

Nutrition Behavior and Body Mass Index in Tanzania. Survey from a Cancer Prevention and Awareness Campaign in Northern Tanzania, 2019- 2020

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Abstract

Objective: In Tanzania, cancer is becoming a major public health concern. Risk factors such as poor dietary behavior, high body mass index, physical inactivity, alcohol and tobacco consumption increase the incidence. Limited cancer treatment facilities, prevention programs, and poor knowledge of cancer risk factors and symptoms in the population contribute to late-stage presentation and high mortality rates. The objective of this study is to examine the association of lifestyle factors including body mass index (BMI), physical activity, and dietary behaviors among participants who attended three cancer prevention events in rural and urban areas in Tanzania.

Methods: A cross-sectional survey among PrevACamp- attendees in northern Tanzania between August 2019 and February 2020 were chosen. Participants were interviewed using a structured questionnaire on sociodemographic data, medical history, dietary habits, and physical activity, the body mass index was also determined.

Results: 235 participants (114 urban/ 121 rural) were included in the survey. Urban residents had higher rates of obesity ($p=0.0021$) and less physical activity than participants from rural areas (4.63 days [$SD=2.03$] and 5.50 days [$SD=2.00$], respectively ($p=0.006$). Urban dwellers often skip their lunch and prefer to eat a snack. They use salt frequently, consume more processed meat, eat mainly starchy foods, drink more alcohol and sweetened sodas.

Conclusion: Rural women more interested in cancer prevention than men. People in rural areas are more physically active and less overweight than those in urban areas. The cause is manifold, yet they hint at a lack of health care for women and a progressing urbanization according to Western patterns.

There is an alarming high percentage of overweight among urban dwellers. Although people eat more healthy foods compared to rural populations, they tend to have a high body mass index. Physical inactivity and overweight will be a serious problem in Tanzania in the future, contributing to the risk of cancer.

Background

Poor nutrition behaviours are emerging as a major public health problem worldwide, with five leading attributes: high body mass index (BMI), low intake of fruits and vegetables, physical inactivity, tobacco use, and alcohol consumption. Indeed, these risk factors contribute to about one-third of cancer mortality worldwide [1]. Studies have shown that specific dietary components can contribute by increasing or decreasing the development of cancer [2] [3] [4].

Many low and middle income countries in Sub-Saharan Africa, like Tanzania, face a double burden of nutrition related diseases, with mal- and over-nutrition coexisting [5]. Cancer mortality rates are higher in Sub-Saharan Africa than in high-income countries [6].

In countries with routine, effective prevention and early detection programs, cancer incidence and mortality rates have declined precipitously over the last half century [7].

In Sub-Saharan Africa nutrition behaviours are in transition and following more and more a western pattern [5]. An important factor for changes in people's nutrition behavior is rapid urbanization [5].

Tackling cancer in Tanzania is in its infancy. Tanzania is one of the largest countries in Sub-Saharan Africa with increasing urbanization and a growing population of almost 60 million people. Tanzania's urbanization is associated with profound lifestyle changes and a risk of developing overweight and obesity, poor physical activity, and poor nutrition patterns [8] [9]. However, nutritional status is equally considered to be an important determinant of health [10].

The Tanzanian Ministry of Health and Social Welfare (MoHSW) implemented a National Cancer Control Strategy (NCCS) in 2013, which included recommendations for nutrition [11]. The details of the measures to be implemented remain open [11].

Cancer control strategies need to be strengthened at all levels, from prevention to diagnosis to treatment. To date, the health system is not yet fully prepared, having a total of three cancer centres located in Dar es Salaam, Mwanza and Moshi. Previous studies have also reported a lack of knowledge about cancer among health care providers and communities [12] [13] [14] [15] [16]. Education, sex, socioeconomic status, and place of residence influence disease perception and health-seeking behavior [13] [14] [16] [17] [18]. Consequently, it is important to educate health care providers and to increase awareness on cancer risk factors in communities [13] [19].

In addition, in Tanzania is an evident trend of obesity which makes the population vulnerable to get cancer and other nutrition related diseases [8] [9]. However, information about nutritional behaviour of people living in rural and urban regions is sparse [5] [20].

Purpose of the study

The objective of this study is to examine the association of lifestyle factors including body mass index (BMI), physical activity, and dietary behaviors among participants who attended three cancer prevention events in rural and urban areas in Tanzania.

This study was conducted to analyze dietary behaviors in the Kilimanjaro region. The survey focused on identifying possible differences among genders and among rural and urban areas.

Methods

Context and Design

This quantitative study is one of three sub-studies [13] [14] of a comprehensive research project named PrevACamp (Cancer Prevention and Awareness Campaign). This is a five-year-project at Kilimanjaro Christian Medical Center, supported by the international partners Mission One World and Foundation for Cancer Care (2017-2022). The goal of this project is to provide cancer education and screening in communities in northern Tanzania.

2.1. Study setting and population

A cross-sectional survey was chosen from August 2019 until February 2020 at three PrevACamp sites: in Kibosho (faith-based hospital), Mormella (private hospital) and Moshi Urban (faith-based hospital) among PrevACamp participants. According to the Tanzanian census of 2012, Moshi Urban had a population of 184,292 [21]. Kibosho is located in Moshi Rural with a population of 466,737 and Mormella is located in the rural Meru district with a population of 268,144 [21]. The majority of inhabitants make a living from day labor jobs, small businesses or small-scale farming [22]. Participants were recruited by loudspeaker cars, through church services and radio advertisements in the respective districts.

2.2. Study technique

Questionnaires were used as the data collection tool. BMI, according to the World Health Organization standard measurements, was assessed with scale and measure tape [23].

Respondents were recruited from all PrevACamp registrants using a convenience sample of just-arriving attendees.

Trained interviewers informed all potential respondents about the purpose of the study and obtained their consent. BMI measurement was provided to all PrevACamp participants above the age of 18 years. All were informed by nurses about the BMI measurement process and possible results.

BMI measurement: Before the interview started, the participant's weight and height were determined, and BMI was calculated. The result was documented and given to the patient and afterwards copied onto the questionnaires.

Questions from the validated General Nutrition Knowledge Measure (GNKQ) [24] were selected by two Tanzanian oncology and nutrition nurses at CCC. Chosen questions by GNKQ were rephrased, and additional questions were added for cultural and social adaptation into the Tanzanian setting. The questionnaire was designed in English, translated into Swahili, then back-translated by a local oncology nurse. The questionnaire was divided into three parts: Part (A) discussed socio-demographic characteristics including habits of alcohol and smoking consumption, questions about cancer or other disease history, BMI results and questions about satisfaction with the results, and food and shopping patterns. Part (B) included a nutrition assessment: questions about eating habits, such as intake of fruit and vegetables, fats, starchy foods and salt. Part (C) presented questions about physical activities.

The survey included in total 46 items: 26 closed responses (no/yes), 5 semi open responses (no/yes, if yes then open question), 8 open-ended responses, 2 multiple response questions and 5 binary questions about socio-demographic characteristics. Average interview time was 15 minutes. The questionnaires were administered by two male and three female interview-trained health care professionals.

BMI Measurement: Each person who enrolled in the BMI program was documented in a register "BMI screening book" from the Cancer Care Centre. Information recorded in the reporting form included: serial number, name of client, address, phone number and age. Measurements were performed by two nutrition specialised nurses.

Data Analysis

Continuous variables were summarised by using the mean, standard deviation (SD), median and interquartile range. Categorical variables were summarised in frequencies and percentages. The data were stratified by sex and urban or rural areas. Chi-square was used to find possible associations between sociodemographic factors with participants' nutrition behavior. The comparison of the difference between the social demographic characteristics was conducted using odds ratio (OR) and 95% CIs. Data analysis will be led by using IBM SPSS Statistics 27.

Results

The sociodemographic characteristics are shown in Table 1. A total of 235 participants (114 urban/ 121 rural) were interviewed. Overall, the mean age was 47.6 years ($M=47.6$; $SD=14.8$). 89 of the participants were male and 146 were female, with a significantly lower percentage of male in rural areas than in urban. 82.5% in urban and 62.8% in rural regions were married ($p = 0.003$). Most participants completed elementary school or less (62.3% vs. 81.8%), followed by secondary school (28.9% vs. 12.4%) and postsecondary school (8.8% vs. 5.8%) with significant differences between urban and rural ($p = 0.003$). In urban regions, 32.5% were farmers, 13.2% were formally employed, 49.1% were self-

employed. In the rural regions, 60.3% were farmers, 6.6% were formally employed, 28.9% were self-employed and 4.1% were other ($p < 0.0001$).

In urban regions a significantly smaller percentage of people have a monthly income less than \$50 (41.2% vs. 69.4%) whereas there is a higher percentage of people having an income between \$50-100 (30.7% vs. 17.4%) and more than \$100 (28.1% vs. 13.2%) compared to the rural regions ($p < 0.0001$) (Table 1). Women in rural areas have an income less than \$50 (75.3%) whereas men earn more than \$100 (31.3%) ($p = 0.002$). In urban regions no significant differences were observed (Table 4).

Anthropometric data, health data and physical activity

Considering BMI, differences between the urban and rural regions could be observed (Table 2). There is a positive association between living in an urban region and the development of being overweight (OR 2.44; 95% CI: 1.32-4.51) ($p=0.0021$). BMI shows no difference among the genders.

51.7% participants from the urban and 71.1% from the rural areas are satisfied with their weight. The urban region is positively associated with being unsatisfied with weight (OR 2.29; 95% CI 1.29-4.07) ($p= 0.0023$) and also with the feeling of problems because of weight (OR 1.81; 95% CI 0.88-3.75) ($p= 0.083$).

Nutritional Behaviour and Food Consumption and Lifestyle

Food-gathering

The survey showed that residents from both areas frequently buy their food from the local market with 78.9% of urban and 66.1% of rural individuals doing so. Food from personal cultivation of the field to house is used by 46.5% in urban and 54.5% in rural areas. The minority from both regions are getting their edibles from the supermarket referred by 5.3% and 0.8% each.

Nutritional practice

The results are presented in figure 1. 35.1% in urban and 43.0% in rural areas skip their breakfast, and 11.4% compared to 19.8% skip evening meals more than once a week. For skipping lunch more than once a week, there are significant differences found between urban and rural areas (57.0% and 37.2%; $p = 0.002$). 35.1% in urban and 23.1% in rural areas skip meals, snacking instead on most days ($p = 0.044$). The use of alcohol and cigarette smoking in urban vs. rural were 43% vs 33.1% and 1.8% vs. 1.7% respectively, without significant differences between the regions.

The correlations between nutrition behaviour and lifestyle and residence are shown in fig.1. No significant differences could be observed regarding sex.

Food consumption

Within the topical groups (Fruits and Vegetables, Fat, Starchy Food, Salt, Drinks and Alcohol) the answers to all questions show a positive correlation with urban region, which in most cases is significant. Considering the topic Sugar Consumption, a negative correlation with urban regions was observed. Detailed information is shown in table 6.

Regarding sex, the results within the topical groups Drinks and Salt reflect significant differences between male and female (table 6).

Physical activity

The evaluation of the level of physical activity is shown in Table 6. There is a negative association shown between intensive physical activity at work for at least 10 minutes in individuals living in urban areas ($OR=0.71$; 95% CI 0.40-1.24) ($p=0.193$), likewise for intensive sports, fitness and leisure activities for at least 10 minutes ($OR=0.78$; 95% CI 0.41-1.48) ($p=0.419$). In both evaluations no significant difference between the sexes has been observed.

Participants from urban and from rural regions that answered affirmatively about doing work that involves vigorous intensity, are working a mean of 4.67 days [$SD=1.835$] and 4.66 days [$SD=1.811$] a week ($p = 0.975$) with a mean time of activity of 5.51 h [$SD=3.76$] and 4.70 h [$SD=3.01$] a day respectively ($p = 0.176$).

Participants from urban and from rural regions that answered affirmatively about doing vigorous-intensity sports for at least 10 minutes, are active a mean of 3.6 days [$SD=2.26$] and 3.18 days [$SD=1.63$] ($p = 0.415$) a week and a mean time of 2.59 h [$SD=2.07$] and 2.90 h [$SD=2.13$] a day respectively ($p = 0.570$).

Considering the data about traveling to and from places by walking or bicycle for at least 10 minutes continuously, people from urban and rural areas declared 4.63 days [$SD=2.03$] vs. 5.50 days [$SD=2.00$] respectively ($p=0.006$).

Discussion

The objective of this study was to gain a deeper understanding of the relationship between lifestyle factors and dietary behaviors among participants of cancer prevention events in Moshi Urban, Moshi Rural, and Meru District.

Our results highlight variations between male and female participants at the three PrevACamps and disparities between rural and urban residents in (1) BMI, (2) physical activity and (3) nutrition behaviors such as intake of fruits and vegetables, processed meats, sugar and salt, skipping meals and alcohol consumption.

Variations between male and female participants

Results from PrevACamps in rural areas show that women participated in cancer prevention more than men. This discrepancy implies that women are interested in cancer prevention when these programs are in nearby settings. A previous study from Tanzania postulated that rural women's health status was significantly worse than men. Low education, socioeconomic status, and lower quality health care for rural women were highlighted as barriers [18]. Another study reported that over 80% of women living in rural areas do not have access to health facilities [19]. However, the results of PrevACamp in Moshi Urban show that men and women were equally represented. One explanation for participation could be that educational, occupational and income levels are better for both sexes in urban areas than in rural areas. Better educational status could at least partially explain the comparatively high participation of men in urban areas, assuming that educational status correlates with better health awareness [25] [26] [27].

The results indicated no profound differences in eating behavior between men and women. Findings were that men would choose healthier convenience foods when available and drink more during their workday than women. In addition, men reported regularly choosing convenience foods and processed meats.

Disparities between rural and urban participants

First, our data indicate that participants from urban regions have a higher BMI. More than two-thirds of participants from urban regions are overweight or have obesity compared to rural regions with about 50%. These findings are in line with previous observations of increased cases of obesity in urban regions of Tanzania [20] [28] [29]. Elevated BMI and less physical activity are associated with cardiovascular disease [30] [25], fatty liver disease [26], and some cancers [27] [31] [32]. There is also evidence of initial BMI and increased cancer mortality [33].

In tandem, our results show lower satisfaction with body weight and higher rates of health problems among participants from the urban region. In consideration that higher BMI are associated with the above-mentioned diseases, it might be possible that people from urban regions have a higher risk to develop health related problems, different metabolic diseases and cancer than people from rural regions. However, when interpreting these results, it is important to consider differences in body composition. Participants who have a high BMI in combination with a high percentage of lean body mass do not necessarily have to be considered overweight or obese. Differences in body composition are known from several ethnic groups and races [34]. So more profound investigations about the body composition of the participants may give a better understanding.

Second, our data confirm that living in urban areas is negatively associated with an active lifestyle. In 2019, McTiernan et al. summarised that physical activity leads to a reduction in the risk of developing carcinomas [27]. Amongst them are carcinoma of the bladder, breast, colon, endometrium and esophagus [27] [35]. In addition to physical inactivity, other risk factors include obesity, sex hormones, insulin resistance, insulin-related factors, adiponectin, systemic inflammation, low vitamin D, and immune disorders that can trigger cancers [35] [36] [37]. To what extent less physical activity in urban compared to rural regions leads to an elevation of cancer cases needs further evaluation.

Third, our results indicated a change towards a western lifestyle in the urban regions. This is observed by people replacing lunch with snacking, frequently using salt while cooking, increasing intake of processed meats, basing main meals around starchy foods, and drinking alcohol and sweetened sodas at elevated levels. This is in line with previous findings [20] [38]. Considering the behavior to snack frequently, snacks are high in energy but less rich in nutrients, leading to higher intakes of energy than needed [39]. Moreover, snacking does not guarantee to cover the daily need of nutrients. A good education about healthy nutrition may lead to healthy snacking pattern and seems to be a possible alternative if the main meal cannot be ensured. However, snacking while doing other activities might be associated with less satiety and higher food consumption [40].

The frequent use of salt reported by the participants is also observed in other countries from Sub-Saharan Africa [41]. However, a study about the salt consumption worldwide showed that the salt intake in Sub-Saharan Africa East was the lowest worldwide in 2013. The urbanization and change into a more western diet might lead to a rise of salt intake [42]. The high salt consumption levels in our findings reflect the extensive consumption of processed meat, also reported by the participants.

In addition, our results show that substantial amounts of sweetened and starchy foods and sweetened lemonade are crucial in urban and rural regions. A study showed that this high consumption, especially of sweetened sodas, is associated with many health-related problems [38].

The elevated intake of alcohol in Moshi Urban is consistent with previous findings by Temba et al. 2021 [20]. Also data from South Africa confirm this trend [43]. However, there appears to be wide variation between the regions in different countries [43] [37]. Religion, culture, and education seem to be important factors, which may influence alcohol intake.

Interestingly, our survey indicated that people from urban regions eat more fruits and vegetables, choose healthy food preparation alternatives instead of fried foods, and do not add sugar to meals too often. They also reported better

drinking habits with plenty of fluids, including water, and fewer sweetened beverages compared to people from rural areas.

The elevated consumption of fruits was not expected but might be a result of the season in which the survey was implemented. An existing study showed that there might be seasonal changes in food patterns in Kilimanjaro-region, with a change towards a more healthy way of nutrition during dry season [20]. In addition, Temba et al. identified a number of food-derived metabolites which have an impact on immune response and inflammatory events [44]. Consequently, there is evidence that nutrition impacts immune status. The researchers reasoned that plant based traditional diets in Tanzania are beneficial for health. The frequent consumption of fruits and vegetables could also be due to a greater level of education in the urban area. Better education might be associated with an increased understanding for healthy nutrition and a healthier lifestyle.

Considering the rhythm of food intake, many participants skip breakfast and lunch. Dinner is not skipped that often. Having dinner more regularly than breakfast and lunch may be a traditional behavior maintaining the feeling of belonging within families, as it is common in African countries.

Limitation

Study findings cannot be generalized for the Tanzanian population as our sample represents voluntarily attending people from three region in Northern Tanzania.

However, this survey gives an overview about the differences in lifestyle between urban and rural areas of the Kilimanjaro region in Tanzania. These data are based on a questionnaire which was implemented retrospectively during a cancer screening event. To gain further information about nutritional changes, methods like 24h protocols of food intake and activity protocols in a greater variety of residents are suitable.

Conclusion

In summary, this study shows that rural women in particular are more interested in cancer prevention than men. People in rural areas are more physically active and less overweight than those in urban areas. The cause is manifold, yet they hint at a lack of health care for women and a progressing urbanisation according to Western patterns.

In urban areas, an unhealthy diet of sweetened, starchy foods and beverages and a lack of physical activity have a positive effect on obesity, a risk factor for cancer.

Summarizing the negative correlation by low-intensity physical work and sports, people living in rural areas seem to have a more active lifestyle than those living in urban areas. Although people eat more healthy foods compared to rural populations, they tend to have high BMIs. Physical inactivity will be a more serious problem in Tanzania in the future, contributing further to the risk of cancer.

Declarations

Statement conflict of Interest:

The authors declare that they have no competing interests.

Ethical approval and consent to participate:

Each participant over 18 years completed a consent form prior to the interview.

Participants have filled out a consent form indicating that the data will be published

All data and materials are available.

Ethical approval is available.

Authors have no competing interests are present

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Contributions of the authors

Antje Henke: writing part methods and discussion, data analysis, proof reading

Susann Rosenbaum: writing part results, data analysis, proof reading

Furaha Serventi: resources, data collection and analizes, proof reading

Oliver Henke: data analysis, proof reading

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Tables

Table 1: Socio-demographic information (N=235)

Variables	Total	Urban	Rural	P-values
	N=235	N=114	N=121	
Age (years)				0.477
[Mean; SD]	[47.6; 14.8]	[48.4; 15.7]	[46.9; 13.9]	
20-29	28	15 (13.2)	13 (10.7)	
30-39	42	19(16.7)	23 (19.0)	
40-49	67	28 (24.6)	39 (32.2)	
50+	98	52 (45.6)	46 (38.0)	
Sex (%)				<0.0001
Male	89	57 (50.0)	32 (26.4)	
Female	146	57 (50.0)	89 (73.6)	
Religion (%)				0.003
Christian	215	98 (86.0)	117 (96.7)	
Muslim	20	16 (14.0)	4 (3.3)	
Marital status (%)				0.003
Married	170	94 (82.5)	76 (62.8)	
Single	42	12 (10.5)	30 (24.8)	
Divorced/widowed	23	8 (7.0)	15 (12.4)	
Education level (%)				0.003
Primary/below	170	71 (62.3)	99 (81.8)	
Secondary	48	33 (28.9)	15 (12.4)	
Above secondary	17	10 (8.8)	7 (5.8)	
Occupation (%)				<0.0001
Farmer	110	37 (32.5)	73 (60.3)	
Formal employed	23	15 (13.2)	8 (6.6)	
Self-employed	91	56 (49.1)	35 (28.9)	
Other*	11	6 (5.3)	5 (4.1)	
Income (%)				<0.0001
<50	131	47 (41.2)	84 (69.4)	
50-100	56	35 (30.7)	21 (17.4)	
>100	48	32 (28.1)	16 (13.2)	
History of cancer in your family				

Yes	62	40 (35.1)	22 (18.2)	0.003
No	173	74 (64.9)	99 (81.8)	
Have you ever had cancer?				
Yes	2	1 (0.9)	1 (0.8)	0.966
No	233	113 (99.1)	120 (99.2)	

Body Mass Index (BMI) & Nutrition Assessment: Result Summary

Table 2: The relationship between BMI and region(N= 235)

Variables	Residence		P-value	OR	95% CI
	Urban (%)	Rural (%)			
BMI (kg/m²)					0.016
Underweight	6(5.3)	4(3.3)			
<i>Normal weight</i>	26(22.8)	51(42.1)			
Overweight	42(36.8)	37(30.6)			
Obesity	40(35.1)	29(24.0)			
Overweight all (Overweight + Obesity)	82 (71.9)	66 (54.6)	0.0021	2.44	[1.32; 4.51]
 Are you satisfied with your weight?					0.005
Not at all	19(16.7)	6(5.0)			
Less satisfied	36(31.6)	29(24.0)			
<i>Satisfied</i>	42(36.8)	65(53.7)			
<i>Very Satisfied</i>	17(14.9)	21(17.4)			
<i>Satisfied</i>	59 (51.7)	86 (71.1)	0.0023	2.29	[1.29; 4.07]
Not satisfied	55 (48.3)	35 (29.0)			
Do you feel any problem because of your weight?					0.083
Yes	26(22.8)	17(14.0)		1.81	[0.88; 3.75]
No	88(77.2)	104(86.0)			

Body Mass Index (BMI) & Nutrition Assessment: Result Summary

Table 3: The association between residence, sex by socio-demographic and information on cancer

Variables	Urban			Rural		
	Male	Female	P-value	Male	Female	P-value
Education				0.174		
Primary/below	40 (70.2)	31 (54.4)		27 (84.4)	72 (80.9)	
Secondary	14 (24.6)	19 (33.3)		1 (3.1)	14 (15.7)	
Above secondary	3 (5.3)	7 (12.3)		4 (12.5)	3 (3.4)	
Occupation*				0.379		
Farmer	21 (36.8)	16 (28.1)		17 (53.1)	56 (62.9)	
Formal employed	5 (8.8)	10 (17.5)		5 (15.6)	3 (3.4)	
Self-employed	27 (47.4)	29 (50.9)		10 (31.3)	25 (28.1)	
Other	4 (7.0)	2 (3.5)		0	5 (5.6)	
Income				0.065		
<50	24 (42.1)	23 (40.4)		17 (53.1)	67 (75.3)	
50-100	22 (38.6)	13 (22.8)		5 (15.6)	16 (18.0)	
>100	11 (19.3)	21 (36.8)		10 (31.3)	6 (6.7)	
History of cancer in your family				0.432		
Yes	18 ((31.6)	22 (38.6)		3 (9.4)	19 (21.3)	
No	39 (68.4)	35 (61.4)		29 (90.6)	70 (78.7)	

a. 3 cells (37.5%) have expected count less than 5. The minimum expected count is 1.32.

Table 4: Nutrition and Residence (N = 235)

	Residence				
	Urban	Rural	P-value	OR	95% CI
FRUITS AND VEGETABLES					
Do you eat different types of fruit (e.g. avocado, orange, mango, water melon) and/or vegetables (e.g mchicha, sukuma wiki, chinese, tembele, leshu) every day?					
Yes	85 (74.6)	61 (50.4)	0.000	2.88	[1.60-5.21]
No	29 (25.4)	60 (49.6)			
Do you eat more than 4 different varieties of fruit each week? (e.g. avocado, orange, mango, water melon)					
Yes	71 (62.3)	28 (23.1)	0.000	5.48	[3.00-10.10]
No	43 (37.7)	93 (76.9)			
Do you eat more than 4 different varieties of vegetables each week? (e.g. avocado, orange, mango, water melon)					
Yes	77 (67.5)	62 (51.2)	0.011	1.98	[1.13-3.49]
No	37 (32.5)	59 (48.8)			
FAT					
Do you choose baked, steamed or grilled food options when available, rather than fried foods (such as crisps and snacks, or fish and chips)?					
Yes	47 (41.2)	23 (19.0)	0.000	2.99	[1.60-5.62]
No	67 (58.8)	98 (81.0)			
Do you include some unsalted nuts and seeds in your diet?					
Yes	42 (36.8)	10 (8.3)	0.000	6.48	[2.91-14.76]
No	72 (63.2)	111 (91.7)			
STARCHY FOOD					

Do you base your main meals around starchy foods? e.g, potatoes, ugali, cooked banana, rice or bread.

Yes	111 (97.4)	116 (95.9)	0.527 Yates 0.784	1.60	[0.32- 8.64]
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No	3 (2.6)	5 (4.1)			
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Do you regularly choose ugali or cooked banana or potatoes for your meal a whole day?

Yes	107 (93.9)	102 (84.3)	0.020	2.85	[1.07- 7.82]
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No	7 (6.1)	19 (15.7)			
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SUGAR

Do you regularly eat sugar-coated breakfast cereals or add sugar to your breakfast cereals?

Yes	37 (32.5)	67 (55.4)	0.000	0.39	[0.22- 0.68]
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No	77 (67.5)	54 (44.6)			
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Do you add sugar to your drinks like coffee, tea?

Yes	83 (72.8)	100 (82.6)	0.069	0.56	[0.29- 1.10]
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No	31 (27.2)	21 (17.4)			
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Do you like to drink soda?

With sugar

Yes	52 (45.6)	35 (28.9)	0.008	2.06	[1.16- 3.66]
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No	62 (54.4)	86 (71.1)			
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SALT

Do you regularly add salt to food during cooking?

Yes	86 (75.4)	76 (62.8)	0.037	1.82	[1.00- 3.33]
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No	28	45			
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		(24.6)	(37.2)		
Do you regularly add salt to meals at the table?					
Yes	27 (23.7)	28 (23.1)	0.922	1.03	[0.54-1.97]
No	87 (76.3)	93 (76.9)			
Do you regularly eat savoury snacks at work? For example, crisps or salted nuts					
Yes	30 (26.3)	26 (21.5)	0.385	1.31	[0.69-2.49]
No	84 (73.7)	95 (78.5)			
Do you regularly eat pre-prepared meals? For example,e.g Fried pags of food					
Yes	36 (31.6)	24 (19.8)	0.039	1.87	[0.99-3.54]
No	78 (68.4)	97 (80.2)			
Do you regularly eat processed meats or smoked fish?					
Yes	43 (37.7)	18 (14.9)	0.000	3.47	[1.77-6.83]
No	71 (62.3)	103 (85.1)			
DRINKS					
Do you drink plenty of fluids at regular intervals during the working day?					
Yes	74 (64.9)	43 (35.5)	0.000	3.36	[1.90-5.95]
No	40 (35.1)	78 (64.5)			
Do you opt for a variety of different drinks, including water, at work?					
Yes	72 (63.2)	42 (34.7)	0.000	3.22	[1.83-5.71]
No	42	79			

		(36.8)	(65.3)			
Do you avoid sugary fizzy drinks?						
Yes	31	17	0.013	2.29	[1.13- 4.65]	
	(27.2)	(14.0)				
No	83	104				
	(72.8)	(86.0)				
ALCOHOL						
Do you drink less than 2-3 units of alcohol a day if you're a woman, or less than 3-4 units of alcohol a day if you're a man?						
Yes	42	58	0.019	1.86	[1.07- 3.25]	
	(36.8)	(47.9)				
No	72	63				
	(63.2)	(52.)				

Table 5: Nutrition and Sex (N = 235)

	Residence				
	Male	Female	P-value	OR	95% CI
FRUITS AND VEGETABLES					
Do you eat different types of fruit (e.g. avocado, orange, mango, water melon) and/or vegetables (e.g mchicha, sukuma wiki, chinese, tembele, leshu) every day?					
Yes	56 (62.9)	90 (61.6)	0.844	1.06	[0.59-1.89]
No	33 (37.1)	56 (38.4)			
Do you eat more than 4 different varieties of fruit each week? (e.g. avocado, orange, mango, water melon)					
Yes	42 (47.2)	57 (39.0)	0.220	1.40	[0.79-2.46]
No	47 (52.8)	89 (61.0)			
Do you eat more than 4 different varieties of vegetables each week? (e.g. avocado, orange, mango, water melon)					
Yes	51 (57.3)	88 (60.3)	0.653	0.89	[0.50-1.57]
No	38 (42.7)	58 (39.7)			
FAT					
Do you choose baked, steamed or grilled food options when available, rather than fried foods (such as crisps and snacks, or fish and chips)?					
Yes	38 (42.7)	32 (21.9)	0.001	2.65	[1.44-4.91]
No	51 (57.3)	114 (78.1)			
Do you include some unsalted nuts and seeds in your diet?					
Yes	24 (27)	28 (19.2)	0.163	1.56	[0.80-3.04]
No	65 (73)	118 (80.8)			
STARCHY FOOD					

Do you regularly choose ugali or cooked banana or potatoes for your meal a whole day?

Yes	82 (92.1)	127 (87.0)	0.222	1.75	[0.66-4.83]
No	7 (7.9)	19 (13.0)			

SUGAR

Do you regularly eat sugar-coated breakfast cereals or add sugar to your breakfast cereals?

Yes	41 (46.1)	63 (43.2)	0.662	1.13	[0.64-1.98]
No	48 (53.9)	83 (56.8)			

Do you like to drink soda?

With sugar

Yes	33 (37.1)	54 (37.0)	0.989	1.00	[0.56-1.80]
No	56 (62.9)	92 (63.0)			

SALT

Do you regularly add salt to food during cooking?

Yes	66 (74.2)	96 (65.8)	0.177	1.50	[0.80-2.80]
No	23 (25.8)	50 (34.2)			

Do you regularly eat pre-prepared meals? For example,e.g

Fried pags of food

Yes	30 (33.7)	30 (20.5)	0.0248	1.97	[1.04-3.72]
No	59 (66.3)	116 (79.5)			

Do you regularly eat processed meats or smoked fish?

Yes	30 (33.7)	31 (21.2)	0.034	1.89	[1.00-3.56]

No	59 (66.3)	115 (78.8)				
DRINKS						
Do you drink plenty of fluids at regular intervals during the working day?						
Yes	52 (58.4)	65 (44.5)	0.039	1.75	[0.99-3.09]	
No	37 (41.6)	81 (55.5)				
Do you opt for a variety of different drinks, including water, at work?						
Yes	51 (57.3)	63 (43.2)	0.036	1.77	[1.00-3.14]	
No	37 (41.6)	81 (55.5)				
Do you avoid sugary fizzy drinks?						
Yes	15 (16.9)	33 (22.6)	0.289	0.69	[0.33-1.43]	
No	74 (83.1)	113 (77.4)				
ALCOHOL						
Do you drink less than 2-3 units of alcohol a day if you're a woman, or less than 3-4 units of alcohol a day if you're a man?						
Yes	34 (38.2)	66 (45.2)	0.292	0.75	[0.42-1.33]	
No	55 (61.8)	80 (54.8)				

Table 6: The relationship between physical activity and residence (N = 235)

Variables		Total	Urban	Rural	P-value	OR	CI 95%
WORK							
Does your work involve vigorous-intensity activity that causes large increase in breathing, or heart rate like carrying or lifting heavy loads, digging or construction work for at least 10 minutes continuously? (%)	Yes	144 (61.3)	65 (57.0)	79 (65.3)	0.193	0.71	[0.40; 1.24]
	No	91 (38.7)	49 (43.0)	42 (34.7)			
In a typical week, on how many days do you do vigorous- intensity activities as part of your work? [Mean; SD]							
	N	141	64	77	0.975		
	[Mean; SD]	4.67; 1.82	4.67; 1.84	4.66; 1.81			
How much time (min) h do you spend doing vigorous-intensity activities at work on a typical day? [Mean; SD]							
	N	130	66	64	0.176		
	[Mean; SD]	5.11; 3.43	5.51; 3.76	4.70; 3.01			
SPORTS							
Do you do any vigorous-intensity sports, fitness or recreational (leisure) activities that cause large increases in breathing or heart rate like [running or football] for at least 10 minutes continuously? (%)	Yes	57 (24.3)	25 (21.9)	32 (26.4)	0.419	0.78	[0.41; 1.48]
	No	178 (75.7)	89 (78.1)	89 (73.6)			
In a typical week, on how many days do you do vigorous- intensity sports, fitness or recreational (leisure) activities? [Mean; SD]							
	N	58	25	33	0.415		
	[Mean; SD]	3.36; 1.92	3.60; 2.26	3.18; 1.63			
How much time (minutes) do you spend doing vigorous-intensity sports, fitness or recreational activities on a typical day? [Mean; SD]							
	N	61	25	36	0.570		
	[Mean; SD]	2.77; 2.10	2.59; 2.07	2.90; 2.13			
In atypical week, on how many days do you walk or bicycle for at least 10 minutes continuously to get to and from places? [Mean; SD]							
	N	165	87	78	0.006		
		5.04; 2.06	4.63; 2.03	5.50; 2.00			

Figures

Nutrition and Lifestyle

■ urban ■ rural

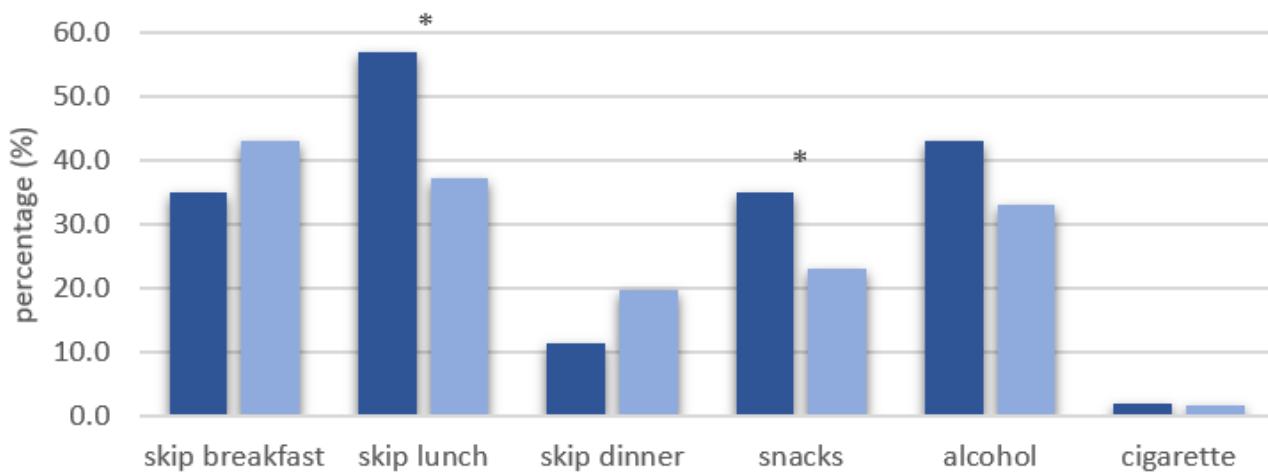


Figure 1

The correlations between nutrition behaviour & lifestyle and residence are shown in fig.1.