

## To Investigate the Correlation Between the Socioeconomic Status and Cardiometabolic Associated Risk Indicator Among Middle Aged Adults in Selected Sub-Counties in Kisumu County in Nyanza Region in Kenya

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### ABSTRACT

The prevalence of Cardio- metabolic associated risk indicators are known to vary significantly across the world (Huh et al., 2019). Study design. This was a cross-sectional quantitative study on correlation between socioeconomic and cardio metabolic associated risk indicators among Residents in selected sub counties in Kisumu county Nyanza region in Kenya. It involved the determination of five indicators of cardio metabolic disorders, which included; general obesity (BMI), central obesity (waist: hip ratio), blood pressure (SBP and DBP), dyslipidemia (Lipid profile) among the residents. Results. Our study showed a strong association between BMI, WC and hypertension in the study population. These findings are in agreement with other studies that also reported an association between hypertension and prehypertension, BMI and WC as well as diabetes (hypertension 19.4%, obesity 44%, hyperglycemia 21.8% and dyslipidemia 14.9%)

## **INTRODUCTION**

According to World Health Organization (WHO) 2022 projections, cardio metabolic related risk indicators are already a worldwide epidemic, with an estimated 57.8% of individuals worldwide anticipated to be exposed to the risk indicators by 2030. Others include diabetes, hypertension, dyslipidemia, cardiovascular disease, and many malignancies. Obesity is defined by an excessive accumulation of body fat, which gives rise to considerable cardiac metabolic related risk indicators. As a result, obesity is usually referred to as the primary cardio metabolic risk factor and a critical public health concern that demands immediate treatment in order to avoid cardio metabolic illnesses (Yu et al., 2019). Advances in health care, as well as lifestyle and behavioral changes brought about by globalisation, have resulted in an increase in the incidence of cardio metabolic risk markers. Cardio metabolic risk markers, such as lower quality of life, greater healthcare expenses, and a higher risk of mortality, are linked to socioeconomic level (Mustapha et al., 2022). Cardio metabolic multimorbidity (CM), defined as the presence of two or more cardio metabolic illnesses in the same person, is on the rise in middle-aged people. A recent research discovered that combining cardiac metabolic disorders multiplicatively increased the risk of mortality, with each new ailment doubling the risk of mortality (Ulasi et al., 2021). Many Sub-Saharan African nations, including Kenya, are now undergoing nutrition transitions, which are characterized by changes in dietary patterns and physical activity that predispose to lifestyle metabolic illnesses (Ghaemian et al., 2020).

## **LITERATURE REVIEW**

The speed with which the nutrition transition is taking place in Kenya is particularly notable, as rapid urbanization and economic expansion have resulted in dietary shifts toward more processed energy-dense foods. Over the last two decades, the prevalence of overweight or obesity in women aged 15 and older grew from 56% in 1998 to 68% in 2016 and from 29% to 31% in men (Islam et al., 2020). Non communicable diseases (NCDs) currently outnumber HIV/AIDS and TB combined in terms of age-standardized mortality. The primary cause of premature death is cardiovascular disease. Non communicable diseases (NCDs) currently outnumber HIV/AIDS and TB combined in terms of age-standardized mortality. Cardiovascular disease is the primary cause of early death, and diabetes-related mortality has been steadily increasing (Ambrose et al., 2023). Kenya, notably Kisumu county and adjoining counties, has the greatest HIV/AIDS burden, and most health-care investment is allocated on antiretroviral therapy, leaving insufficient funding for NCDs, particularly at the primary care level (Muchira et al., 2023). Furthermore, the Kenyan health-care system is structured to handle single illnesses, whereas specialty divisions deal with specific chronic problems. These variables make multimorbidity management in the nation more difficult. Quantifying the burden of cardio metabolic risk markers linked with diverse illnesses will guide policies and programs to address clusters of disorders (Dakshinamurthy et al., 2020). Kenya has started executing its strategy plan to reduce NCD-related early death by one-third by 2030, which includes integrating chronic disease management into basic

care. Because observational studies often focus on specific illness outcomes, little is known globally concerning cardiac metabolic related risk indicators and risk variables (Haregu et al., 2016). For example, while it is generally established that BMI and cigarette use raise the risk of cardiovascular disease, diabetes, and stroke, the magnitude of their impact on clusters of combinations is seldom evaluated. The bulk of research on cardio metabolic related risk markers are undertaken in high-income nations, with just a handful in low-and-middle-income countries like Kenya (Haregu et al., 2016).

The majority of these investigations were done on older age groups. In Kenya, research on cardio metabolic related risk markers has received little attention. National burden of illness studies concentrate on specific disorders (Osofi et al., 2018). The World Health Organization's NCD Action Plan (2013-2020) established the goal of reducing NCD-related premature death by 25% by 2025. As a result, it is timely to concentrate on an NCD research agenda for Sub-Saharan Africa (SSA) (Ronn et al., 2020). Obesity is one of the primary causes of the rise in cardio metabolic disorders (CMDs) on the continent; therefore, a better knowledge of the role of genetic, environmental, and behavioral variables in modifying body fat distribution is required. In addition, disparities in disease epidemiology and pathogenesis for NCDs exist between SSA and high-income countries. Women, for example, have a substantially greater incidence of obesity than males in most African nations, although the prevalence of obesity in the industrialized world is higher. Furthermore, the cut point for waist circumference used to identify metabolic syndrome in SSA appears to differ from that utilized in other groups (Ramsay et al., 2016).

## **METHODOLOGY**

### **Study design**

This was a cross-sectional quantitative study on correlation between socioeconomic and cardio metabolic associated risk indicators among Residents in selected sub counties in Kisumu county Nyanza region in Kenya. It involved the determination of five indicators of cardio metabolic disorders, which included; general obesity (BMI), central obesity (waist: hip ratio), blood pressure (SBP and DBP), dyslipidemia (Lipid profile) among the residents, and from these, the correlation between socioeconomic and cardio metabolic associated risk indicators in the study population was determined.

### **Study Area**

The study area was selected sub counties, in Kisumu County in Nyanza region of Kenya.

### **Study Population**

The participants were middle aged adults from selected sub counties in Kisumu County in Nyanza region of Kenya.

### **Sample Size**

A sample size was determined using Slovin's statistical formula (1960) method in which the sample size is given by the expression:

$$n = \frac{N}{N + N(e)^2}$$

n = desired sample size

N = target population, i.e. the total number of respondents.

e= Margin of error at 95 % confidence level (0.05).

Given N = 410 middle aged adults available at the time of study. By Substitution in the formula we get:

$$N = 410 / 1 + 410(0.05)^2$$

$$n = 202 \text{ participants.}$$

### **Inclusion Criteria**

Included in the study population sample were all middle aged adults who met the inclusion criteria.

### **Exclusion Criteria**

Residents available the time of study who met the inclusion criteria but who declined to consent.

### **Sampling Procedure and Sampling Methods**

Participants were randomly selected to represent the entire population under the study. Respondents present within the time frame of the study, who met the inclusion criteria and were willing to participate. They were requested to complete the questionnaires and subjected to the research study procedures after detailed explanation in the language they understood well. They were requested to sign a consent form as a sign of willingness and they were interviewed and requested to / assisted to fill the questionnaires. Anthropometric measurements were taken and then five milliliters of blood was taken by venous puncture method for the biochemical parameters which was determined in the laboratory and the results recorded accordingly.

### **Data Collection, Presentation And Analysis**

Questionnaires with questions concerning ethnicity, age, dietary intake, smoking and drinking history, level of exercise, and physical activities was formulated to collect information from respondents. The data from anthropometric measurements including, blood pressure both systolic and diastolic, weight, height, waist circumference, hip circumference was taken. Fasting blood glucose level was determined by use of glucometer and Five milliliters (5mls) of blood was collected by vein puncture method using a syringe and needle for the spectrophotometric analysis of lipid profile. This included the serum levels of low-density lipoprotein, high-density lipoprotein, triglycerides and cholesterol. The blood for lipid profile was collected from the patients and analyzed within the JOOTRH hospital laboratory. The samples were run in duplicates to ensure accuracy of the results.

### **Data Quality Control**

The questionnaires were pre-tested by giving some students/staffs in the faculty of health sciences to assess the suitability and acceptability of the data collection tool, to the participants and the necessary adjustments were made to ensure adequate data quality, the instrument for lipid profile analysis was pretested by running few blood samples according to the manufacturer's instructions before the actual data analysis. The glucometer was adjusted according to the specifications.

### **Procedure**

The participants were weighed on a platform-type balance weighing machine with a capacity of up to 160 kgs, with the help of two qualified registered nurses in the department of Internal Medicine, JOOTRH hospital, who explained the procedure to the participants. The weight measurements was made with the participant wearing light clothes and without shoes, standing upright at the centre of the balance, with their arms extended down the sides of the body and the head positioned perpendicular to the floor.

The height measurement was taken using a graduated scale (in centimeters) attached to a wooden set square with a lock, fixed against the wall and the reading was recorded in centimeters and afterwards converted into meters. The body mass index (BMI) was expressed in  $\text{kg}/\text{m}^2$ . (BMI was calculated as the weight of the individual in kilogram divided by the square of the height in meters). Waist and hip circumference was determined using a graduated tape measure with respondents wearing light cloths and the waist to hip ratios calculated from the measurements.

The Systolic Blood Pressure (SBP) and Diastolic Blood Pressure (DBP) was determined by measuring two times the arterial blood pressure in the right arm using a mercury sphygmomanometer, before the filling of the questionnaire and after filling the questionnaire with the participant in a seated position. The first and fifth Korotkoff sounds were used to represent SBP and DBP respectively and then the average of the two measurements was used. Hypertension was defined as any blood pressure (Systolic and/or Diastolic) that was greater than or equal to 130/90mmhg (WHO 2009).

Two qualified nurses were recruited from the department of Internal medicine assisted in collecting of five millimeters of blood in a blood specimen bottles with anticoagulant (Ethyl Diamine Triacetic Acid) for lipid biochemistry (spectrophotometric analysis of lipid profile) from the respondent by vein puncture method using a syringe and needle and the blood was transported to the JOOTRH hospital laboratories facilities where it was analyzed. The blood samples were discarded after results were justified.

### **Data Presentation**

The data collected from the study area was presented in form of tables and figures after calculations of means and standard errors of the means.

### **Statistical Analysis**

Results were expressed as percentages, frequencies and mean  $\pm$  SD. The data was analyzed using IBM SPSS Statistics software version 20 and excel. Pearson's correlation coefficients were obtained for each of the cardio metabolic associated risk indicators.

### **Ethical Considerations**

Ethical approval was obtained from the Institutional Research and Ethics Committee (IREC) that's Hospital Ethical committee, before the commencement of the research. Participants signed an informed consent form for their participation after a thorough explanation of the procedure and importance of the study to them. Every participant had the right to refuse to participate by not signing the consent form or was to withdraw from the study if they felt uncomfortable at some stage. For the purpose of confidentiality, questionnaires were used with identification codes and not names. Two qualified nurses were recruited from the department of Internal medicine who assisted in taking anthropometric measurements and collecting of blood samples from the respondents and the blood was transported to JOOTRH hospital facilities for analysis within the hospital laboratory facilities. The blood samples were discarded after results were justified. The blood biochemistry was analyzed for free without payment.

### **Limitations and Delimitation.**

The limitations included lack of honesty and accuracy of respondents in terms of self-reporting since the questionnaires were open ended questions especially questions on lifestyle, food eaten by the respondents and familial diseases if applicable.

## **RESEARCH RESULT**

The study major considered the correlation between socioeconomic status and cardio metabolic associated risk indicators among middle aged adults in selected sub counties in Kisumu county Nyanza region of Kenya by determining the respondents both systolic and diastolic blood pressures, body mass index (BMI), waist hip ratio (WHR), Fasting Blood Glucose (FBG) and lipid profile (LDLC, HDLC, TGs and Total Cholesterol). Respondents were regarded to have cardio metabolic associated risk indicators if they had two or more of the indicator components. Fasting Blood Glucose (FBG):  $\geq 7.6$ mmol/l Blood pressure:  $\geq 130/90$  mmHg (systolic blood pressure:  $\geq 130$ mmhg, and diastolic blood pressure:  $\geq 90$ mmhg. Dyslipidemia: triglycerides (TG):  $\geq 2$  mmol/L, and high-density lipoprotein cholesterol (HDL):  $\geq 1.6$  mmol/L, low density

lipoprotein (LDL):  $\geq 3.34\text{mmol/l}$  and cholesterol (CHO):  $\geq 5\text{mmol/l}$ . Central obesity: waist: hip ratio  $> 0.90$  (male);  $> 0.85$  (female), or body mass index  $> 30\text{ kg/m}^2$ . Normal weight, overweight, and obesity were defined as a BMI less than 25, 25 to 27, and  $>27$ , respectively. The results obtained are presented below.

### Demographic Data of Participants

#### 1. Age of the participants

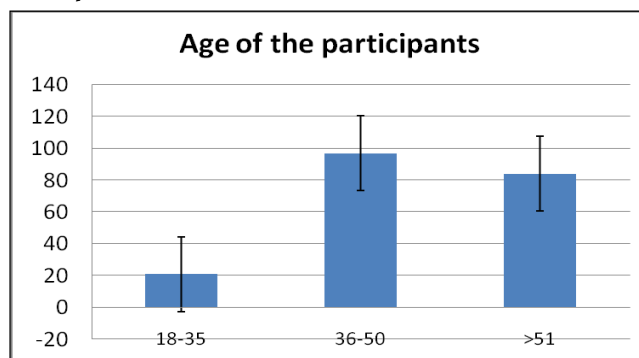


Figure 1. Age of The Participants

Most of the participants (48%) were aged 36-50 years, followed by those over 51 years (41.6%) and the least were aged 18-35 years (10.4%).

#### 2. Sex of the participants

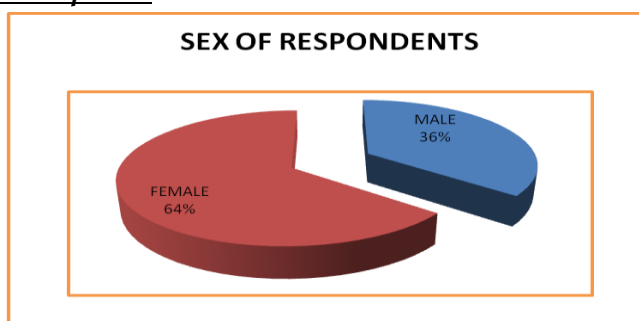


Figure 2. Shows Sex of Participants

Figure 2 above shows that most of the respondents 129(64%) were females and 73(36%) were males.

#### 3. BMI, Waist-Hip ratio and Blood Pressure

##### 1. Body Mass Index (BMI)

Table 1. BMI of The Participants

BMI	Category	Frequency	%
18.00 - 25.00	Healthy weight	54	26.7
25.10 - 30	Overweight	36	17.8
>30.00	Obese	112	55.4
Total		202	100

Most (55.4%) of the participants were Obese while 26.7% had a healthy weight as shown in the table 1 above.

2. *Waist-Hip ratio*

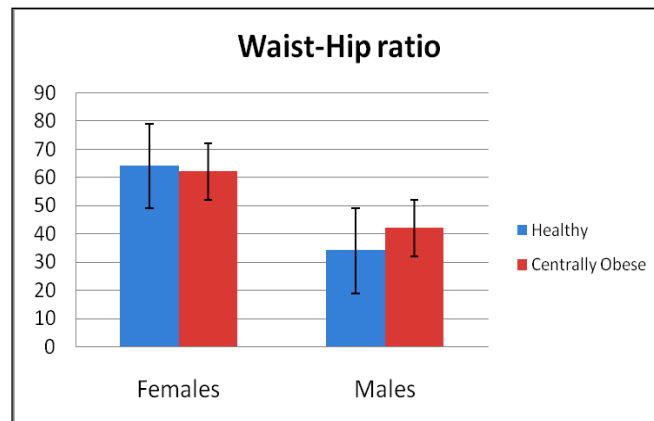


Figure 3. Waist-Hip Ratio of The Participants

The females who had a Waist hip ratio of over 0.8 were classified as centrally obese (55%) while 49% of the males had a waist hip ratio of 0.9, which was also classified as central obese.

3. *Blood Pressure*

Table 2. Blood Pressure of The Participants

Blood pressure	Category	Freq	%
90/60-130/90	Healthy	62	31
131/91-179/109	Hypertensive	121	60
>180/110	Hypertensive emergency	19	9

Most of the participants were hypertensive (60%) while 9% had hypertensive emergencies.

4. *Blood picture*

1. Fasting blood glucose

Table 3. Fasting Blood Sugar of The Participants

Blood sugar	Category	Freq	%
≤7.6mmol/l	Normal	70	34.7%
>7.7mom/l	Above normal	132	65.3%

Most of the participants (65.3%) had blood sugar above normal while only 34.7% of the respondents had normal blood sugar.

## 2. Lipid profile

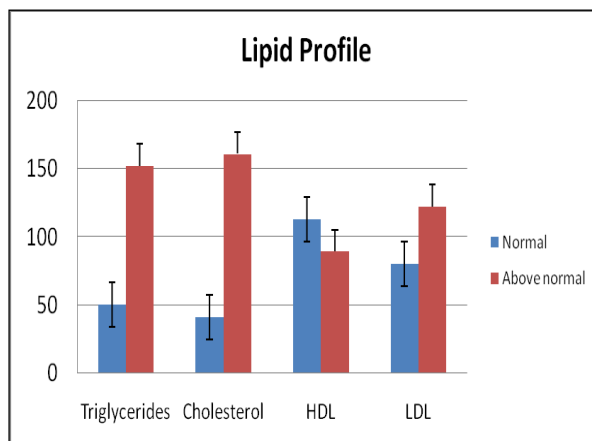


Figure 4. Lipid Profile of The Participants

The triglyceride and cholesterol levels of the participants were significantly higher at a  $P < 0.05$ . The HDL levels were normal in 55% while the LDL levels were significantly increased in 60% of the participants.

## 5. Prevalence of cardio Metabolic associated risk indicators

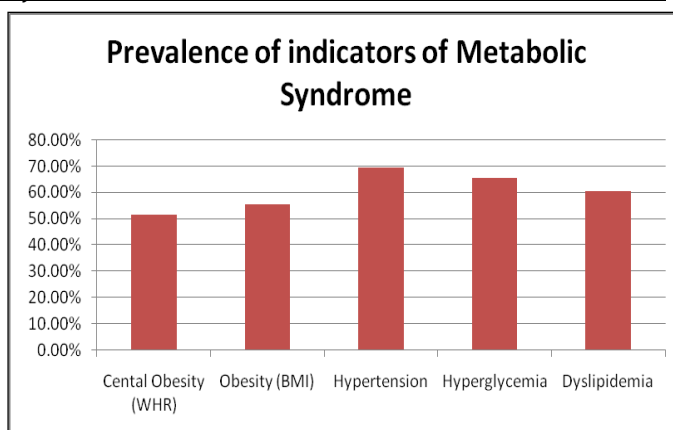


Figure 5. Indicators of Cardio Metabolic Associated Risk Factors

Most of the participants were hypertensive (69%) while 50% had central obesity. General obesity, hyperglycemia and dyslipidemia were also common among the participants.

## 6. Prevalence of cardio Metabolic associated risk indicators

Table 4. Prevalence of Cardio Metabolic Associated Risk Indicators Present in The Participants

Indicators	Frequency	%
<b>hypertension</b>	39	19.4%
<b>obesity</b>	89	44%
<b>hyperglycemia</b>	44	21.8%
<b>dyslipidemia</b>	30	14.9%
<b>Total</b>	202	100%

The participants had mostly two cardio metabolic associated risk indicators present. A total of 36.7% of the participants had 3 and 4 indicators and thus fit the classification of cardio metabolic associated risk indicators.

## DISCUSSION

The purpose of this study was to look at the relationship between socioeconomic level and cardio metabolic risk factors among middle-aged people in Kisumu County, Nyanza region of Kenya, in a randomly selected middle-aged population aged 18 and up. This research group, like many others in low- and middle-income countries (LMICs), is enduring poor nutritional transitions, resulting to overweight/obese adults. In general, about a quarter of the study population was overweight/obese, and obesity increased with age, which agrees with Ronn et al study who discussed abdominal visceral and cutaneous adipose tissues and associations with cardio-metabolic risk indicators, which is also present in our study (Ronn et al., 2020). This finding has also been documented in demographic health surveys conducted in seven Sub-Saharan African nations. On the other hand, 44% of the study population was obese, which is the primary cardio metabolic related risk factor, a proportion greater than in other Sub-Saharan African nations (Uganda, Nigeria, South Africa, Equatorial Guinea, and Cameroon) (Ronn et al., 2020). Dyslipidemia, particularly low HDL-C, is a risk factor for a number of cardiovascular illnesses and is growing increasingly common in Sub-Saharan Africa. Despite relatively normal levels of TC and TG, low HDL-C affected approximately 14.9% of the overall population, indicating that low HDL-C affects a large proportion of adults over the age of 18. This finding agrees with Bamba et al., 2014, who suggested that controlling dyslipidemia is one way of controlling cardio metabolic disorders in the population (Bamba et al., 2014). The low HDL-C values identified in our research group may thus be suggestive of a significant and developing cardio metabolic risk signal in the study region. Our findings are consistent with a previous research in Sub-Saharan Africa and the Middle East, in which 30% of individuals had low HDL-C (Bamba et al., 2014). Other studies in Sub-Saharan Africa found an even greater frequency of low HDL-C, with 43.1% in Nigeria 2 and 80% in Botswana, predominantly affecting those aged 35 to 54 (Bamba et al., 2014). The current study found that

hyperglycemia was present in 21.8% of the participants, indicating that the study group is at risk of diabetes due to the participants' low socioeconomic position.

Diabetes is a cardio metabolic risk sign. According to Emdin et al., 2017, abdominal obesity has been linked to type 2 diabetes and coronary heart disease (CHD), which are cardio metabolic risk markers. Because diabetes in LMICs has gotten little attention, it is probable that a large number of middle-aged persons in Kisumu counties and the whole Nyanza area of Kenya have subclinical problems as a result of delayed or missed diagnosis and a lack of frequent monitoring. The high proportions seen in this study may indicate that a big proportion of individuals with diabetes are unaware of their condition and so are not monitored or treated, which is consistent with Emdin et al., 2017.. This notion is supported by the fact that diabetic medication was not reported in this population. When utilizing WHO diabetes diagnostic criteria, that is, a HbA1c cut-off of 6.5% and FPG of 7.0 mmol/L, the prevalence of diabetes in participants was 21.8%, which is one of the linked risk indicators to cardio metabolic illnesses among the study group. Previous cross-sectional research has demonstrated that middle-aged persons acquire physiological transitory insulin resistance as a result of their lifestyle, independent of socioeconomic position. In the study population, there was a substantial connection between BMI, WC, and hypertension. These findings are consistent with previous research that found a link between hypertension and prehypertension, BMI and WC, and diabetes (hypertension 19.4%, obese 44%, hyperglycemia 21.8%, and dyslipidemia 14.9%). Furthermore, the link between hypertension and high waist circumference (WC) was twice as robust as the link between high BMI and blood pressure. This finding implies that central obesity may be a stronger predictor of hypertension risk. and other cardiovascular disorders in our research sample, which are linked to socioeconomic status. Thus, optimum body weight control and a lower risk of central obesity may have a good influence on hypertension control in this group, as well as a reduction in cardio metabolic risk markers and diseases.

This study also discovered a robust link between waist circumference and levels of low density lipoprotein cholesterol. In a comparative cross-sectional research done in Ghana, Otieno et al found similar relationships. Strong correlations were found in the various models between body mass index (BMI)... Since abdominal fat accumulation increases in proportion to body mass index and body, waist circumference (WC) and hyperglycemia levels, which can be explained by the inter-relationship of the two indices, is one of the main risk factors for diabetes and prediabetes at the same time cardio metabolic associated risk indicators. Excessive visceral fat in abdominal obesity is the major source of free fatty acids and inflammatory cytokines, which may contribute to insulin resistance and type 2 diabetes mellitus, according to the research. This explains why, in our research cohort, waist circumference was highly related with diabetes and hypertension.. As a result, assessing WC using ideal WC cut-off values, as done in this work, would be a practical, time-efficient, and cost-effective screening method for identifying at-risk persons in the Kisumu county population. Even though we removed individuals who reported meal or beverage intake prior to blood sample during the data cleaning procedure, we cannot rule out the possibility of 'fasting

status' misreporting. Researchers, stakeholders, and government officials can utilize the findings of this study to design interventions or policies. The current study's key strengths are the random selection of study participants and the standardized evaluation of anthropometrical and laboratory parameters. Furthermore, rather than using the set cut-offs utilized in the adult population, we adopted age- and sex-specific cut-offs that take into consideration the physiological development of the young age group. There is limited evidence on the relationship of numerous obesity indices with multiple cardio metabolic risk factors in this group; hence, our work contributes significantly to filling this gap.

This work contributes to the knowledge on the relationship between socioeconomic level and cardio metabolic risk factors such as obesity, which is related with greater risks of hypertension, dyslipidemia, and type 2 diabetes mellitus in the study group. Based on our findings, we recommend that there is a need for effective interventions to raise awareness as well as primary prevention strategies for cardio metabolic risk indicators and their complications in Kisumu County in Kenya's Nyanza region, using local multidisciplinary approaches in Swahili. Furthermore, there is a need for health surveillance activities that specifically target the age group of 18 to 45 years. These can also be used to track preventative efforts

## **CONCLUSIONS AND RECOMMENDATIONS**

### **Conclusions**

The participants had mostly two indicators of cardio metabolic associated risk indicators present. 36.7% of the participants had 3 and 4 indicators and thus fit the classification of cardio metabolic associated risk indicators. General obesity (44%), abdominal obesity (16%), diabetes mellitus (21.8%), dyslipemia (14.9%) were present in the study population and was important risk factors for the cardio metabolic disorders. The study identified distinct modifiable cardio metabolic associated risk indicators that threaten the health status of these communities, namely general obesity, abdominal obesity, hypertension, physical inactivity and diabetes mellitus.

### **Recommendations**

Since we found a greater preponderance of risk factors of cardio metabolic associated risk indicators in overweight and obese among the study population in this study, our results point to the need for measures to prevent and treat obesity in this and other high-risk groups. Interventions for cardio metabolic associated risk indicators can be both behavioral and medical. Behavioral interventions include changes in dietary and lifestyle habits including regulated carbohydrate and fat intake as well as having physical exercise, while medical interventions include use of antihypertensive, hypoglycemic and hypolipidaemic agents. Weight reduction deserves first priority in individuals with abdominal obesity and the cardio metabolic disorders, which should be practiced in Kisumu County communities. Achieving the recommended amount of weight loss will reduce the severity of most or all of the cardio metabolic risk factors.

### *Study limitations*

The problems included language barriers, which were sorted out by use of locally trained research assistants. In addition, due to resource constraints there was inability to study all the aspects of cardio metabolic associated risk indicators.

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