

Behavioural risk factors for non-communicable diseases amongst adults aged 18 years and above in Collins Chabane Municipality of Vhembe District in Limpopo Province, South Africa

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Abstract

Background: Tobacco use, alcohol consumption, physical inactivity, unhealthy diet and obesity are the behavioural risk factors for non-communicable diseases. To determine behavioural risk factors for non-communicable diseases amongst adults aged 18 years and above in Collins Chabane municipality of Limpopo province, South Africa.

Methods: This study included 365 participants recruited from Collins Chabane municipality of Vhembe district, Limpopo province, South Africa. Municipality was selected using simple random sampling and convenience sampling was used to choose participants. Anthropometric measurements were measured following standard techniques. Data on dietary intake was collected using Food Frequency Questionnaire. Permission and clearance were obtained and participant's rights were respected.

Results: About (24.4%) of participants consumed alcohol in the current study. Males were more likely to consume alcohol as compared to female counterpart (54.6% vs. 3.3 %) Gender has a large effect on alcohol consumption. Cramer's $V = 0.58$. The prevalence of alcohol consumption was higher in male (22.8%) as compared to (1.6%) female counterparts. The prevalence of underweight, overweight and obesity was 7.7%, 29.8%, and 11.3%, respectively. Majority 61.1% of the participants had sedentary lifestyle in the current study. About 13.9% of the participants smoked cigarette in the current study. Of all participants who smoked cigarette 10.1% initiated smoking at the age of less than 19 years

Conclusion: Behavioural risk factors such as smoking, alcohol consumption, consumption of over required amount of sugar, sodium, protein, energy, carbohydrates, excessive fats intake, physical inactivity, overweight, obesity exist among people in Collins Chabane municipality.

Introduction

Non-communicable diseases (NCDs) are the leading causes of death in the world (WHO, 2010) and in South Africa (Pillay-van Wyk et al., 2016; Statistics South Africa, 2017). Low and middle income countries are undergoing a rapid epidemiological transition characterised by a shift from disease burden dominated by communicable disease and childhood illnesses to non-communicable disease such as type 2 diabetes mellitus, and cardiovascular disease which affects all age groups (Beaglehole et al., 2011; Mahmood et al., 2013; Gouda et al., 2019). These developing countries are experiencing the fastest rising prevalence of non-communicable diseases with more devastating outcomes compared with high income countries (Islam et al., 2014; Juma et al., 2019). The worldwide data reported that NCDs accounts for 80% related death in low and middle income countries (Maimela et al., 2016).

In South Africa, the occurrence of NCDs burden has increased over the past years resulting in an estimated 37% of all-cause mortality and 16% of disability-adjusted life years (Alberts et al., 2005; Puoane et al., 2012). Nojilana et al. (2016) and Bradshaw (2001) revealed that mortality due to NCDs is similar in all province of South Africa, even though the causes may differ. Most risk factors of NCDs are often categorised as behavioural or biological (Hoy et al., 2013; Maimela et al., 2016). Behavioural risk factors such as low income, age, smoking, unhealthy diet, stress, consumption of alcohol and sedentary life style are considered

as major modifiable risk factors for non-communicable diseases. Kraja et al. (2016) revealed that tobacco use, alcohol consumption, physical inactivity, unhealthy diet, and obesity are the behavioural risk factors for non-communicable diseases and many others account for 80% of mortality. Studies on the prevalence of such risk factors had been carried out in urban and rural villages around South Africa (Wandai and Day, 2015; Maimela et al., 2016; Manning et al., 2016). Bearing in mind that the causes of NCDs may differ we conducted a study on the prevalence of behavioural risk factors in Collins Chabane municipality of Vhembe District.

Methodology

The study was conducted in Collins Chabane municipality, which is one of four municipalities of Vhembe District. The Collins Chabane Local municipality is a Category B municipality situated within the Vhembe District in the far north of the Limpopo Province. The municipality shares borders with Musina in the north, Thulamela in the north-east, the Mopani District in the south, and Makhado in the west. It is making up 20% of its geographical area. It was established by the amalgamation of portions of the Thulamela and Makhado Local Municipalities in August 2016. The municipality is predominately rural-based with only one town. The massive development of modern shopping centres with all the well-known chain stores presented which could lead to lifestyle changes lead to the selection of this municipality. Simple random sampling was used to Collins Chabane from the four municipalities in Vhembe District. The municipality has an estimated total population of 347974 (Stats SA, Community Survey, 2016). Of the total population, 36.4%, 58.5% and 5.1% are population under 15, between 15 and 64, and over 65 respectively (Statistics South Africa Community Survey, 2016). Convenience sampling was used to select three hundred and sixty-five participants. Data was collected during a three-month (March to May 2018) period by a team of health professionals (a nutritionist and a biokineticists). Participants were aged between 18 and above, consented and were present on the day of data collection. Participants who were in wheelchairs were excluded due to the lack of equipment to measure their weight and height, and those with psychological and mental diseases who are unable to recall and/or give correct data or information required. Data was collected using a questionnaire with four sections namely physical activity level, alcohol and tobacco use, weight and height, and Food Frequency Questionnaire. An expert from the Department of Linguistics at the University of Venda translated the questionnaire into the local language used in Collins Chabane which is Xitsonga and Tshivenda. Anthropometric assessments were performed according to standard procedures as described by the International Society for the Advancement of Kinanthropometry. The following measurements were taken in duplicate using calibrated equipment with the adult wearing light clothing and no shoes: standing height and weight. Height was measured to the nearest 0.1 cm using a calibrated portable stadiometer and weight was measured to the nearest 0.01 kg on a portable Seca solar scale (model 0213) (Seca, Hammer Steindamm, Hamburg, Germany). The solar scale and stadiometer were calibrated before measurements using a calibration weight and steel tape respectively (Lee and Nieman, 2010).

Food survey

Food Frequency questionnaire was used to assess the dietary intake of pregnant mothers. The adequacy of nutrients intake was compared with the recommended dietary intake for pregnancy (Food and Nutrition

Board, 2011).

Definition of underweight, Normal, Overweight and Obesity

The BMI (Kg/m^2) was selected to estimate the prevalence of underweight, overweight and obesity according to WHO references values. Underweight was defined as less ($<$) 18.5, normal weight: 18.5 to 25, Overweight: 25-29.5 and Obesity: $>30 \text{ kg}/\text{m}^2$ (WHO, 1995).

Statistical Analysis

Statistical package of social sciences (IBM SPSS Statistics., Armonk, NY version 24) was used to analyse categorical and descriptive data such as mean, standard deviation, frequencies and percentages. Spearman's correlation coefficients were used to compare relationship between variables. For comparison of gender, the Independent t-test was used. A $p \leq 0.01$ and $p \leq 0.05$ will be considered statistically significant. Food finder was used to analysed dietary intake of the study participants.

Results

Table 1 provides the socio-demographic characteristics of males and females. About 32.1% of the participants were between the age of 18-25 years while 25.2% were between the age of 26-35 years. Majority (58.7%) of participants had secondary education while 16.9% had tertiary education and only 14.6% had primary education. Most (60.3%) of participants were single while 22.2% were married. Majority (76.2%) of the participants were unemployed while 23.8% were employed. Of all participants who were working, 10.6% were self-employed while 8.2% worked at the government and 4.9% worked in the private sector.

About 12.4% of the participants were suffering from health condition in the current study. Of all participants who suffered from health condition, only 9.7% suffered hypertension while 2.4% diabetes and only 0.3% suffered cancer (Table 2).

About (24.4%) of participants consumed alcohol in the current study. The prevalence of alcohol consumption was higher in male (22.8%) as compared to (1.6%) female counterparts. Only 16.7% of participants consumed alcohol at the age of less than 19 years. Of all the participants who consumed alcohol only 22.7% consumed beer. In addition, only 18% of the participants engaged in binge drinking. However, 13.9% of the participants consumed alcohol because of peer pressure. Only 12% of the participants consumed alcohol on weekend (Table 3).

The prevalence of underweight, overweight and obesity was 7.7%, 29.8%, and 11.3%, respectively. The prevalence of overweight was higher in female (21.1%) as compared to 8.7% of male counterparts. In addition, females (2%) were more obese as compared to male (9.3%) (Table 4).

About 46% of female had sedentary lifestyle as compared to their male counterparts (15.1%). Furthermore, male (13.2%) had not good enough as compared to 9.1% of females. However, only 3.6% of males had very active as compared to (1.0%) of females (Table 5).

About 13.9% of the participants smoked cigarette in the current study. Of all participants who smoked cigarette 10.1% initiated smoking at the age of less than 19 years. Only 9% of the participants smoked cigarette 1-5 times per day. However, 20.4% of the participants were exposed to tobacco (Table 6).

About 12.5 % of males and 16.0 % of females met the recommended daily allowance of carbohydrates while the majority 53.9% of males and 57.7% of females consumed over required amount of carbohydrates. Furthermore, most males (66.4%) and 73.2% of females consumed over required amount of protein. Only 17.1% of males and 16.9% of females met the recommended daily allowance of fats while the majority 60.5% of males and 53.1% of females consumed excessive amounts of fats (Table 7).

About 40.8% of males and 39.4% of females consumed excessive amount of energy while 34.9% of males and 28.6% of females consumed over required amount of energy. About 45.5% of males and 50.7% of females consumed over required amount of sugar. Only 17.1% of males and 16.0% met the recommended daily allowance for dietary fibre while 53.9% of males and 47.9% of females consumed over required amount of dietary fibre. Furthermore 36.2 % of males and 26.3% of females met the recommended daily allowance for sodium while 34.2% of males and 32.4% of females over consumed the recommended amount of sodium (Table 8).

Males

BMI negatively correlated with protein ($r = -0.007$; $p = 0.932$). Protein strongly correlated with energy ($r = 0.823$; $p = 0.000$), total fats ($r = 0.830$; $p = 0.000$), carbohydrates ($r = 0.587$; $p = 0.000$) and total sodium ($r = 0.666$; $p = 0.000$). Energy strongly correlated with total fat ($r = 0.817$; $p = 0.000$), carbohydrates ($r = 0.877$; $p = 0.000$), total dietary fibre ($r = 0.663$; $p = 0.000$) and sodium ($r = 0.724$; $p = 0.000$).

Females

BMI negatively correlated with total protein ($r = -0.007$; $p = 0.914$) and total fat ($r = -0.089$; $p = 0.197$). Total protein strongly correlated with energy ($r = 0.827$; $p = 0.000$), total fat ($r = 0.741$; $p = 0.000$), carbohydrates ($r = 0.582$; $p = 0.000$), total dietary fibre ($r = 0.503$; $p = 0.000$) and sodium ($r = 0.620$; $p = 0.000$). Energy strongly correlated with total fat ($r = 0.795$; $p = 0.000$), carbohydrates ($r = 0.875$; $p = 0.000$), total dietary fibre ($r = 0.720$; $p = 0.000$) and sodium ($r = 0.766$; $p = 0.000$) (Table 9).

Significance difference between males and females

There was a significant difference between males and females in terms of BMI as the p-value is less than 0.005 (Table 10).

Significant relationship between gender and alcohol consumption

There is a significant relationship between gender and alcohol consumption.

, (1, N=365) =126.299, p =0. 000. Gender is dependent upon alcohol consumption. Males are more likely to consume alcohol as compared to female counterpart (54.6% vs. 3.3 %). Gender has a large effect on alcohol consumption. Cramer's V = 0.587

4.11.2 Significant relationship between gender and physical activity

Gender is significantly associated with physical activity.

, (4, N =365) = 29.849, P =0.000.

Gender is dependent upon physical activity. Males are more likely to be physical active than the female counterpart (10.5% vs. 1.9%), the results also reveal that females are more likely to leave sedentary lifestyle than males. Gender has a small effect on physical activity. Cramer's V= 0.286

Discussion

In this study, we focused on behavioral risk factors such as alcohol consumption, cigarette smoking, physical inactivity, nutritional status, dietary intake. This behavioral risk factors are also the risk factor for hypertension and diabetes which could put burden on the overburdened economy of South Africa. Despite South Africa prohibiting the advertising and promotion of tobacco according to The Tobacco Products Control Act 83 of 1993, our study found a very low prevalence (13.9%) of cigarette smoking among male participants. Similarly, Maimela et al. (2016) and Thorogood et al. (2007) reported the lower prevalence of cigarette smoking at 13% and 14% respectively in rural areas. However, Agaku et al (2012) reported high prevalence of tobacco use among South Africans males. About 10.1% of the male participants in the current study initiated smoking at the age of less than 19 years. Congruently, The Surgeon General Reports (2012) revealed that majority of adults' smokers initiated the habit of smoking before the age of 18 years. It is estimated that about 15 million premature death in the world is attributed to smoking and 4 million of these deaths were in men.

Our study showed that smoking and alcohol consumption are high prevalent in male participants than in female. Similarly, Maimela et al. (2016) revealed that smoking and alcohol consumption were more prevalent in men than in women as per cultural practices. The prevalence of smoking and alcohol consumption in the current study was 13.9% and 24.4% respectively. The prevalence of the smoking and alcohol consumption in the current study was lower than the prevalence reported in a study done on adults aged 18 years and older in all nine provinces of South Africa (Reddy et al., 1996), and study done on adults of Dikgale village in Capricorn district of Limpopo Province (Maimela et al., 2016). In Nigeria, Olawuyi and Adeoye (2018) reported a lower prevalence of smoking (6.4%) and alcohol consumption (28.6%) as compared to the current study. We found significant relationship between gender and alcohol consumption and males were more likely to consume alcohol as compared to females.

The findings of this study indicate that 46% of females had sedentary lifestyle as compared to 15.1% of their male counterparts; the findings of the study were supported by the study done by Maimela, (2016) which reveals that females had a significantly higher prevalence of physical inactivity 70.8% as compared to

40.7% of males. Sedentary lifestyles of men and women leads to high prevalence of overweight and obesity leading to risk for non-communicable diseases (Ram et al., 2014). Lifestyle changes generated by technology and capitalism have affected the way people exercise, eat, leading to a risk of diseases (Richardson et al., 2008; Mozaffarian et al., 2011). South Africa, like any other developing country is undergoing a rapid transition with increased intake of energy dense foods, and decreased level of physical activity and low intake of fruits and vegetables due to increasing urbanisation, changing modes of transportation and sedentary working environment (Bourne et al., 2002; Motadi et al., 2015). Strong evidence shows that physical inactivity increases the risk of many adverse health conditions, including major non-communicable diseases such as coronary heart diseases, type 2 diabetes and shortens life expectancy (Lee et al., 2012). Adults who are insufficient physical active have a high risk of all causes of mortality compared with those who do at least 30 minutes a moderate in physical activity per week (WHO, 2014).

The prevalence of underweight, overweight and obesity was 7.7%, 29.8%, and 11.3%, respectively. The prevalence of overweight in the current study was higher than the prevalence (18.1%) reported by Motadi et al (2017) in Mopani district while that of obesity was lower. The results are higher than the provincial prevalence of 4.8% (overweight) and 3.3% (obesity). The prevalence was higher in female as compared to their male counterparts. However, the prevalence was lower when looking at provinces with Limpopo having 24% and 32.6% compared with 21.1% and 8.7% for females and males, respectively (Shisana et al., 2013). The prevalence of overweight may be attributed to sedentary lifestyle and overconsumption of fats, sugar and carbohydrates observed among participants which are known to be major risk factors for weight gain. Lack of physical activity can lead to increased calories resulting in weight gain and other health conditions. Overweight and obesity increase the risk of debilitating health problems such as type 2 diabetes mellitus, hypertension and cardio vascular diseases and increases the risk of mortality from these conditions (Motadi et al., 2017).

Poverty, poor food choices, lack of availability or decreased accessibility to certain foods, coupled with lack of knowledge about the importance of food group diversity for the health may limit the inclusion of healthy food in their daily diets (Cole *et al.*, 2010). Majority 53.9% of males and 57.7% of females consumed over required amount of carbohydrates. Over consumption of carbohydrates by the participants may be due to the fact that diet of many South African comprise of staple food such as maize meal porridge, and rice which are consumed two to three per day and this food items are excellent sources of carbohydrates. Steyn et al. (2003) indicated that maize is among the most commonly consumed food items by the South African adult population. Porridge and rice are the staple foods in the South African diet and previously this staple food were consumed with vegetables and a small amount of animal-derived food, this practice has been changing to western diets which include consumption of fatty foods and less amount of vegetables (Labadarios *et al.*, 2005).

Majority 60.5% of male participants and 53.1% of females consumed excessive amounts of fats. Perhaps this over consumption of fats may be attributed to consumption of fast food which are found in every fast food outlets at every corner of South African townships and rural areas (Motadi et al., 2017). Concurrently Onyiriuka et al. (2013) reported that nutrition transition in developing countries is characterised by a trend towards consumption of a diet high in fat, sugar and refined foods and low in fibre which were also

observed in the current study. Sugar has been part of human diet in the last decade. Even though South African has introduced sugar tax in 2016 with aim of reducing obesity by 10% in 2020, we found that 45.5% of males and 50.7% of females consumed over required amount of sugar in the current study, and this sugary drinks are found at most intersections around Limpopo Province. South African continue to consume sugary food and drinks on regular basis. High intake of free sugars threatens the nutrient quality of the diet by providing energy without specific nutrients resulting to unhealthy weight gain and increased risk of obesity and various NCDs (WHO, 2003; Te Morenga et al., 2013; Sheiham and James, 2014). Several studies reported the association between high intake of sugars sweetened beverages and the development of obesity (Drewnowski and Bellisle, 2007; Mattes et al., 2011).

Limitation Of The Study

Data was based on self-reports and may be affected by potential under-reporting especially on smoking and alcohol. The study was a cross sectional and didn't follow participants for a period. Some of the behavioural risk factor such as dietary intake may vary seasonally and might not be the representative. This data may not be the representative of Vhembe District as it focused on one municipality.

Conclusion And Recommendation

Behavioural risk factors such as smoking, alcohol consumption, consumption of over required amount of sugar, sodium, protein, energy, carbohydrates, excessive fats intake, physical inactivity, overweight, obesity exist among people in Collins Chabane Municipality. Due to nutrition transition and liberalisation which makes people access fast food due to market globalisation which leads to a change in dietary patterns, it is recommended that measures to control risk factors at rural areas should include awareness on consequences of consuming fast foods, physical inactivity, overweight and obesity.

Abbreviations

NCDs: Non-communicable diseases

BMI: Body Mass Index

Declarations

Acknowledgments

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Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on request.

Authors' contributions

SC, NT, NN and MR collected the data. MNS analyzed the data. MSA, SC, NT, NN, MR and MNS contributed materials/analysis tools. MSA prepared the draft manuscript. MSA and MNS finalized the manuscript and provided a critical review. All authors have read and approved the final manuscript.

Ethical consideration

Ethical clearance for the study was obtained from the University of Venda Research Ethics Committee (SHS/18NUT/07/1906) and the permission to conduct the study was granted by the Limpopo Provincial Department of Health Research Committee. The study was performed in accordance with principles of the Declaration of Helsinki (2008), Good Clinical Practices and the laws of South Africa. A full and adequate oral and written explanation of the study was given to the participants. Participants gave written signed informed consent to participate in the study. The consent form included the participants's right to withdraw from the study and codes were used to ensure confidentiality of the information obtained.

Consent to publication

The manuscript does not contain any individual person's data in any form.

Competing interests

The authors declare that they have no competing interests.

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Tables

Table 1: Socio-demographic data of study participants

Age categories	Male n (%)	Female n (%)	Total n (%)
18-25 years	57 (15.7)	60 (16.4)	117(32.1)
26-35 years	38 (10.5)	54 (14.7)	92(25.2)
36-45 years	21 (5.7)	24 (6.7)	45(12.4)
46-55 years	16 (4.4)	20 (5.4)	36(9.8)
56-65 years	7 (1.9)	23 (6.3)	30(8.2)
66-75 years	10 (2.7)	27 (7.4)	37(10.1)
76-85 years	3 (0.8)	5 (1.4)	8(2.2)
Educational level			
Primary	17 (4.7)	36 (9.9)	53(14.6)
Secondary	96 (26.3)	118 (32.4)	214(58.7)
Tertiary	33 (9.0)	29 (7.9)	62(16.9)
Never attended school	6 (1.6)	30 (8.2)	36 (9.8)
Marital status			
Single	94 (25.7)	126 (34.6)	220(60.3)
Married	37 (10.1)	44 (12.1)	81(22.2)
Divorced	4 (1.0)	5 (1.5)	9(2.5)
Widowed	3 (0.8)	29 (7.9)	32 (8.7)
Living with a partner	14 (3.8)	9 (2.5)	23(6.3)
Employment status			
Employed	66 (18.1)	21(5.7)	87 (23.8)
Unemployed	86 (23.6)	192 (52.6)	278 (76.2)
Type of employment			
Government	20 (5.5)	10 (2.7)	30 (8.2)
Private sector	14 (3.8)	4 (1.1)	18(4.9)
Self employed	32 (8.7)	7 (1.9)	39 (10.6)

Table 2: Health condition of the study participants

Do you suffer any from health condition?	Male n (%)	Female n (%)	Total n (%)
Yes	8 (2.2)	37 (10.1)	45(12.4)
No	144 (39.5)	176 (48.2)	320(87.7)
Type of health condition			
Hypertension	5 (1.4)	30 (8.3)	35(9.7)
Diabetes	2 (0.5)	7 (1.9)	9(2.4)
Cancer	1 (0.3)	-	1(0.3)

Table 3: Alcohol consumption of study participants

Do you consume alcohol	Male n (%)	Female n (%)	Total
Yes	83(22.8)	6(1.6)	89 (24.4)
No	69(18.9)	207(56.7)	276(75.6)
Age of consumption of the study participants			
1.<19	58(15.9)	3(0.8)	61(16.7)
2.20-29	20(5.5)	2(0.5)	22(6.0)
3.30-39	2(0.5)	-	2(0.5)
4. 40-49	2(0.5)	1(0.3)	3(0.8)
5.50-59	1(0.3)	-	1 (0.3)
kind of alcohol			
Beer	78 (21.3)	5 (1.4)	83(22.7)
Wine	1 (0.3)	-	1(0.3)
Traditional beer	4 (1.1)	1 (0.3)	5(1.4)
Do you engage in binge drinking?			
Yes	64 (17.5)	2 (0.5)	66(18)
No	19 (5.2)	4 (1.1)	23(6.3)
Reason for drinking alcohol			
Peer pressure	45 (12.3)	6 (1.6)	51(13.9)
Curiosity	-	-	
Boredom	26 (17.1)	-	26(7.1)
Influence of adults	12 (3.3)	-	12(3.3)
Frequency of alcohol consumption			
Everyday	16 (4.4)	-	16(4.4)
3-5 times a week	7 (1.9)	2 (0.5)	9(2.4)
Once a week	10 (2.7)	-	10(2.7)
Only on weekend	42 (11.5)	2 (0.5)	44(12)
On special occasions	8 (2.2)	2 (0.5)	10(2.7)
Do you have family history of alcohol consumption			
Yes	18 (4.9)	2 (0.5)	20(5.4)
No	65 (17.8)	4 (1.1)	69(18.9)

Do you lose appetite?

Yes	30 (8.2)	1 (0.3)	31 (8.5)
No	53 (14.5)	5 (1.4)	58 (15.9)

Table 4: Nutritional status of the study participants

Categories	Male n (%)	Female n (%)	Total n (%)
Underweight	16 (4.4)	12 (3.3)	28 (7.7)
Normal	97 (26.6)	90 (24.6)	187 (51.2)
Overweight	32 (8.7)	77 (21.1)	109 (29.8)
Obese	7 (2)	34 (9.3)	41 (11.3)

Table 5: Physical activity index of the study participants

Physical activity index	Male n (%)	Female n (%)	Total n (%)
81 to 100 (very active)	13 (3.6)	4 (1.0)	17 (4.6)
60 to 80 (active and healthy)	16 (4.4)	2 (0.5)	18 (4.9)
40 to 59 (acceptable)	20 (5.5)	6 (1.6)	26 (7.1)
20 to 39 (not good enough)	48 (13.2)	33 (9.1)	81 (22.3)
under 20 (sedentary)	55 (15.1)	168 (46.0)	223 (61.1)

Table 6: Cigarettes use

Do you smoke?	Male n (%)	Female n (%)	Total n (%)
Yes	51 (13.9)	-	51(13.9)
No	101 (27.7)	213 (58.3)	314(86.1)
Initiation of smoking			
<19	37(10.1)	-	37(10.1)
20-29	11(3.0)	-	11(3.0)
30-39	2(0.5)	-	2 (0.5)
40-49	1(0.3)	-	1(0.3)
Frequency of smoking			
1-5 per day	33(9.0)	-	33(9.0)
6-10 per day	14(3.8)	-	14(3.8)
11-20 per day	4(1.0)	-	4(1.0)
Exposure to tobacco			
Yes	67(18.5)	7(1.9)	74(20.4)
No	85(23.4)	205(56.2)	290(79.6)

Table 7: Energy, protein and fats RDA of the study participants

Categories	Carbohydrates		protein		fats	
	Male n (%)	Female n (%)	Male n (%)	Female n (%)	male n (%)	Female n (%)
Under recommended	19 (12.5)	20 (9.4)	1 (0.7)	1 (0.5)	20 (13.2)	36 (16.9)
Recommended	19 (12.5)	34 (16.0)	-	-	26(17.1)	36 (16.9)
Over required amount	82 (53.9)	123 (57.7)	101 (66.4)	156 (73.2)	14 (9.2)	28 (13.1)
Excessive	32 (21.1)	36 (16.9)	50 (32.9)	56 (26.3)	92(60.5)	113 (53.1)
Total	152 (100.0)	213 (100.0)	152 (100.0)	213 (100.0)	152 (100)	213 (100.0)

Table 8: Energy, Total Sugar, total dietary fibre and sodium RDA of the study participants

Categories	Energy		Total sugar		Total dietary fibre		Sodium	
	Males n (%)	Females n (%)	Males n (%)	Females n (%)	Males n (%)	Females n (%)	Males n (%)	females n (%)
Under Recommended	11 (7.2)	7 (3.3)	27 (17.8)	28 (13.1)	3 (2.0)	3 (1.4)	42 (27.6)	82 (38.5)
Recommended	26 (17.1)	61 (28.6)	10 (6.6)	5 (2.3)	26 (17.1)	34 (16.0)	55 (36.2)	56 (26.3)
Over required amount	53 (34.9)	61 (28.6)	69 (45.5)	108 (50.7)	82 (53.9)	102 (47.9)	52 (34.2)	69 (32.4)
Excessive	62 (40.8)	84 (39.4)	46 (30.3)	72 (33.8)	41 (27.0)	74 (34.7)	3 (2.0)	6 (2.8)
Total	152 (100.0)	213 (100.0)	152 (100.0)	213 (100.0)	152 (100.0)	213 (100.0)	152 (100.0)	213 (100.0)

Table 9: Correlations between BMI and dietary intake of males and females.

	Total protein	Energy	Total fat	Carbohydrates	Total sugar	Total dietary fibre	Sodium
Males							
BMI	r = -0.007 p = 0.932	r = 0.068 p = 0.408	r = 0.049 p = 0.547	r = 0.097 p = 0.233	r = 0.098 p = 0.229	r = 0.202 p = 0.012	r = 0.015 p = 0.852
Total protein	r = 1.000 p = N/A	r = 0.823 p = 0.000	r = 0.830 p = 0.000	r = 0.587 p = 0.000	r = 0.157 p = 0.053	r = 0.402 p = 0.000	r = 0.666 p = 0.000
Energy	r = 0.823 p = 0.000	r = 1.000 p = N/A	r = 0.817 p = 0.000	r = 0.877 p = 0.000	r = 0.397 p = 0.000	r = 0.663 p = 0.000	r = 0.724 p = 0.000
Total fat	r = 0.830 p = 0.000	r = 0.817 p = N/A	r = 0.817 p = 0.000	r = 0.550 p = 0.000	r = 0.075 p = 0.360	r = 0.321 p = 0.000	r = 0.650 p = 0.000
Carbohydrates	r = 0.587 p = 0.000	r = 0.877 p = 0.000	r = 0.550 p = 0.000	r = 1.000 p = N/A	r = 0.607 p = 0.000	r = 0.770 p = 0.000	r = 0.605 p = 0.000
Total sugar	r = 0.157 p = 0.053	r = 0.397 p = 0.000	r = 0.075 p = 0.360	r = 0.607 p = 0.000	r = 1.000 p = N/A	r = 0.460 p = 0.000	r = 0.212 p = 0.009
Total dietary fibre	r = 0.402 p = 0.000	r = 0.663 p = 0.000	r = 0.321 p = 0.000	r = 0.770 p = 0.000	r = 0.460 p = 0.000	r = 1.000 p = N/A	r = 0.416 p = 0.000
Sodium	r = 0.666 p = 0.000	r = 0.724 p = 0.000	r = 0.650 p = 0.000	r = 0.605 p = 0.000	r = 0.212 p = 0.009	r = 0.416 p = 0.000	r = 1.000 p = N/A
Female							
BMI	r = -.007 p = 0.914	r = 0.008 p = 0.906	r = -.089 p = 0.197	r = 0.027 p = 0.692	r = 0.039 p = 0.571	r = 0.148 p = 0.031	r = 0.026 p = 0.706

Total protein	r = 1.000 p = N/A	r = 0.827 p = 0.000	r = 0.741 p = 0.000	r = 0.582 p = 0.000	r = 0.242 p = 0.000	r = 0.503 p = 0.000	r = 0.620 p = 0.000
Energy	r = 0.827 p = 0.000	r = 1.000 p = N/A	r = 0.795 p = 0.000	r = 0.875 p = 0.000	r = 0.469 p = 0.000	r = 0.720 p = 0.000	r = 0.766 p = 0.000
Total fats	r = 0.741 p = 0.000	r = 0.795 p = 0.000	r = 1.000 p = N/A	r = 0.601 p = 0.000	r = 0.124 p = 0.071	r = 0.340 p = 0.000	r = 0.700 p = 0.000
Carbohydrates	r = 0.582 p = 0.000	r = 0.875 p = 0.000	r = 0.601 p = 0.000	r = 1.000 p = N/A	r = 0.653 p = 0.000	r = 0.750 p = 0.000	r = 0.659 p = 0.000
Total sugar	r = 0.242 p = 0.000	r = 0.469 p = 0.000	r = 0.124 p = 0.071	r = 0.653 p = 0.000	r = 1.000 p = N/A	r = 0.503 p = 0.000	r = 0.241 p = 0.000
Total dietary fibre	r = 0.503 p = 0.000	r = 0.720 p = 0.000	r = 0.340 p = 0.000	r = 0.750 p = 0.000	r = 0.503 p = 0.000	r = 1.000 p = N/A	r = 0.581 p = 0.000
Sodium	r = 0.620 p = 0.000	r = 0.766 p = 0.000	r = 0.700 p = 0.000	r = 0.659 p = 0.000	r = 0.421 p = 0.000	r = 0.581 p = 0.000	r = 1.000 p = N/A

Table 10: Significance difference between males and females

Variables	P –values	Male median (IQR)	Female median (IQR)
BMI	0.000	22.1858 (19.7-25.3)	25.1600 (22.3-29.0)
Energy	0.431	14985.00 (13116.0-18158.5)	14459 .00 (12195-18739)
Total protein	0.239	177.00 (146.0-218)	169.00 (140-209)
Total fat	0.130	109.50 (83.0-140.0)	103.00 (79-133)
Carbohydrates	0.317	421.51 (353-517.5)	407.00 (352 -517)
Sugar	0.122	163.50 (111.50 -517.5)	174 .00 (140-217)
Dietary fibre	0.088	54.00 (43.5- 76.0)	59.00 (44-80)
Sodium	0.317	2297.50 (1940-2695)	2215.00 (1753-2753)