.2)	21(70.0)	< 0.0001

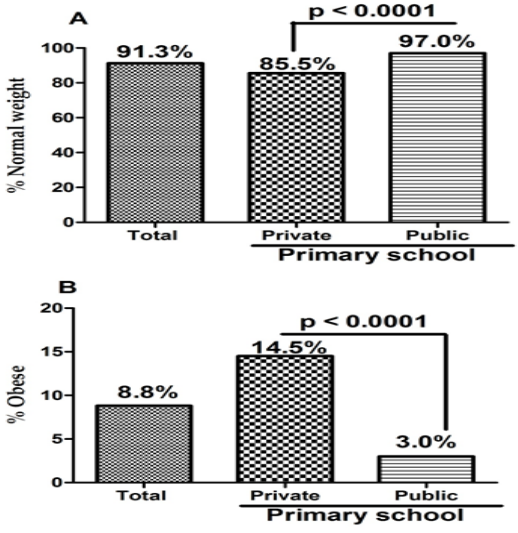

Figure 2: Comparison of children who are Normal weight (A) and Obese (B) to type of school as determined by % BF. Data was analyzed using Fischer's exact test.

reported prevalence rates of overweight was 8.66% and that for obesity was 4.69% with other findings in the same region showing an increased prevalence of overweight and obesity from 4.94% and 1.26% in 2003 to 6.57% and 1.89% in 2005 with particular rise in the age group of 5 – 11 years (Raj *et al.*, 2007). These reported rates although giving an indication of a rise in prevalence rates were however lower compared to that estimated from this study.

The obesity prevalence from this study is lower than the 10.9% childhood obesity reported among Ghanaian children in a university primary school (Mohammed *et al.*, 2012) and the 11.1% reported among school children aged 5 to 14 years (Fazili *et al.*, 2012). Notwithstanding, the fact that the estimated childhood obesity rate from this study compares well with the 7.5% prevalence of obesity reported among children in Pakistan (Mushtaq *et al.*,

2011) and 8.1% prevalence of obesity reported among primary school children in South Africa (Armstrong *et al.*, 2006), the evidence of childhood obesity emerging as a public health related problem in the Tamale metropolis is imminent as related in some available literature (Bar-Or, 2003). The combined prevalence of overweight and obesity estimated from this study was 17.3% is indeed indicative of an increased tendency of worsening future trends of childhood obesity with its attendant problems within the Tamale metropolis.

Drawing children from private and public institutions in this study showed clearly that children from the private schools were more prone to being overweight and obese compared to their counterparts from the public schools as related in the study of Al -Hazzaa *et al.,* (2012) with associated factors being parents/guardians with either high education and going to school in cars. These suggest that children belonging to relatively higher socio-economic strata who are likely to study in private schools are at higher risk of obesity and could further be attributed to the cultural predisposition of Ghanaians to view obesity as a sign of wealth, well-being and beauty (Amoah, 2003) therefore parents do not make any conscious effort to improve their children's obesity status but rather encouraging its worsening.

Researchers have made suggestions that childhood obesity is largely the result of a decline in regular physical activity (Bascetta, 2005). A review of other literature suggests that overweight among pre-school children, as well as older children, may be associated less with increased energy intake and more with low physical activity (Schlicker *et al.*, 1994). Declines in physical activity and sedentary lifestyle was assessed in this study through playing of computer games and it was observed that overweight and obese children were more likely to engage in playing computer games. Researchers have hypothesized that playing games or watching television cause obesity by one or more of three mechanisms: displacement of physical activity, increased calorie consumption while playing games or watching TV and reduced basal metabolism (Chhatwal *et al.*, 2003). The significant trend associated with playing video games and overweight/obesity could be mediated through one of the three mechanisms iterated in other studies.

Increases in calorie intake was assessed by checking whether the children take food to school and also whether they eat from the school canteen and this showed significant trends with childhood overweight and obesity. This can be attributed to the gradual penchant of consuming poultry, meat and dairy products adequately whilst there is low intake of vegetables with a mixed trend in fruits, grains and cereals. Cycling as a mode of going to school from this study showed a fair reduction in the percentage of children who were obese and its use was also fairly distributed between children from private and public schools. This outcome is most profound and goes a long way to suggest that, cycling, if not as a mode of going to school should be encouraged in the children since they enjoy doing it.

Although not the prime focus of the study, it is worth-noting that the estimated underweight prevalence rate from the study was 6%. Underweight was significantly linked with parental/guardian educational level. The fact that most of the parents/ guardians of underweight children either had no education or only basic education buttresses the association of socio-economic class with weight status of children which finding is consistent with the view of previous studies and the trend established earlier that obesity in developing countries increases with socio-economic class (Chhatwal *et al.*, 2003). It is therefore imperative to note that overweight/obesity and under-nutrition co-exist in school going children within the Tamale metropolis which might have adverse and dire effects on cognitive abilities and this is consistent with anthropometric studies conducted among children in Nigeria, South Africa and several other countries undergoing economic transition (Ene-Obong *et al.*, 2012; Kimani-Murage *et al.*, 2010; Peltzer *et al.*, 2011; Renzaho *et al.*, 2006).

CONCLUSION

Overweight, obesity and underweight co-exist among children of school-going age within the Tamale metropolis and socio-economic factors, sed-

entary lifestyle and high caloric intake are associated with the estimated prevalence rates of overweight, obesity and underweight observed among the children. Childhood obesity is an emerging public health problem within the Tamale metropolis and mitigating factors need to be introduced to avert the dire burden on cognitive ability and general public health of children within the studied age brackets. Parents' negative attitude towards outdoor physical activities and their lack of dietary control on a child's obesity should be addressed with proper counseling of parents. Furthermore, the positive effects of cycling should be encouraged among the children even if not as a means of going to school; as a moderate-intensity physical activity that could be engaged in leisurely.

COMPETING INTERESTS

The authors declare that they have no competing interests.

REFERENCES

Abraham, S, Collins, G, Nordsieck, M (1971) Relationship of childhood weight status to morbidity in adults. *HSMHA Health Rep* 86(3): 273-284.

Al-Hazzaa, HM, Abahussain, NA, Al-Sobayel, HI, Qahwaji, DM, Musaiger, AO (2012) Lifestyle factors associated with overweight and obesity among Saudi adolescents. *BMC Public Health* 12: 354.

Amoah, AG (2003) Sociodemographic variations in obesity among Ghanaian adults. *Public health nutrition* 6(8): 751-757.

Armstrong, ME, Lambert, MI, Sharwood, KA, Lambert, EV (2006) Obesity and overweight in South African primary school children -- the Health of the Nation Study. *S Afr Med J* 96(5): 439-444.

Bar-Or, O (2003) The juvenile obesity epidemic: Strike back with physical activity. *Sports Science Exchange* 16(2): 1-6.

Bascetta, CA (2005) *Childhood Obesity: Most Experts Identified Physical Activity And the Use of Best Practices As Key to Successful Programs*. DIANE Publishing: Washington, D.C.

Chhatwal, J, Verma, M, Riar, SK (2003) Obesity among pre-adolescent and adolescents of a developing country (India). *Asia Pacific journal of clinical nutrition* 13(3): 231-235.

Datar, A, Sturm, R, Magnabosco, JL (2004) Childhood overweight and academic performance: national study of kindergartners and first-graders. *Obes Res* 12(1): 58-68.

Deurenberg, P, Weststrate, JA, Seidell, JC (1991) Body mass index as a measure of body fatness: age- and sex-specific prediction formulas. *Br J Nutr* 65(2): 105-114.

Ene-Obong, H, Ibeanu, V, Onuoha, N, Ejekwu, A (2012) Prevalence of overweight, obesity, and thinness among urban school-aged children and adolescents in southern Nigeria. *Food Nutr Bull* 33(4): 242-250.

Fazili, A, Mir, AA, Pandit, IM, Bhat, IA, Rohul, J, Shamila, H (2012) Nutritional Status of School Age Children (5-14 years) in a Rural Health Block of North India (Kashmir Using WHO Z-Score System. *Online J Health Allied Scs.* 11(2):2.(2): 1-3.

Garrow, JS (1988) *Obesity and related diseases*. Churchill Livingstone: London.

Gillis, JL, Bar-Or, O (1997) Food Away from Home, Sugar-Sweetened Drink Consumption and Juvenile Obesity. *J Am Coll Nutr* 16(6): 539-545.

Janssen, I, Katzmarzyk, PT, Boyce, WF, Vereecken, C, Mulvihill, C, Roberts, C, Currie, C, Pickett, W (2005) Comparison of overweight and obesity prevalence in school-aged youth from 34 countries and their relationships with physical activity and dietary patterns. *Obes Rev* 6(2): 123-132.

Janssen, I, Katzmarzyk, PT, Ross, R, Leon, AS, Skinner, JS, Rao, DC, Wilmore, JH, Rankinen, T, Bouchard, C (2004) Fitness alters the associations of BMI and waist circumference with total and abdominal fat. *Obes Res* 12(3): 525-537.

Kimani-Murage, EW, Kahn, K, Pettifor, JM, Tollman, SM, Dunger, DB, Gomez-Olive, XF, Norris, SA (2010) The prevalence of stunting, over-

weight and obesity, and metabolic disease risk in rural South African children. *BMC Public Health* 10: 158.

Lazzeri, G, Pammolli, A, Pilato, V, Giacchi, MV (2011) Relationship between 8/9-yr-old school children BMI, parents' BMI and educational level: a cross sectional survey. *Nutr J* 10: 76.

Livingstone, MB (2001) Childhood obesity in Europe: a growing concern. *Public Health Nutr* 4(1A): 109-116.

Lobstein, T, Baur, L, Uauy, R (2004) Obesity in children and young people: a crisis in public health. *Obes Rev* 5 Suppl 1: 4-104.

Mahajan, PB, Purty, AJ, Singh, Z, Cherian, J, Natesan, M, Arepally, S, Senthilvel, V (2011) Study of childhood obesity among school children aged 6 to 12 years in union territory of Puducherry. *Indian journal of community medicine: official publication of Indian Association of Preventive & Social Medicine* 36(1): 45.

McDonald, CM, Baylin, A, Arsenault, JE, Mora-Plazas, M, Villamor, E (2009) Overweight is more prevalent than stunting and is associated with socioeconomic status, maternal obesity, and a snacking dietary pattern in school children from Bogota, Colombia. *J Nutr* 139(2): 370-376.

Mohammed, H, Vuvor, F (2012) Prevalence of childhood overweight/obesity in basic school in Accra. *Ghana medical journal* 46(3): 124-127.

Mushtaq, MU, Gull, S, Shahid, U, Shafique, MM, Abdullah, HM, Shad, MA, Siddiqui, AM (2011) Family-based factors associated with overweight and obesity among Pakistani primary school children. *BMC Pediatr* 11: 114.

Parsons, TJ, Power, C, Logan, S, Summerbell, CD (1999) Childhood predictors of adult obesity: a systematic review. *Int J Obes Relat Metab Disord* 23 Suppl 8: S1-107.

Peltzer, K, Pengpid, S (2011) Overweight and obesity and associated factors among school-aged adolescents in Ghana and Uganda. *Int J Environ Res Public Health* 8(10): 3859-3870.

Raj, M, Sundaram, K, Paul, M, Deepa, A, Kumar, RK (2007) Obesity in Indian children: time trends and relationship with hypertension. *National Medical Journal of India* 20(6): 288.

Renzaho, AM, Gibbons, C, Swinburn, B, Jolley, D, Burns, C (2006) Obesity and undernutrition in sub-Saharan African immigrant and refugee children in Victoria, Australia. *Asia Pac J Clin Nutr* 15(4): 482-490.

Schlicker, SA, Borra, ST, Regan, C (1994) The weight and fitness status of United States children. *Nutrition reviews* 52(1): 11-17.

Serdula, MK, Ivery, D, Coates, RJ, Freedman, DS, Williamson, DF, Byers, T (1993) Do obese children become obese adults? A review of the literature. *Prev Med* 22(2): 167-177.

Whitaker, RC, Wright, JA, Pepe, MS, Seidel, KD, Dietz, WH (1997) Predicting obesity in young adulthood from childhood and parental obesity. *N Engl J Med* 337(13): 869-873.

WHO (2008) Obesity and overweight, WHO (ed). Geneva: WHO.

WHO/FAO (2002) *Joint WHO/FAO Expert Consultation on Diet Nutrition and the Prevention of Chronic Diseases. Diet, nutrition and the prevention of chronic diseases*.

ISSN 2026-6294