

Physical Activity levels associated with Overweight and Obesity amongst female traders in Municipal Markets in Eldoret, Kenya.

Mugotitsa Lynnah *, Prof. Jennifer Wanjiku Khamasi **, Florence Wakhu Wamunga ***

* Bsc. Agriculture bio-systems Management, Moi University, School of Agriculture Biotechnology, Department of Family and consumer Science, University of Eldoret

** Wanjiku Khamasi, Associate Professor, Dedan Kimathi University of Technology

***PhD.University of Eldoret

DOI: 10.29322/IJSRP.12.10.2022.p13048

<http://dx.doi.org/10.29322/IJSRP.12.10.2022.p13048>

Paper Received Date: 4th September 2022

Paper Acceptance Date: 5th October 2022

Paper Publication Date: 13th October 2022

Index Terms- Women traders, Body Mass Index, Overweight, Obese, Physical activity

Abstract- Background: Overweight (BMI 25-29) and obesity (BMI ≥ 30) is currently a global epidemic. Increase in non-communicable diseases is a major cause of death globally that is linked to nutritional imbalances like overweight and obesity. This study was to determine the prevalence of overweight and obesity among women traders aged 20-50 years at Eldoret municipal markets, Kenya and identify the levels of physical activity amongst these women.

Methods: This study was a cross sectional descriptive survey. Data was collected using researcher administered questionnaires for demographic information, their physical activity patterns and anthropometric measurements (height, weight, and waist and hip circumference) for Body mass index calculations was collected from 238 registered female traders aged 20-50 years from the Eldoret Municipal markets. Proportionate sampling was used to identify the number of subjects per market because all the four markets differ in population. Body Mass Index (BMI) was used to determine the prevalence of overweight and obesity. Data was analyzed using the Statistical Package for Social Sciences (SPSS) software (Version 26). Descriptive and inferential statistics was used to describe the data. Chi-square tests was performed at 0.05 level of significance to establish the association between physical activity and nutritional status.

Results: The prevalence of overweight 24 % and obesity 37% among the women traders was 61% with a statistically significant ($p < 0.05$) relationship between overweight and obesity and

Conclusion: This study concludes that the prevalence of obesity and overweight among women traders is a cause to worry being it is a predisposing factor to non-communicable diseases, which is currently a major cause of deaths.

Recommendation: The ministry of health in collaboration with the trade department and related policy makers should introduce obesity and overweight and the risks that come with it through sensitization programs for the market women and outreach programs and implement essential strategies that can play an important role in the sensitization of anti-obesity habits and practices.

I. INTRODUCTION

The increasing prevalence of overweight and obesity remains a major contributing factor to the global burden of non-communicable diseases which are chronic, disability and a reduced life expectancy (Chu et al., 2018; Roth et al., 2020). OWO is as a result of abnormal or excess fat accumulation in the adipose tissues resulting to an impairment in the health of an individual (Ahmed, Sultan, & Greene, 2021). OWO classification is done using the index of weight for height whereby, in adults, obesity is having a body mass index (BMI) of greater than 30.0 Kg/ M², while overweight is having a BMI that is greater than 25.0 Kg/ M² but less than 30 Kg/ M² respectively (WHO,2016).

The entire process involved in an individual becoming OWO may not be very clear, but one major reason is when an individual has an imbalance between energy consumption and energy expenditure resulting to a high energy intake and a low energy output. There are increasing levels of OWO among women of reproductive age in urban Africa whereby obesity has doubled or tripled in 12 of the 24 countries in Africa (Amugusi, Dimbuene, Mburu, Muthuri & Ezech, 2017).

Despite the serious implications of obesity and overweight, most attention is concentrated on famine and under nutrition or malnutrition (Ekholuenetale, Tudeme, Onikan, & Ekholuenetale, 2020) yet on the other hand, women form a better part of our community hence equally exposed to health risks associated with OWO.

Physical activity is very significant in health for the well-being of the heart, body and mind. It remains to be a major contributing factor in prevention and management of non-communicable diseases, reduction of depression and anxiety, thinking, learning and judgment enhancement and improvement of the general well-being in healthy growth and development. However, according to WHO (WHO, 2020). Globally, one in every four adults fail to meet the global physical activity recommendations yet up to five million deaths a year could have been avoided if only the population was more physically active (Migueles et al., 2017). Physical

activity is the body movement during leisure time, transport from one place to another and as part of an individual's work (Ross et al., 2020). Physical activity is classified in four dimensions as indicated in the table below

Table 1: Dimensions of physical activity

Dimension	Definition and context
Mode	Specific activity performed (eg, walking, gardening, cycling).
Frequency	Number of sessions per day or per week (Session is ≥ 10 min in duration/length)
Duration	Time (minutes or hours) of the activity during a specified time frame (eg, day, week, month or year)
Intensity	Rate energy expenditure which indicates metabolic demand

The infrastructure that is prevalent in a given population influences the means of transport that is found in the neighborhood and this influences the chances of walking by the people in the region. High neighborhood walkability has been found to be associated with a decreased prevalence of overweight and obesity (Creatore et al., 2016). The world has witnessed a reduction in transport-related physical activity and this is closely associated with the increase in car ownership as well as the presence of infrastructure that supports automotive transport (King & Jacobson, 2017). The choice of transportation can influence obesity and especially the decision by an individual regarding whether to travel by motorized travel (e.g., driving an automobile) or active travel (e.g., walking, cycling). While auto-mobiles provide a fast and convenient travel mode, replacing active travel with motorized travel also replaces the physical activity involved in walking or cycling with the sedentary activity of driving, thereby reducing personal energy expended (King & Jacobson, 2017).

There has been a shift in the working environments for different people across the globe. The majority of the people in white-collar jobs have minimal moderate to vigorous physical activity and hence they are mostly sedentary (Migueles et al., 2017). The development of communication technology further aggravates the situation as basic things such as moving from one office to another have been replaced by technological systems. The development of various enterprise resource planning programs and systems have facilitated communication between people within an organization without having them meet or move from their desks. This reduces the walkability of the populations and the chances of involving themselves in any form of physical activity (Ross et al., 2020).

II. MATERIALS AND METHODS

Study design, setting, population

In this study descriptive survey was most suitable because of its unique characteristic of describing characteristics and frequencies through a survey. The research was conducted in the day to day environment of the female traders and was quick to perform because there is no

follow-up on the subjects hence inexpensive (Asenahabi, 2019).

This study was conducted in the four Municipal markets in Eldoret. Eldoret serves as the main administrative center of Uasin Gishu County. Eldoret stands out as the principal town in the Rift valley region of Kenya serving as the capital of Uasin Gishu County. According to the Kenya Population and Housing Census 2019, Eldoret is the second most important city in Western Kenya after Kisumu and the fifth most populated urban area in Kenya. Eldoret Municipality has four Municipal markets. Two of these markets are in the town center, whereby one is the main market and the other is the retail market. The other two are Kahoya, which is out of town and the Eldoret West market, which is an assorted goods market. All the four markets were used for the study.

Sampling technique, ethical consideration

The study applied non-probability sampling procedure in the determination of the sample size. A clustered sampling technique which denotes the technique dividing the population into smaller groups and randomly selecting among them to form a sample (Mahmud, Huang, Salloum, Emara, & Sadatdiynov, 2020). According to the Eldoret municipal Market records, the total traders are 840 (inclusive of the male traders) in all the four markets, with female traders being 80%(672) of all the traders, (Uasin Gishu County, 2017). All the four markets were eligible for this study. Proportionate sampling was used to determine the number of subjects per market as they differ in population, having a retail market with an estimated population of 700 registered traders, main market has 100 registered traders, West market has 30 registered traders and Kahoya market has only 10 registered traders, registration was determined by having a trader allocated a stall space within the four walls of the specific municipal market.

Table 2: Population data for Eldoret County council markets (Uasin Gishu County, 2017)

Stratum	Retail Market	Main market	West market	Kahoya Market
Total population	700	100	30	10
Fraction of female (4/5); Sample population	560	80	24	8
Sample ratio	70	10	3	1
Sample size	198	28	9	3

Ethical consideration

Before conducting the research, a clearance form from the Graduate School of the University of Eldoret was obtained. A research permit was also obtained from the Ethical Committee of National Commission for Science, Technology and Innovation (NACOSTI). The Eldoret county council office was also informed of research intentions. Participants were recruited upon their informed consent and they were assured of confidentiality and anonymity is maintained throughout the study. Confidentiality was applied by providing the participants' identification numbers and no names and/ or other means of identification was used. All the

references used to obtain the information in this study were duly acknowledged.

Data collection procedure

The study adopted use of primary data collected from respondents using structured questionnaires. While structuring the questionnaire the study adopted questions from Global Physical Activity Questionnaire (GPAQ) (Armstrong and Bull 2006) for physical activity data. The relevant market authorities were consulted and an official approval to proceed with the research within the market was given. The market was visited a month before data collection to establish the market patterns and identify an appropriate or most convenient time for data collection. The researcher and the assistants visited the market and carried out the study after allowing the participant to sign the consent form. The researcher and research assistants administered the questionnaire, and took the anthropometric measurements; to avoid inter-observer errors; one research assistant would take the anthropometric measurements twice while the other assistant took the records before moving to another participant. For calibration accuracy of the weighing scale, a known weight of a kilo of flour was used to continuously confirm accuracy. Upon completion, the two research assistants checked the questionnaire for completion, the accuracy of information and consistency before moving to the next participant.

Data analysis

Data was then analyzed using SPSS version 26. Nutritional status was determined using WHO gender specific BMI –for – Height. Descriptive statistics was used in the analysis of the quantitative variables like, weight, height, BMI at <0.5 level of significance. Chi-square test was used to determine the level of statistical significance in nutritional status and physical activity as the independent variables. Data analysis involved testing for variability and associations with Pearson’s Correlation Coefficient test being applied to measure variability and associations respectively. This study also applied a +5% or -5% precision level and a 95% confidence level (Wagner et al., 2019).

III. RESULTS

Demographic and socioeconomic characteristics of the respondents

A total of 238 female traders participated in the study. The age groups 30-39 and 40-49 had the highest number of participants at 38% and 37% respectively. Age group 20-29 years had 16% women, and 50-59 years had the least participants at 8%. The mean age in this study was 37 years. Majority, 50% of the respondents were married, the singles were 24%, separated 13% (30), and divorced 7%. The response shows that the majority of the respondents (47%), have between 3-5 children. The respondents with 0-2 children were 41% and 12% had a parity of 6 and above children as indicated in table 5 below which shows the demographic characteristics of the respondents.

The respondents with no formal education were 9%. Those with primary education were 48%. The respondents with secondary education were 32% and 12% had tertiary education.

Table 3: Demographic characteristics of the respondents

Factor	n (%) (n=238)
Age	
20 -29 Years	39 (16.4)
30-39 Years	91 (38.2)
40- 49 Years	88 (37.0)
50- 59 Years	20 (8.4)
Marital Status	
Single	58 (24.4)
Married	120 (50.4)
Divorced	30(12.6)
Separated	14(5.9)
Parity	
0-2 Children	97 (40.8)
3-5 Children	112 (47.1)
6 and above children	29 (12.2)
Education	
None	21 (8.8)
Primary	113 (47.5)
Secondary	17 (31.5)
Tertiary	29 (12.2)

The sample was categorized into six income group levels as follows: Those with income range <10,000 per month, 11,000-20,000; 21,000-30,000; 31,000-40,000; 41,000-50,000 and 50,000 plus

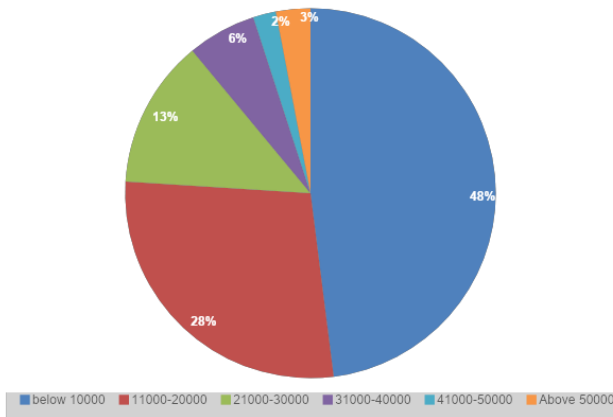


Figure 1: Monthly income of the respondents

Out of the 238 women, 48% earned less than Kshs. 10,000; 28% earned in the range of 11,000 – 20,000; 13% earned between 21,000 and 30,000; 6% earned in the range of 31,000 – 40,000; 2% earned in the range of 41,000 – 50,000 and 3% earned above 50,000.

Physical activity levels

The 238 respondents reported to spend different hours at the market. According to this study 11% women traders spent between one to three hours at the market. Those who spent above seven hours at the market were the majority at 75 %. The remaining 14% reported to spent between four hours to six hours on the vending job

The mode of travel to and from the market was considered. The means of transport that was common among the respondents was the use of matatu which is a form of public transport 77%. The respondents who walked and those who used motorcycles were 11% and 10% respectively.

Another measure of physical activity at work was established by asking the women if their work involved activities that require hard physical effort (vigorous physical activity) like moving around while carrying a heavy load or moderate physical effort (moderate physical activity) like walking around the market. The results indicated that 66% of the women had a very light (sitting) level of physical activity: not active, while 13% had light weight (standing for less than two hours) level of physical activity:

slightly active. Moderately active (walking) level of physical activity was among 20% of the women traders while only 1% (2) of the respondents had a vigorously active level (walk carrying a heavy load) of physical activity.

Total time spent on sedentary activities per day was established by asking the women to report on the total time spent sitting, standing, walking or reclining at work, and getting goods from one place to another place. The results indicated that 79% engaged in sedentary behavior of sitting for more than five hours in a day, with 15% of them being slightly active by spending two to five hours standing at their specific workstations without being mobile. The activity levels of these respondents during the day is sedentary whereby 5% of the respondents engage in moderate active activities like walking for less than two hours as reflected in the figure 4.3 below.

The results indicated that most of the respondents are exposed to being sedentary at their work stations since most of their tasks were conducted while sitting. Movement was often within the cubicle work station which does not offer a lot of space for vigorous movement

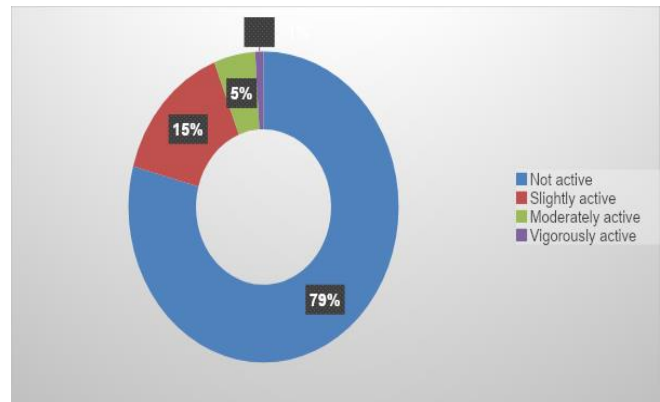


Figure 2: Physical activity levels

Relationship between socio demographic and economic characteristics of the normal weight, overweight and obese women traders

With the $\alpha \leq 0.05$, there was a statistically significant relationship between overweight and obesity and the marital status ($p=0.024$), income ($p = 0.012$), age ($p <0.05$) and parity ($p= 0.012$). However, there was an insignificant relationship between in being overweight or obese and level of education ($p= 0.178$).

Table 4: Relationship between socio demographic to economic characteristics of the nutritional status of women traders

Socio demographic Characteristics		Normal weight (n%)	Overweight (n%)	Obese (n%)	Chi-Square test (P-Value)
Marital status	Married	18 (56.3)	49 (58.3)	53(43.4)	0.024
	Single	8 (25.0)	18 (21.4)	32(26.3)	
	Separated	4 (12.5)	12 (14.3)	14(11.5)	
	Divorced	2 (6.3)	2 (2.4)	12 (9.8)	
	Widowed	0 (0.0)	3 (3.6)	11 (9.0)	

Level of Education	None	1 (3.1)	8 (9.5)	12 (9.8)		
	Primary	12 (37.5)	34 (40.5)	67(54.9)	0.178	
	Secondary	11 (34.4)	32 (38.1)	32(26.2)		
	Tertiary	8 (25.0)	10 (11.9)	11 (9.1)		
Monthly income	Below 10,000	14 (43.8)	42 (50.0)	59(48.5)		
	11,000-20,000	4 (12.5)	22 (26.2)	41(33.6)		
	21,000-30,000	7 (21.9)	13 (15.5)	12 (9.8)	0.012	
	31,000-40,000	5 (15.6)	4 (4.8)	5 (4.1)		
	41,000-50,000	2 (6.3)	0 (0.0)	2 (1.5)		
	Above 50,000	0 (0.0)	3 (3.6)	3 (2.5)		
	Age	21 - 25	11 (34.4)	5 (6.0)	7 (5.7)	
		26 -30	5 (15.6)	18 (21.4)	16(13.1)	
31 - 35		8 (25.0)	15 (17.9)	19(15.6)	0.000	
36 -40		3 (9.4)	21 (25.0)	30(24.6)		
41 -45		4 (12.5)	14 (16.7)	25 (20.5)		
46 - 60		1 (3.1)	11 (13.1)	25(20.5)		
Parity	0 - 2 Children	17 (53.1)	43 (51.2)	37(30.3)		
	3 -5 Children	15 (46.9)	31 (36.9)	66(54.1)	0.012	
	< 6 Children	0 (0.0)	10 (11.9)	19(15.6)		

Nutritional status in relation to physical activity levels among women traders aged 20-50 years in Eldoret Municipal markets

Among the 11% who spent between one to three hours at the market, 52% of these respondents were overweight while 24% were obese and 24% were normal in weight. Those who spent above seven hours at the market were the majority at 75 %, with 58% of them being obese, 34% were overweight and 8% had normal weight. The rest 14% reported to spent between four hours to six hours on the vending job and 42% of them were obese while 18% were of normal weight but 40% were overweight. Therefore, the longer the hours spent at the market the more the chances of being overweight or obese because the level of physical activity while at the market was low.

The women who use matatu 77%, 50% were obese while 11% were normal weight and 39% were overweight. Fifty-nine percent of those who walked were obese, 29% were normal weight and 12% were overweight. On the other hand, 56% of those who used motorcycles were obese, 41% were overweight and 3% was of normal weight. The respondents using matatu made up 40% of those who were obese in relationship to the

mode of transport used to travel to the market. Majority of these market women do not walk to their centers of business meaning a low level of physical activity which does not balance with the levels of energy consumption and energy use hence predisposing them to being overweight or obese.

The physical activity levels were low having 79% engaging in sedentary behavior, hence 80% of those who were sedentary were obese and only 3% were of normal nutritional status. Among the 15% who were slightly active, 69% of them were obese, 22% were overweight and only 9% were in the normal nutritional status category. The results indicated that most of the respondents had a sedentary lifestyle whereby tasks were conducted while sitting. Movement was often within the cubicle workstation which does not offer a lot of space for vigorous movement.

ANOVA statistics indicate that there is a statistically significant relationship between levels of physical activity and nutritional status, p- value= 0.000, which is greater than critical value of 0.05, and indicates that, overall, the regression model is statistically significant in predicting the outcome variable

Table 5: Relationship between levels levels of physical activity and nutritional status

ANOVA^a

Model	Sum of Squares	df	Mean Square	F	Sig.
1 Regression	1.497	1	1.497	3.574	.000 ^b
Residual	13.824	33	.419		
Total	15.321	34			

a. Dependent Variable: Nutritional status

b. Predictors: (Constant), physical activity levels

IV. DISCUSSION

Prevalence of overweight and obesity among women traders aged 20-50 years at Eldoret Municipal market by demographic and socioeconomic status

The prevalence of obesity and overweight was determined using BMI and Waist Circumference ratio. These methods were considered adequate to determine the overall fat and abdominal fat deposition in the sampled population. The study population was aged 20-50 years; the mean age of 37.4 and a median of 38, and a mean BMI of 30.3kg/M².

This study found that the overweight prevalence among women traders age 20-50 to be 26%, whereas that for obese women to be 37%. Therefore, 53% of the respondents were in the overweight or obese category. In essence, approximately one in every two respondents was obese or overweight, concurring with a study by (Mkuu et al., 2018) The mean age of the respondents being 37.4 matches a study by (Mkuu et al., 2018). WHO (WHO, 2019) indicates that the prevalence of obesity and overweight is generally greater in older women; hence the risk of obesity and overweight increases across the lifespan, explaining the increased risks of non-communicable diseases as one grows older Bruce et al., 2008.

Women aged 40 to 44 have four times the risk of being obese or overweight than women aged 15 to 24 (Hales, Carroll, Fryar, & Ogden, 2017; Mkuu et al., 2018) established that the prevalence for young adults between ages 20-39 is at 35.7%. According to Lee et al. (2017) proves that the older people get, the higher their chances of becoming overweight and obese. Data in this study indicates the age bracket 30 to 39 years as the highest population. However, the age bracket of 40 to 49 years is the highest 32% (76) in obesity and overweight prevalence. The minor percentage 10% (28) of obese and overweight respondents is in the age bracket of 20 to 29 shows the risk of obesity and overweight is lower among younger women.

Forty-eight percent of the respondents receive an income below 10,000 per month, making them low income earners. According to (Ondicho et al., 2016) confirmation in his study among health workers in Kisumu that overweight and obesity is rapidly increasing among the low and middle-income earners.

Although the relationship between marital status and overweight and obesity is not clearly established, a study by (Tzotzas et al., 2010) indicates that married individuals tend to be heavier than the unmarried. In this study marital status indicates a significant relationship to prevalence of obesity and overweight being $P=0.024$. On the other hand, the divorced and separated had higher percentages of those who are overweight and obese as compared to the never married or single which relates to a study (Bell & Thorpe Jr, 2019).

Higher parity has previously been implicated as one of the predisposing risk factors of obesity and overweight among women (Taghdir et al., 2020) which is revealed in this study at $p=0.012$. The greater the number of live births the higher the prevalence of obesity and overweight which makes parity positively associated with the risk of obesity and overweight especially the abdominal obesity. In this study, a parity of six and more children has all the subjects being either obese or overweight. Women who have three or more children were 1.75 times at risk of being obese or

overweight according to a study by Taghdir et al. (2020), whereby in this study those with a parity of 3 and above had 87% of them being overweight or obese. On the other hand, the married participants showed a higher prevalence of obesity than other marriage categories except for the widowed women.

A study by Bell and Thorpe Jr (2019) indicates that married individuals will more often have a confidant with whom they can eat together; therefore, this makes them eat more often. Another study by (Ondicho et al., 2016) explains how the married are less conscious about their weight because they are not actively seeking a mate. On the other hand, a couple of studies (Bell & Thorpe Jr, 2019; Ondicho et al., 2016) explain that there is a lot of psychological, and social disruption when there is a disruption in someone's marital status, and it mainly affects women.

Physical activity levels of women traders aged 20-50 years in Eldoret Municipal markets

Physical activity (PA) is known to be a major factor in reducing the likelihood of being obese or overweight and physical inability which is associated with aging, P. Mawaw et al. (2017) which improves the quality of life measures. Previous research, Tremblay et al. (2011) indicates that the levels of physical activity as per the health regulations tends to decrease as people age, which is risky for women approaching menopause because they are highly predisposed to non-communicable diseases like chronic heart disease.

The study results indicated that >65% of the women did work that did not involve vigorous physical activity. The differences between the BMI regarding vigorous physical activity was significant (p -value = 0.01), with the proportion of obese females who engaged in less physical activity, i.e. 0-10 minutes is high at 74% and this proportion reduced among females who spent 10-20 and 20-30-minutes on physical activity. This same trend was witnessed among women who did not work for more than 20 minutes a day. The proportion of obese women who spend 0-10 minutes on the continuous walk was 66%, and this percentage sharply dropped to 13% among women who spent 20-30 minutes walking. (Table 5.0). The levels of physical activity among the respondents were at minimum levels, which is one reason for having high levels of obesity and overweight (Peters et al., 2019). The increase in sedentary lifestyle coupled with the consumption of energy-dense foods accounts for the increasing burden of obesity and overweight.

The results indicated that 80% of the women engaged in sedentary behavior of sitting as explained by (Lavie et al., 2019) with 15% of the women being lightly active by standing and only 5% being moderately active by moving around their stalls. The use of mobile phones more so helps to link with the improved technology which offers affordable delivery services as indicated by (i Figuls et al., 2018). A sedentary practice increases the risks of being obese or overweight, as acknowledged in a study by (Migueles et al., 2017). In this case, the problem of overweight and obesity among the group of women traders is not a paradox as most of these women engage in sedentary activities (Creatore et al., 2016; Lavie et al., 2019) coupling with the long hours of physical inactivity and high energy intake, there has to be a high prevalence of obesity and overweight. A study by Mkuu et al. (2018) that reveals women aged 40 to 44 years have four times higher chances of being overweight and obese as compared to women aged between 15 to 24 years, explaining why the study

sample of mean age 37.4 years is at a high risk of being overweight or obese.

The analysis further proceeded to logistic regression which indicated only the means of transport to the market has no significance relationship with the prevalence of obesity and overweight. Whereas factors like hours spent at the market were significant, in relation to a study by (Amugsi et al., 2017) who says the longer the hours one stays away from home the higher the chances of unhealthy eating habits hence increasing the prevalence of obesity and overweight. The activity level remains significant as the study indicates that most women, P. Mawaw et al. (2017) while at their vending job have a sedentary work environment which predisposes them to the high prevalence of obesity and overweight.

ACKNOWLEDGMENT

I would like to acknowledge my supervisors for their patience in working with me and offering the step by step guidance and supervision. I acknowledge my family for their unwavering support, in both socially and economically during my period of taking this professional step of growth, may God richly bless you.

COMPETING INTERESTS

All authors declare that they have no competing interests

REFERENCES

- [1] Ahmed, B., Sultana, R., & Greene, M. W. (2021). Adipose tissue and insulin resistance in obese. *Biomedicine & Pharmacotherapy*, 137, 111315.
- [2] Amugsi, D. A., Dimbuene, Z. T., Mberu, B., Muthuri, S., & Ezech, A. C. (2017). Prevalence and time trends in overweight and obesity among urban women: an analysis of demographic and health surveys data from 24 African countries, 1991–2014. *BMJ open*, 7(10), e017344.
- [3] Asenhab, B. M. (2019). Basics of research design: A guide to selecting appropriate research design. *International Journal of Contemporary Applied Researches*, 6(5), 76-89.
- [4] Bell, C. N., & Thorpe Jr, R. J. (2019). Income and marital status interact on obesity among Black and White men. *American journal of men's health*, 13(1), 1557988319829952.
- [5] Chu, D.-T., Nguyet, N. T. M., Dinh, T. C., Lien, N. V. T., Nguyen, K.-H., Ngoc, V. T. N., . . . Jurgowski, A. (2018). An update on physical health and economic consequences of overweight and obesity. *Diabetes & Metabolic Syndrome: Clinical Research & Reviews*, 12(6), 1095-1100.
- [6] Creatore, M. I., Glazier, R. H., Moineddin, R., Fazli, G. S., Johns, A., Gozdyra, P., . . . Manuel, D. G. (2016). Association of neighborhood walkability with change in overweight, obesity, and diabetes. *Jama*, 315(20), 2211-2220.
- [7] Ekholuenetale, M., Tudeme, G., Onikan, A., & Ekholuenetale, C. E. (2020). Socioeconomic inequalities in hidden hunger, undernutrition, and overweight among under-five children in 35 sub-Saharan Africa countries. *Journal of the Egyptian Public Health Association*, 95(1), 1-15.
- [8] i Figuls, M. R., Garcia, L. M., Martinez-Zapata, M. J., Pacheco, R., Mauricio, D., & Cosp, X. B. (2018). Interventions for treating overweight or obesity in adults: an overview of systematic reviews. *The Cochrane Database of Systematic Reviews*, 2018(12).
- [9] King, D. M., & Jacobson, S. H. (2017). What is driving obesity? A review on the connections between obesity and motorized transportation. *Current obesity reports*, 6(1), 3-9.

- [10] Lavie, C. J., Ozemek, C., Carbone, S., Katzmarzyk, P. T., & Blair, S. N. (2019). Sedentary behavior, exercise, and cardiovascular health. *Circulation research*, 124(5), 799-815.
- [11] Mahmud, M. S., Huang, J. Z., Salloum, S., Emara, T. Z., & Sadatdiynov, K. (2020). A survey of data partitioning and sampling methods to support big data analysis. *Big Data Mining and Analytics*, 3(2), 85-101.
- [12] Mawaw, P. M., Yav, T., Mukuku, O., Lukanka, O., Kazadi, P. M., Tambwe, D., . . . Luboya, O. N. (2017). Prevalence of obesity, diabetes mellitus, hypertension and associated risk factors in a mining workforce, Democratic Republic of Congo. *Pan African Medical Journal*, 28(1).
- [13] Migueles, J. H., Cadenas-Sanchez, C., Ekelund, U., Nyström, C. D., Mora-Gonzalez, J., Löf, M., . . . Ortega, F. B. (2017). Accelerometer data collection and processing criteria to assess physical activity and other outcomes: a systematic review and practical considerations. *Sports medicine*, 47(9), 1821-1845.
- [14] Ondicho, Z., Omondi, D., & Onyango, A. (2016). Prevalence and socio-demographic factors associated with overweight and obesity among healthcare workers in Kisumu East Sub-County, Kenya.
- [15] Ross, R., Chaput, J.-P., Giangregorio, L. M., Janssen, I., Saunders, T. J., Kho, M. E., . . . McLaughlin, E. C. (2020). Canadian 24-Hour Movement Guidelines for Adults aged 18–64 years and Adults aged 65 years or older: an integration of physical activity, sedentary behaviour, and sleep. *Applied Physiology, Nutrition, and Metabolism*, 45(10), S57-S102.
- [16] Roth, G. A., Mensah, G. A., Johnson, C. O., Addolorato, G., Ammirati, E., Baddour, L. M., . . . Benziger, C. P. (2020). Global burden of cardiovascular diseases and risk factors, 1990–2019: update from the GBD 2019 study. *Journal of the American College of Cardiology*, 76(25), 2982-3021.
- [17] Taghdir, M., Alimohamadi, Y., Sepandi, M., Rezaianzadeh, A., Abbaszadeh, S., & Mahmud, F. M. (2020). Association between parity and obesity: a cross sectional study on 6,447 Iranian females. *Journal of preventive medicine and hygiene*, 61(3), E476.
- [18] Tremblay, M. S., LeBlanc, A. G., Kho, M. E., Saunders, T. J., Larouche, R., Colley, R. C., . . . Gorber, S. C. (2011). Systematic review of sedentary behaviour and health indicators in school-aged children and youth. *International journal of behavioral nutrition and physical activity*, 8(1), 1-22.
- [19] Kenya National Bureau of Statistics (KNBS) & ICF Macro. (2019). Kenya Demographic and Health Survey 2014-2015 Calverton, Maryland: KNBS and ICF Macro.
- [20] Tzotzas, T., Vlahavas, G., Papadopoulou, S. K., Kapantais, E., Kaklamanou, D., & Hassapidou, M. (2010). Marital status and educational level associated to obesity in Greek adults: data from the National Epidemiological Survey. *BMC public health*, 10(1), 1-8.
- [21] Wagner, C., Kawulich, B., & Garner, M. (2019). A mixed research synthesis of literature on teaching qualitative research methods. *SAGE Open*, 9(3), 2158244019861488.
- [22] World Health Organization Fact Sheet (2016). Obesity and Overweight.
- [23] World Health Organization Fact Sheet (2020). Obesity and Overweight

AUTHORS

First Author – Mugotitsa Lynnah, Bsc. Agriculture bio-systems Management, Moi University, School of Agriculture Biotechnology, Department of Family and consumer Science, University of Eldoret. Lynnahm28@gmail.com

Second Author- Prof. Jennifer Wanjiku Khamasi, Associate Professor, Dedan Kimathi University of Technology wanjiku.khamasi@gmail.com

Third Author – Florence Wakhu Wamunga. PhD. University of Eldoret. florencewakhu@yahoo.com

Correspondence Author – Mugotitsa M Lynnah . Lynnahm28@gmail.com. Cell: +254721831667

Authors contributions

ML, JW, and FW were all involved in all aspects of the development of this manuscript.