

Prevalence and Factors Associated With Overweight or Obesity Among Primary and Secondary School Teachers In Moshi Municipality, Kilimanjaro, Tanzania.

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Abstract

Background: Overweight and obesity are global public health problems. Overweight or obesity is estimated to cause 4 million deaths, 3.9% of all Years of Potential Life Lost (YPLL) and 3.8% of all Disability Adjusted Life Years (DALYs). Overweight or obesity also leads to conditions such as diabetes and hypertension. It has been shown that teachers have a greater occurrence of overweight or obesity than the general population. This study aimed to determine the prevalence of overweight or obesity among primary and secondary school teachers and to assess factors associated with these problems in Moshi Municipality, Kilimanjaro region, Tanzania.

Methods: This was a cross sectional study in which data was collected using a modified WHO-STEPS Survey tool. Data cleaning and analysis were conducted using STATA version 14.0. Frequency and percentage were used to summarize categorical data while mean/median with their respective measures of dispersion were used to summarize continuous data. The Modified Poisson regression model was used to determine factors associated with overweight or obesity among primary and secondary school teachers. The effect was estimated by Prevalence Ratio with 95% confidence intervals and P-value less than 5% considered to be statistically significant.

Results: A total of 968 teachers were included in this study with median (IQR) age of 37, (32-48) years. Most of the participant were female (69.7%) about (51.6%) were secondary school teachers. Overall, the prevalence of overweight or obesity was 72.7%. Teachers who were 35+ years had a 27% (aPR: 1.27; 95%CI: 1.1 – 1.4; $p < 0.0001$) greater prevalence of overweight or obesity than those below the age of 35. Female teachers had a 43% higher prevalence of overweight or obesity than male teachers (aPR: 1.43; 95%CI: 1.3 – 1.7; $p < 0.0001$). Persons with a positive history of smoking had only 1% higher prevalence of overweight or obesity, however this was not statistically significant.

Conclusion: The Prevalence of overweight or obesity was high, suggesting the need for early intervention with lifestyle changes among teachers in Moshi Municipal. There is an urgent need to design lifestyle interventions targeting overweight or obesity among teachers - especially female teachers and those aged 35+.

Introduction

Overweight/obesity is abnormal, excess fat accumulation that may impair health¹. The World Health Organization (WHO) defines Body Mass Index (BMI) as a simple index of weight and height that is commonly used to classify adults as overweight or obesity¹. It is calculated by dividing a person's weight in kilograms by the square of height in meters (kg/m^2). A BMI of $< 18.5 \text{ kg}/\text{m}^2$ is classified as underweight, BMI of $18.5\text{--}24.9 \text{ kg}/\text{m}^2$ is classified as normal weight, BMI of $25\text{--}29.9 \text{ kg}/\text{m}^2$ is classified as overweight and $\text{BMI} \geq 30 \text{ kg}/\text{m}^2$ is classified as obesity¹.

Overweight/obesity is a global public health problem². In 2016 overweight or obesity was estimated to cause 4 million deaths, 3.9% of Years of Potential Life Lost (YPLL) and 3.8% of Disability Adjusted Life Years (DALYs)². According to WHO, in 2016 about 2.01 billion adults (39%) aged 18 + were overweight, of these 678 million (33%) were obese². Low- and middle-income countries (LMICs) are highly affected by overweight and obesity³. In Africa, the prevalence of overweight is estimated to be 27% and the prevalence of obesity is 8% among adults aged 20 years or more⁴. In Tanzania overweight and obesity is an increasing health problem and the prevalence of overweight and obesity is 26% in the general population⁵. The prevalence of overweight and obesity is high in urban settings compared to rural settings. Generally, the prevalence of overweight or obesity is higher among women (36%) than among men (13%)⁶.

Overweight or obesity leads to high morbidity and mortality⁷. It increases the risk of developing cardiovascular diseases (CVDs) and increases risk of developing co-morbidities like hypertension and diabetes⁸⁻⁹. It also increases the risk of developing different types of cancers, e.g., endometrial and colon cancer¹⁰. Furthermore, overweight or obesity increases the burden of disease and health care costs among individuals/family and community in the health system⁷. Generally, the problem of overweight and obesity in developing countries is neglected. There is a misconception that an overweight or obese person is “healthy”.

Teachers are a very important group in the community. Improving the health of teachers also improves their effectiveness as role models. Students are more likely to eat healthier foods if their teachers are of normal weight and are regularly seen to eat healthy foods¹¹. Studies have shown that teachers have a higher occurrence of overweight or obesity compared to general population¹². Excess intake of energy dense foods and little or no physical exercises are believed to cause this observation¹². Despite several studies on overweight and obesity that have been carried out in Tanzania, few studies have been done in special influential groups such as primary and secondary school teachers. This study aimed to determine the prevalence of overweight and obesity and to assess factors associated with these problems among primary and secondary school teachers in Moshi Municipality, Kilimanjaro region, Tanzania.

Methods

2.1 Study design and study setting

This was a cross-sectional study conducted in Moshi Municipal Council in Kilimanjaro Region, Tanzania. Moshi Municipal Council was randomly selected from the 7 districts of the Kilimanjaro region. According to the 2012 National Census, Moshi Municipality has a population of 184,292 people and covers approximately 59 square kilometers and is the smallest municipality in Tanzania by area¹⁴. Of this large, population, 75% depends on agriculture. There are other economic activities like tourism, manufacturing and small-scale beekeeping and fishing. There are 78 (primary and secondary schools) in Moshi Municipality. Of these 78 schools, 48 are primary schools and 30 are secondary schools. Among the 48

primary schools there are 35 public schools while out of the 30 secondary schools there are 14 public schools.

2.2 Study Population and Procedures.

The study population included primary and secondary school teachers who were enrolled in the primary study (January 2018). The study excluded participants who were pregnant at the time of the study. Teachers were informed about the study aims and follow-up schedule and those agreeing to participate gave signed consent. Face-to-face interviews using a WHO STEPS Instrument²⁷ were conducted by trained research assistants who were medical students at Kilimanjaro Christian Medical University College (KCMUCo). The interviews were conducted in the Swahili language. The information collected included social demographic characteristics, economic characteristics and behavioural characteristics such as history of alcohol use, history of smoking and fruit and vegetable intake per day. After the interviews, physical and clinical examinations were conducted including, anthropometric measures such as weight (kg), height (cm) and waist circumference (cm). Blood pressure and blood sugar levels were also measured. A total of 997 primary and secondary school teachers were enrolled. Analysis was conducted on 968 teachers for whom complete information of weight and height were available.

2.3 Data Processing, Categorization, and Analysis.

The data were cleaned and analysed using STATA version 14.2. Descriptive statistics were used to summarize data. Proportions were used for categorical variables and mean or median with respective measures of dispersion were used for numerical variables. The Prevalence Ratio (PR) with 95% Confidence Interval (CI) was used to measure the strength of association between overweight or obesity and exposure variables (socio demographic, economic and behavioural characteristics). The Modified Poisson regression model was performed to control for confounders. A p value of less than 0.05 was considered as statistically significant.

2.4 Categorization of Variables.

A teacher was considered overweight or obese if their BMI was ≥ 25.0 kg/m². The age of participants was categorized into, 20–34, 35–44, 45–54 and 55 & above. Income per month was categorized into < 50,000Tsh, 50,000–1,000,000Tsh, and > 1,000,000Tsh. Education level was categorized into, Diploma, Bachelor's Degree and Master's Degree or above. The school level at which they teach was recorded as either primary or secondary. Smoking status was categorized as a) has smoked in the past (yes or no), or b) is currently smoking (yes or no). Alcohol use status, whether one has used alcohol in the past (yes or no), is currently using alcohol (yes or no). Fruit and vegetable intake were independently assessed by recording the average number of days in a week one had fruit and vegetable intake, and later were categorized into, 0–3 days or 4–7 days. Physical activity was assessed by asking the number of minutes in a week that one is engaged in moderate or vigorous activity. Those who were active less than 150 minutes per week were regarded not physically active, and those who were active for 150 minutes or more were regarded to be physically active.

2.5 Ethical Consideration.

The permission to conduct this study was sought from the Kilimanjaro Christian Medical University College ethical committee. The study was granted ethical clearance certificate number 1208. Participants who were enrolled gave signed consent. Participants who were found to be overweight or obese received counselling according to the Tanzanian National Treatment Guidelines. Numbers instead of names were used in all the questionnaires used for interview.

Results

Social Demographic characteristics of participants

A total of 968 participants were recruited in the study, 69.7% were female, 60.9% had university degree, 63.3% had monthly income of 500,000–1,000,000/=TZS and 75.2% were married or cohabiting. The median age was 37, (IQR) (32–48) years. Table 1 shows other social demographic characteristics of the participants.

Table 1
Social demographic characteristics of primary and secondary
teachers in Moshi Municipal (N = 968)

Variable	Frequency	%
Variable		%
Median age years (IQR)	37	32–48
Age Years		
20–34 years	382	39.5
35–44 years	285	29.4
45–54 years	166	17.2
55–60 years	135	13.9
Sex		
Male	293	30.3
Female	675	69.7
Education level		
Diploma	276	28.5
University degree	590	60.9
Masters	102	10.5
Type of School teaching		
Primary	469	48.5
Secondary	499	51.6
Marital status		
In union (Married or cohabiting)	728	75.2
Not in union (Separated divorced single)	240	24.8
Income per Month N = 724		
< 500,000/=TZS	199	27.5
500,000–1,000,000/=TZS	458	63.3
> 1,000,000/=TZS	67	9.3
TZS – Tanzanian shillings, 1usd = 2300Tzs.		

Behavior Characteristics Of Participants

Of the 968 participants, 97.9% were not currently smoking, and 90.6% had 0–3 days per week of fruit/vegetable intake. Among them, 70.1% had ≥ 150 minutes per week of physical activity (Table 2).

Table 2
Behaviors characteristics of primary and secondary teachers in Moshi Municipal (N = 968)

Variable	Frequency	%
Currently smoke		
No	947	97.8
Yes	21	2.2
Ever smoke		
No	914	94.4
Yes	54	5.6
Ever alcohol intake		
No	504	52.1
Yes	464	47.9
Fruits intake (Number of days in a week)		
0–3	876	90.5
4 Or more	92	9.4
Vegetables intake (Number of days in a week)		
0–3	891	90.6
4 Or more	92	9.5
Add table salt		
Always	223	23.0
Sometimes	126	13.9
Rarely	619	63.9
Physical activity (Vigorous & Moderate Activities) (n = 873)		
< 150 per minutes	192	21.9
≥ 150 per minutes	681	78.0

Prevalence Of Overweight Or Obesity

Overall, out of 968 participants, 72.7% were overweight or obese. The prevalence among female was 81.9% and among male was 51.5%. Among 968 teachers, 1.2% were underweight, 31.6% had normal BMI, 38.2% and 29% were overweight and obese respectively (Fig. 1).

There was a correlation between overweight or obesity and age, sex, educational level, type of school teaching, marital status and smoking status. Whereby the burden of Overweight or Obesity increased with age, ranging from 57.3% (18–24 yrs.) to 85.9% (55-60yrs) P-value < 0.0001 (Table 3).

Table 3

Prevalence of overweight or obesity by social demographic and behavioral factors (N = 968)

Variable	Overweight/obesity		χ² P-Value
	N	n (%)	
Age			
18–24 years	382	217 (56.8)	
25–34 years	285	226 (79.3)	< 0.0001
35–54 years	166	145 (87.3)	
55–60 years	135	116 (85.9)	
Sex			
Male	293	151 (51.5)	
Female	675	553 (81.9)	< 0.0001
Education level			
Diploma	276	229 (83.0)	
University degree	590	410 (69.5)	< 0.0001
Masters	102	65 (63.7)	
Type of school teaching			
Primary	469	383(81.7)	
Secondary	499	321(64.6)	< 0.0001
Marital status			
In union (married and cohabiting	728	557(76.5)	
Not in union(Separated, Divorced single)	240	147(61.4)	< 0.0001
Income level			
<500,000/=TZS	199	141 (70.9)	0.193
500,000– 1,000,000/=TZS	458	339(74.0)	
>1,000,000/=TZS	67	55(82.1)	
Currently smoke			
No	947	693 (73.2)	0.034
Yes	21	11(52.4)	
Ever smoke			

Variable	Overweight/obesity		X ² P-Value
	N	n (%)	
No	914	673 (73.6)	0.009
Yes	54	31 (57.4)	
Ever alcohol intake			
No	504	359 (71.2)	0.276
Yes	464	345 (74.4)	
Fruit intake (Number of days in a week)			
0–3	876	635 (72.5)	0.607
4 Or more	92	69 (75.0)	
Vegetable intake (Number of days in a week)			
0–3	876	634 (72.4)	0.444
4 Or more	92	70 (76.1)	
Add table salt			
Always	223	156 (70.0)	0.262
Sometimes	126	87 (69.0)	
Rarely	619	461 (74.5)	
Physical activity (Vigorous & Moderate Activities) (n = 873)			
< 150 per minutes	192	138(71.9)	0.855
≥ 150 per minutes	681	494 (72.5)	

Factors Associated With Overweight Or Obesity

Crude Modified Poisson regression of factors associated with overweight or obesity revealed that, teachers aged 35–44 years had significantly 39% higher prevalence of overweight or obesity compared to 18–34 years, P-value < 0.0001 (PR: 1.39; 95%CI: 1.3–1.6; p < 0.00). Similarly, teachers aged 45–54 had significantly 53% higher prevalence of overweight or obesity compared to 18–34 years, P-value < 0.0001 (PR: 1.53; 95%CI: 1.4–1.7; p < 0.042). Female teachers had significantly 59% higher prevalence of overweight or obesity compared to male teachers, P-value < 0.0001 (PR: 1.59; 95%CI: 1.4–1.8; p < 0.001). And, teachers who ever smoked had significantly 21% higher prevalence of overweight or obesity compared to those who had never smoked (PR: 0.79; 95%CI: 0.6–0.9; p 0.042), Table 4.

Table 4

Association between social demographic factors and Behavior overweight or obesity among primary and secondary teachers (N = 968)

Variable	n (%)	Crude	95% CI	P-Value	Adjusted	95% CI	P-value
Age							
18–24 years	217 (57.3)		1			1	
25–34 years	226 (79.6)	1.39	(1.3– 1.6)	< 0.001	1.27	(1.1– 1.4)	< 0.001
35–54 years	145 (87.3)	1.53	(1.4– 1.7)	< 0.001	1.29	(1.1– 1.5)	< 0.001
55–60 years	116 (85.9)	1.51	(1.4– 1.7)	< 0.001	1.26	(1.1– 1.5)	< 0.001
Sex							
Male	151 (51.3)		1			1	
Female	553 (81.9)	1.59	(1.4– 1.8)	< 0.001	1.43	(1.3– 1.7)	< 0.001
Education level							
Diploma	229 (83.1)		1			1	
University degree	410 (69.7)	0.83	(0.8– 0.9)	< 0.001	0.97	(0.9– 1.1)	0.596
Masters	65 (63.8)	0.77	(0.7– 0.9)	0.001	0.94	(0.8– 1.1)	0.497
Type of school teaching							
Primary	383 (81.7)		1			1	
Secondary	321 (64.6)	0.79	(0.7– 0.9)	0.711	1.02	(0.9– 1.1)	0.711
Marital status							
Not in union (separated, divorced)	147 (61.4)		1				
In union (Married, cohabiting)	557 (76.5)	1.24	(1.1– 1.4)	< 0.001	1.08	(0.9– 1.2)	0.177

*Adjusting for alcohol intake, fruit servings per day, vegetable servings per day, physical activity and add salt

Variable	n (%)	Crude	95% CI	P-Value	Adjusted	95% CI	P-value
Income level							
<500,000/=TZS	141 (70.9)		1		1		
500,000–1,000,000/=TZS	339 (74.4)	1.05	(0.9–1.2)	0.363	1.04	(0.9–1.1)	0.481
>1,000,000/=TZS	55 (82.1)	1.15	(1.0–1.3)	0.045	1.04	(0.91.2)	0.544
Ever smoked							
No	673 (73.7)		1		1		
Yes	31 (58.2)	0.79	(0.6–0.9)	0.042	1.01	(0.8–1.3)	0.919
*Adjusting for alcohol intake, fruit servings per day, vegetable servings per day, physical activity and add salt							

In Adjusted Modified Poisson regression, participants; aged 35 + years were significantly associated with 27% higher prevalence of overweight or obesity than aged 18–34 years age (aPR: 1.27; 95%CI: 1.1–1.4; $p < 0.0001$). Female teachers were significantly associated with 43% higher prevalence of overweight or obesity compared to male (aPR: 1.43; 95%CI: 1.3–1.7; $p < 0.0001$), (Table 4).

Discussion

The findings from this study showed a prevalence of 72.7% for overweight or obesity among primary and secondary school teachers. This was higher than the findings of the Tanzania STEPS survey report, which reported the prevalence of 26%²³. Several factors may explain the observed differences, including that the current study recruited a homogenous population (teachers) from a single district (Moshi municipal – urban). Whereas Tanzania STEPS survey recruited a diverse population representative of the entire Tanzanian population. Also, the current study had higher representation from females (69%), who have been shown to have a higher risk for overweight or obesity than males^{24,25,16,26}.

The high prevalence of overweight or obesity among primary and secondary school teachers found in this study (72.7%), was comparable to other studies conducted among teachers, where it was 74.3% in Malaysia¹⁷, 70% in India¹⁶, and 85% in Cape Town, South Africa⁸. The observed similarities in all these studies may be explained partially by the fact that they were all conducted in urban populations and that they all recruited mainly female participants. Other studies conducted among teachers, showed a relatively lower prevalence of overweight or obesity; A study from Ghana reported it to be 61%, this study however, recruited only females who were still of reproductive age¹¹. A study from Ibadan, Nigeria,

reported it to be 55.3%. The fact that 66% of participants in this study were male, could partially explain the lower prevalence¹⁸. A prevalence of 47.2% was reported by a study from Brazil, in this study it was noted that male teachers had higher prevalence than female teachers¹⁹.

The striking observation from all the discussed studies above, is they all report higher prevalence of overweight or obesity among teachers than the general population in their respective countries. While it was 72.7% versus 26% in the current study (Tanzania), it was 74.3% versus 60% in Malaysia¹⁷, in India it was 70% versus a previous range of 30–39%¹⁶ and in Brazil it was 47.2% versus 15.8%¹⁹. The observed trend underlines the high risk that teachers possess and some of these may be explained by factors as observed in the current study. This is an intriguing observation and should be explored in further research.

This study also observed a higher prevalence of overweight or obesity among teachers married or cohabiting (76.5%) than the separated/divorced/single (61.4%). Such a higher prevalence was also observed in Ghana, Tanzania and Nigeria^{11,20}. The possible explanation is that married teachers' pay less attention on their appearance, including being physically attractive as compared to individuals who are still searching for their partners. Also, cultural factors and lay beliefs further may contribute to this observation as obesity is culturally embraced and seen as a sign of wealth and good life in most of our communities, and therefore a sign of successful marriage (partnership).

This study has also shown an increase in the prevalence of overweight or obesity with increasing age among schoolteachers. These findings are consistent with previous studies from Tanzania^{6,24}, India¹⁶, Nigeria¹⁸, and South Africa^{8,12,20}. This observation may be explained by a sedentary lifestyle, decrease in social and physical activity and reduced metabolism that often comes with increasing age²⁰.

The findings from this study have also shown a significant difference in the prevalence of overweight and obesity between female teachers and their male counterparts, where female teachers were 43% more likely to be overweight or obese. The same observation was reported by other studies from Tanzania^{24,26}, Ghana¹¹, Nigeria^{18,21}, Malaysia¹⁷, South Africa^{8,12,20} and India¹⁶. This may be explained partly by the nature of female's anatomy. A woman, has less lean body mass and more fat mass and she tends to accumulate more fat during pregnancy²⁵. This accumulated fat provides energy for the growth of the fetus and for the mother to breastfeed²⁵. When this accumulated fat is not shed after childbirth and after breastfeeding, over time, the overall fat mass increases and puts the woman at risk of overweight or obesity and its related problems²⁵. On the other hand, a study from Brazil¹⁹, reported a higher prevalence of overweight or obesity among males than their female counterparts¹⁹. Observations, such as this, from Brazil, may explain the multidimensional nature of risk factors for overweight or obesity, including social-cultural roles.

Limitations Of The Study

The limitations of this study include recruiting teachers from public schools only, therefore the information obtained cannot be generalised to those in private schools. The study was conducted in an urban setting, and therefore the information obtained cannot be generalized to those in rural setting. The study also, excluded teachers who were on sick leave.

Conclusions

There is high prevalence of overweight or obesity among primary and secondary school teachers in Moshi Municipality. Female teachers and those aged 35 years or more are at increased risk. The preponderance of overweight or obesity among the females and those aged 35 years or more points to the need for group specific or targeted interventions to combat the threat. In developing interventions for weight control, barriers to lifestyle change at the personal, environmental and socio-economic levels should be targeted and stakeholders at different levels should be involved. Policies to regulate dietary habit, provide environments that encourage physical activity behavior, such as creating walkways, and support health services should be formulated and implemented.

Abbreviations

BMI Body Mass Index

CVDs Cardiovascular Diseases

CVA Cerebrovascular Accidents

DALYs Disability Adjusted Life Years

DM Diabetes Mellitus

HCPs Health Care Providers

HICs High Income Countries

HTN Hypertension

KCMC Kilimanjaro Christian Medical Centre

KCMUco Kilimanjaro Christian Medical University College

LMICs Low- and Middle-Income Countries

MoHCDGEC Ministry of Health Community Development Gender Elderly and Children

NCDs Non Communicable Diseases

NMNAP National Multisectoral Nutrition Action Plan

PR Prevalence Ratio

SDGs Sustainable Development Goal

TZS Tanzanian Shillings

WHO World Health Organization

Declarations

Ethical approval, Consent for participation and Publication

The permission to conduct this study was sought from Kilimanjaro Christian Medical University College ethical committee. The study was granted ethical clearance certificate number 1208. Participants who were enrolled gave a signed consent which also gave permission for data collected to be published in scientific journals. Participants who were found to be overweight or obese received counselling according to Tanzania National Treatment Guidelines. Numbers instead of names were used in all interview reports.

Availability of data and Material

The dataset used for analysis of this study is available from the corresponding author on reasonable request.

Competing Interest

The authors declare that they have no competing interests

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Authors' contributions

JMG drafted the manuscript, analyzed data and interpreted results. ZM contributed in drafting of the manuscript and interpretation of results. JMG, MM, RM, BJL and SEM participated in data collection. WM and SEM supervised data analysis and manuscript writing. JMG and ZM participated in data analysis and interpretation of results. All authors read and approved the final version of the manuscript.

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Figures

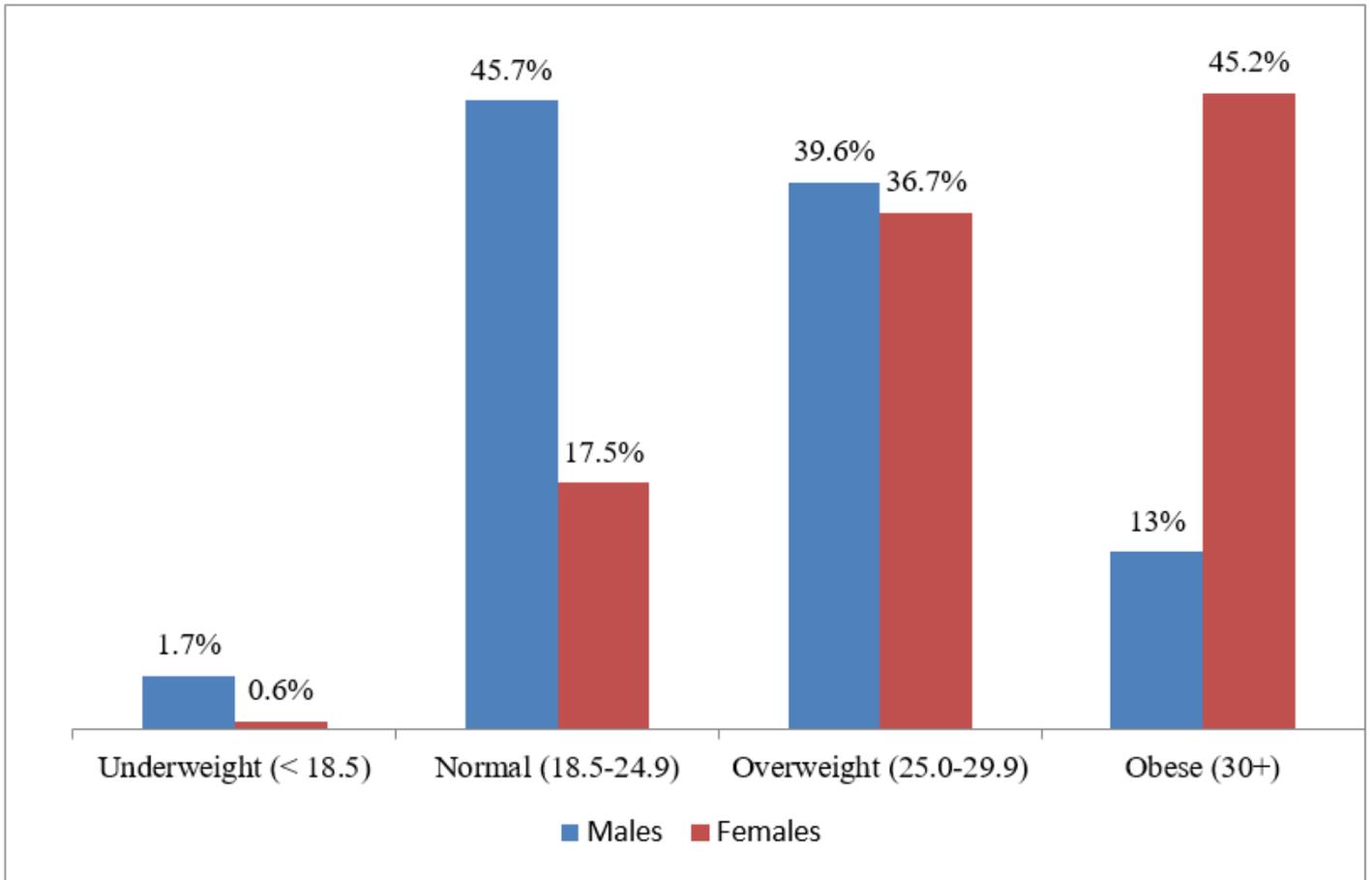


Figure 1

Teacher's BMI categories by sex in Moshi Municipal