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The Determinants of Obesity among Students of the University of Venda, Limpopo Province of South Africa

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Abstract

Background: Obesity is a serious public health issue, recognised as a global epidemic affecting millions of people worldwide. The prevalence of obesity has been established among all age groups of different countries of the world. Numerous researches have confirmed the increasing prevalence rate of overweight and obesity globally. Overweight and Obesity are also prevalent amongst University students. The researcher observed that many students at the University of Venda look overweight; this might indicate the possibility of high prevalence of obesity among the student population. More so, majority of students that look overweight do not utilise the physical exercise equipment at the gym provided by the University or engage in any sporting activity. The purpose of the study was to describe the determinants of obesity among students of the University of Venda.

Materials and Methods: A quantitative approach using a descriptive correlational survey design was adopted. A questionnaire was used as Instrument for data collection from a cross-section of the students. Simple random sampling and systematic sampling methods was used to select the participants. A total of 338 students (155 male and 183 female) were selected to constitute the sample size. The data collected was analysed using Statistical Package for Social Science (SPSS), version 22. Descriptive analyses were performed to show frequency distributions. Chi–square test was used to compare relationship between obesity and socio-demographic; dietary and environmental variables among students.

Results: Overweight and obesity is prevalent among student population with 20% of the participants being overweight and 9.5% obese. Unhealthy eating practices were found among the participants. There was statistical significant difference in BMI between male and female gender with female (66%) being more obese than male (34%). In terms of socio-demographic variable this study found gender and age of participants as important factor of overweight and obesity.

Discussion and Conclusion: This study found that malnutrition among participants exists in the form of under and over nutrition. The study also revealed gender differences among the types of malnutrition. Wherein female participants were more underweight, overweight and obese than their male participants, notably more male participants have normal bodyweight than that their female counterparts. These findings were similar to the findings of Murray in South Africa, study by Pengpid and Peltzer among University students in India. On the contrary to these findings, study by Sardinha et al. On Portuguese adults; show that overweight and obesity were predominantly prevalent among the male than in the female.

This study therefore recommends that regular nutrition education campaign be carried out in the University in order to motivate more healthy food choices. Also consistent Moderate to Vigorous Physical Activities (MVPA) lifestyle is recommended.

Keywords: Obesity; Overweight; Body mass index; Students; South Africa

Introduction

Obesity is viewed as a serious public health issue; and has been recognized as a global epidemic affecting millions of people worldwide [1]. Obesity results from improper energy balance leading to an increased store of energy as fat in the body [2]. Many countries of the world are experiencing increasing rates of overweight obesity [3-7] Studies have also confirmed the prevalence of overweight and obesity amongst university students [8-12]

Considering gender and age as determinants of obesity, studies show higher prevalence of obesity among women and children than men in the USA [8]. The prevalence of obesity follows the same pattern in Korea [13]. In Africa, available literature has also confirmed that there are higher overweight and obesity rates among the female gender than male [2]

The rate of obesity and overweight also vary among different ethnic groups. In the USA, African-American women suffer from obesity at an alarming disproportionate rate when compared to women of other races [8]. In Canada the aboriginals are more obese than the Caucasian group [14]. The pattern is the same in Africa. A study in Kenya show that the prevalence of overweight and obesity is higher among the

Maasai people, while in South Africa black women had the highest prevalence of overweight and obesity [2].

However in a study of the life cycle development of obesity and its determinants in six European countries, it was revealed that women gain weight faster than men; and that this gender–specific difference in age-weight profile suggests that female and male may react differently to weight determinants [15].

The amount of information available to an individual affects his/her level of knowledge regarding the causes and prevention of obesity. Health education plays a vital role in providing information which promotes healthy lifestyles. An individual's level of knowledge about obesity has a direct impact on his or her lifestyle and eating pattern. Obesity rate has been found to be higher among individuals with low level of education than those with higher education level. More educated people who earn more money have lower rates of chronic diseases including obesity, compared to people with lower education and income level [15,16].

The place of residence is a factor in obesity. Studies have indicated variations in the prevalence rates between rural and urban dwellers [17]. The eating practices of individuals who live in the rural area may be different from those who live in urban areas and this factor is important when considering determinants of obesity. Available evidence in South Africa have confirmed higher prevalence of obesity among individuals living in urban areas than those who live in the rural areas [18]. Socio-economic status (SES) relates to the differences between groups of people caused mainly by their financial situation. There are obese people among all income levels; this is contrary to the old belief that obesity is a sickness of the rich [15,19-21].

Eating behaviour is an important factor in obesity. Our health is affected by what we eat. Therefore, it is important that we consider our health as we eat. Study in South Africa show that poor or unhealthy eating practices and lack of basic nutritional knowledge is common in South Africa [21].

The researcher believe that many students of the University of Venda are obese due to eating practices such as consumption of energy dense food that is high in fat and sugar and low in vitamins. Eating behaviour of university students is influenced by their peers, media and also the fact that fast food are always available, making it easier for students to eat different kinds of food [22]. People's eating pattern is largely influenced by the environment to such an extent that health could be affected [23], the results a study result that being inactive has the strongest association with obesity for both men and women [24]. Evidence is very strong that a large number of South Africans follow a sedentary lifestyle [25].

People who are obese are at higher risks of suffering from serious chronic diseases, many of which are life limiting. Not only are obese people affected physically, there are also considerable psychological and social effects associated with being obese [26]. The researcher observed that many students at the University of Venda look overweight which might indicate the possibility of high prevalence of obesity among the student population. More so, majority of students that look overweight do not utilise the physical exercise equipment at the gym facility provided free by the University. This study aimed to determine obesity status and its determinants among students of the University of Venda.

Research Method and design

Study approach and design

This study adopted a quantitative correlational survey design. Data was obtained from a cross-section of the population, at one point in time. The study was conducted at the University of Venda. The University of Venda is a comprehensive, rural based academic institution located in Thohoyandou in Vhembe district, which is the northern region of Limpopo Province of South Africa. The student population is diverse with students from Botswana, Cameroon, DR Congo, Ghana, Kenya, Malawi, Nigeria, Swaziland and Zimbabwe.

Target population

The study population were all University of Venda students who resided in the campus. There were 2165 students officially accommodated in the University hostels at the time of the study. A total of 1176 (54.3%) of these students were females and 989 (45.7%) males. The sample size of 338 participants was calculated using the Slovin formula.

Data collection tools

The weight status determination data was collected using the weight and height scale, whereas the determinants of obesity data was collected using the close-ended questionnaire that was adopted after extensive literature search on the topic and in due consultation with experts in the field of public health. Reliability of the questionnaire was determined through pre-test where thirty four students (which are 10% of the sample population) were requested to answer the questionnaire to determine clarity/ambiguity of questions. The questionnaire was thereafter slightly amended to include few suggestions from students. These set of students that took part in the pre-test were then excluded from the main study.

Ethical considerations

The permission to conduct the study was obtained from the University of Venda authorities. Ethical clearance was issued by the University of Venda Research Ethics Committee (no SHS/15/PH/20/2810). Participants gave their written consents after receiving clarity about the study. Anonymity and confidentiality was maintained by not requesting for name identification in the questionnaires.

Data collection process

Data collection commenced immediately after the researcher obtained the ethical clearance and university permission. Data collection lasted for 22 days. The questionnaire was given to only those students who signed the informed consent form. Anthropometric data of the female participants was taken by a female research assistant trained for that purpose. Participants' weight, height, waist and hip measures were taken twice and average reading was recorded using the anthropometric measurements record sheet. Height was measured without shoes using a Stadiometer, weight was measured in light clothing using a digital scale (Model: UC-3215 Precision Health Scale) and measuring to the nearest of 0.5 kg with the person standing immobile on the weighing machine. The weighing scale was regularly checked and calibrated with known standard weight (1 kg of standard weight placed on the scale when the reading is zero to see if the scale reads it as 1 kg). This was done at the commencement of each session

of the measurement. Waist and Hip circumferences were taken using a Tape measure and measuring to the nearest 0.1 cm. The Waist-to-Hip ratio was then calculated in order to determine body fat distribution as a measure of the extent of risk of obesity.

The data was analysed using the Statistical Package for Social Science (SPSS), version [22]. The questions were coded and entered into SPSS. Descriptive analyses were performed to show frequencies and percentages in order to describe the characteristics of the sample and to determine the status of overweight and obesity in the sample. Chi–square test was used to compare the relationship between weight status and the determinants of obesity among University of Venda students.

Results

Obesity status

BMI distribution across demographic characteristics: The BMI result shows that 9.8% of students were underweight with majority of these being female. In total, 205 (61%) of participants had normal body weight with 34% male and 27% female. Of the 20% of students that were overweight, 14% were female. In total, 9.5% of participants were obese, of this number, 6.2% of these were female.

The age distribution of participants was within the range 17-35. More participants (67%) were within the age 20-25. Of this age bracket 5% were underweight, 43% had a normal body weight; 13% were overweight and 6% obese.

All the participants are from the black ethnic background. In terms of Nationality, South African constituted 96% while Foreign Nationals constituted only 4%.

Their academic status showed that 93% of the participants were undergraduates while 7% were at post-graduate level of studies. All participants who were underweight were undergraduate students, while in the normal body weight range 56% of participants were undergraduates and 5% were post-graduates, 19% undergraduate students were overweight while 1.5% were post-graduate students. There were 8.9% undergraduates that were obese and 1% post-graduates students.

Participants that were married constitute 3% of the sampled population; 96% were single and 1.5% were in other kinds of relationship which was not specified. All the underweight participants were single at the time of this study; for students that have normal body weight 2.9% were married, 96% were single and 1.5% in other kinds of relationships which was not specified. There were 2.9% overweight participants that are married; 94% single and 2.9% in other kinds of relationship. There were 6.3% participants that were obese and married while 94% are single and obese.

Of the 33 (9.7%) participants that were underweight, 7.9% were from the rural areas. Among normal body weight participants (61%), 42% were from the rural areas. A total of 68 (20%) participants were overweight and of this number, 13% were from rural areas. Of the 9.5% participants that are obese, 5.3% were from the rural areas.

In terms of socio-economic status (SES) 42% has low SES, 55% medium/average SES and 3% having High SES. For those with normal body weight (61%), 45% have low SES, 53% medium/average SES and 2% have high SES. Of the 68 participants (20%) that were overweight, 7% have low SES, 12% have medium/average SES and 1% high SES. There were 3.6% participants in the low SES that were obese, 5.3% in the medium/average SES and 0.6% have high SES (Table 1).

Characteristics	BMI of Respondents						Total
	Underweight <18.5	Normal range 18.5-24.9	Overweight/ pre-obese 25.0 -29.9	Obese class I 30.0 -34.9	Obese class II 35.0-39.9	Obese class III ≥ 40	
Gender: Male Female	12 21	113 92	19 49	11 19	0 1	0 1	155 183
Total	33	205	68	30	1	1	338
Age:							
17-19 years 20-25 years 26-30 years 31–35 years	16 16 1 0	48 144 10 3	12 47 9 0	6 21 3 0	0 0 0 1	0 0 0 1	82 228 23 5
Total	33	205	68	30	1	1	338
Ethnic background: Black	33	205	68	30	1	1	338
Nationality: South African Non-South African	33 0	196 9	67 1	28 2	1 0	1 0	326 12

Total	33	205	68	30	1	1	338
Academic status: Undergraduate Post-graduate	33 0	188 17	63 5	28 2	1 0	1 0	314 24
Total	33	205	68	30	1	1	338
Marital status: Married Single Other	0 33 0	6 196 3	2 64 2	2 28 0	0 1 0	0 1 0	10 323 5
Total	33	205	68	30	1	1	338
Permanent residential zone: Town Township Rural areas	3 3 27	26 37 142	7 16 45	6 7 17	0 0 1	0 1 0	42 64 238
Total	33	205	68	30	1	1	338
Socio-economic status: Low Medium/average High	15 18 0	92 108 5	24 41 3	10 18 2	1 0 0	1 0 0	143 185 10
Total	33	205	68	30	1	1	338

Table 1: Socio-demographic and BMI of respondents (N=338).

Waist circumference

Majority (85.2%,) of the male participants had ideal circumference of less than 94 cm, (14.2%) recorded increased risk of between 94.0 and 101.9 cm while 0.6% had substantial risk of ≥ 102 cm. For female, 76% has ideal waist circumference of <80 cm; 21.9% has increased risk, recording between 80.0 and 87.9 cm and 2.1% recorded substantial risk of ≥ 88 cm (Table 2).

	Ideal	Increased risk	Substantial risk
	<94 cm	94.0-101.9 cm	≥ 102 cm
Men	85.2%	14.2%	0.6%
	<80 cm	80.0-87.9 cm	≥ 88 cm
Women	76%	21.9%	2.1%

Table 2: Waist circumference (WC) in men and women associated with increased risk for chronic diseases of lifestyle.

Determinants of obesity

Dietary practices/patterns: Most (51%) participants eat twice a day, 39% eat three times a day, 9% eat once a day and 1% eats four times and more. Majority (70%) of the participants eat breakfast, while 30% skip breakfast. Of the 238 participants that eat breakfast, 37% eat breakfast daily, 22% eat breakfast 2-3 times a week and 11% eat breakfast 4-6 times a week. Majority (92%) of participants prepare their own breakfast by themselves and of these, 49.8% include fruit and vegetables to breakfast while 50.1% do not include fruits and vegetables. In-between meals, students eat snacks such as fruit 22.2%, maize snack 0.5%, 20.1% eat chocolates/sweets and 7.7% eat peanuts.

Participants eat snack at school, Majority, (74%) states that they eat their snacks with friends and 26% eat their snack alone. The participants stated the number of time per day that they watch their favourite programmes. Majority (37.3%) watch once, 24.9% watch twice and 19.5% watch three times per day. For each time they viewed TV, 23.1% spent 30 min-1 hr; 32.2% spent 1hr 30 min-2h rs and 25.4% spent 2 hrs 30min and more watching their favourite programme.

Sixty one percent (61%) of the participants that like advertised commercial foods, 25% do not like and 14% were indecisive. Participants identified commercial foods that are advertised on TV and which are most likely to influence them to eat. Majority (54%) of

participants named soft drinks; 21% identified Chips, 16% named cake and 9% stated other kinds of advertised commercial foods. Of the 221 participants that eat while watching TV, majority (70%) stated that they are encouraged by advertisement to eat and 30% stated otherwise.

Physical activity patterns: student that engage in physical activities represents 64% while 36% do not. Majority (73%) of students engaged in walking for pleasure while 50% engaged in jogging. Less than 47% engaged in other recreational activities within the campus (Table 3).

Approximate numbers of hour each week	Engaged in recreation activity		Less than once a month	Once a month	2 to 3 times a week	4 to 5 times a week	6 times or more	Average time per episode	
	Yes	No							
Walking for pleasure	248 (73%)	90 (26.6%)	62 (18.3%)	29 (8.6%)	92 (27.2%)	27 (8.0%)	38 (11.2%)	1	12
Exercises with weights	157 (46.4%)	181 (53.6%)	40 (11.8%)	39 (11.5%)	49 (14.5%)	11 (3.3%)	18 (5.3%)	0	30
Dancing	106 (31.3%)	232 (68.6%)	72 (21.3%)	21 (6.2%)	11 (3.3%)	1 (0.3%)	1 (0.3%)	0	30
Competitive running	113 (33.4%)	225 (66.6%)	47 (13.9%)	32 (9.5%)	23 (6.8%)	6 (1.8%)	5 (1.5%)	2	00
Jogging	170 (50.3%)	168 (49.7%)	75 (22.2%)	50 (14.8%)	33 (9.8%)	10 (3.0%)	2 (0.6%)	2	00
Tennis	43 (12.7%)	295 (90.0%)	10 (3.0%)	17 (5.0%)	6 (1.8%)	1 (0.3%)	9 (2.7%)	1	00
Football, rugby	96 (28.4%)	242 (71.6%)	15 (4.4%)	23 (6.8%)	22 (6.5%)	20 (5.9%)	16 (4.7%)	1	30
Netball, volleyball or basket	59 (17.4%)	279 (82.5%)	22 (6.5%)	9 (2.7%)	12 (3.6%)	6 (1.8%)	10 (3.0%)	2	00
Snooker	70 (20.7%)	268 (79.3%)	21 (6.2%)	17 (5.0%)	22 (6.5%)	4 (1.2%)	6 (1.8%)	0	30
Musical instrument	70 (20.7%)	268 (79.3%)	23 (6.8%)	13 (3.8%)	19 (5.6%)	5 (1.5%)	10 (3.0%)	2	00
Boxing	25 (7.3%)	313 (92.6%)	11 (3.3%)	4 (1.2%)	3 (0.9%)	2 (0.6%)	5 (1.5%)	0	30

Table 3: Recreation activities within the campus.

Discussion

This study found that malnutrition exists among participants in the form of under and over nutrition. The study also revealed gender differences among the types of malnutrition. Wherein female participants were more underweight, overweight and obese than their male participants, notably more male participants have normal bodyweight than that their female counterparts.

These findings were similar to the findings of [27] South Africa which established that, seven (7) out of 10 women and four (4) out of 10 men in South Africa have significantly more body fat than what is deemed healthy and that of the 70% of overweight South African women, 42% are obese. Further studies that confirmed the findings of this study include study conducted by Pengpid et al. [28] among University students in India. In their study normal weight was higher in male than in female but an aspect of this finding differs with Pengpid et al. [28] in terms of overweight where in their study, male were more overweight than female however, central obesity was more

in the female than in male. On the contrary to this finding, in a similar study by Sardinha et al. [29]. On the prevalence of overweight, obesity, and abdominal obesity in a representative sample of Portuguese adults; their findings show that overweight and obesity were predominantly prevalent among the male than in the female. More than 90% of the different weight statuses were concentrated within the undergraduate level of study. This is in agreement with the findings of Lubel [30]; Stephens [31] and CDC Health Report 16.

Participants mostly eat twice instead of three times a day; moreover, 30% skip breakfast. These findings were in agreement with those of Sakamaki [11] where it was established that majority of university students in Korea (58.9%) and in Japan (81%) eat twice a day.

There was no statistical significant difference in BMI between the undergraduate and the post-graduate group. Overweight and obesity was prevalent in both levels of study. This finding agreed with a similar study by Adderley [8] where there was no statistical significant difference in BMI between the students in different levels of studies in

the USA. There was no statistical significant difference in BMI and the number of meals per day. There are underweight, overweight and obesity status prevalent across all the different meals patterns per day. Similarly, there was no statistical significant difference in BMI and number of times of fruits and vegetables. Although participants stated that they include fruits and vegetable in their meals, however, that did not show any difference in BMI.

There was no statistical significant difference in BMI and number of hours watching TV rather there was a statistical significant difference in BMI between the group of students who stated that advertisement encouraged them to eat the commercial foods that were advertised on TV and the group that stated that advertisement does not encourage them to eat the commercial foods that were advertised on TV. This study concurred with the findings of study be Pengpid and Peltzer28 in which there was no association between sedentary behaviour and overweight/obesity.

Limitations

A limitation that might have been associated with this study was mainly with the instrument used in data collection. The questionnaire did not request information about pregnancy; therefore there was the possibility that female participants in early stages of pregnancy might have participated unnoticed, this could have influenced such participants' weight status.

Conclusions

Overweight and obesity is prevalent among student population of the University of Venda with 20% of the participants being overweight and 9.5% obese. Underweight, overweight and obesity are unhealthy weight statuses that need to be addressed in the University. Factors contributing to difference in weight status are multifaceted including not only socio-demographic variables, dietary practices and physical activities but also psychological factors. Which is why many students that looks overweight are not utilising the Sporting and physical activities/gym equipment provided by the university. Moreover, there was a significant difference in BMI between male and female gender with female (66%) being more obese than male (34%). Overweight and obesity was more prevalent within age 20-25 years while obesity class I and II indicating higher risks were found in the higher age bracket (31-35), therefore in terms of socio-demographic variable this study found gender and age of participants as important factor of overweight and obesity.

Engaging in physical activities and also the number of times spent watching TV was compared with BMI, but did not show significant differences in explaining the overweight and obesity found in students. However, there was statistical significant difference in BMI between the group of students who stated that advertisement encouraged them to eat the commercial foods that were advertised on TV and the group that stated that advertisement does not encourage them to eat the commercial foods that were advertised on TV.

Recommendations

This study recommendation is that regular nutrition education campaign be carried out in the university in other to motivate more healthy food choices such as daily consumption of balanced diets, fruits and vegetables as well eating of breakfast daily. Change of diet to a healthy diet is recommended. Effective monitoring of such dietary program and the eating practices of student would yield the expected result of weight loss if students agree to co-operate and adhere strictly to the program. Students engaged in physical activities but were not consistent in doing their activities. Engaging in moderate-to-vigorous physical activity (MVPA) can yield the expected result of reducing overweight and obesity at a faster rate when MVPA becomes a daily habit. This study therefore recommends a daily MVPA as a lifestyle among student population. Longitudinal studies are needed to investigate trends and impact of changes in eating behaviours and physical activities on BMI using the Health Belief Model (HBM) as framework.

References

1. WHO (2000) Obesity: preventing and managing the global epidemic. Report of a WHO consultation. World Health Organ Tech Rep Ser 894: 1-253.

2. Michael L (2013) A literature Review of Role of Obesity in Adult Health with Reference to Africa. African J of Food, Agr, Nutri and Devel 13: 7088-7104.

3. Ford ES, Li C, Zhao G, Tsai J (2011) Trends in obesity and abdominal obesity among adults in the United States from 1999-2008. Int J Obes (Lond) 35: 736-743.

4. Tremblay MS, Katzmarzyk PT, Willms JD (2002) Temporal trends in overweight and obesity in Canada, 1981-1996. Int J Obes Relat Metab Disord 26: 538-543.

5. Revital, Gross S, Greenberg JB, Rabiniwitz J, Gordon B, et al. (2011) Disparities in obesity temporary trends of Israeli Adolescents by ethnic origin. Int J Pedic Obes 6: e154-e161.

6. Ning X, Zhan C, Yang Y, Yang L, Tu J, et al. (2014) Secular trends in prevalence of overweight and obesity among adults in rural Tianjin, China from 1991 to 2011: a population-based study. PLoS One 9: e116019.

7. Abubakari AR, Lauder W, Agyemang C, Jones M, Kirk A, et al. (2008) Prevalence and time trends in obesity among adult West African populations: a meta-analysis. Obes Rev 9: 297-311.

8. Adderley-Kelly B (2007) The prevalence of overweight and obesity among undergraduate health sciences students. ABNF J 18: 46-50.

9. Cutillas AB, Herrero E, Eustaquio AS, Zamora S, Perez-Llamas F (2013) Prevalence of underweight, overweight and obesity, energy intake and dietary caloric profile in University Students from region of Murcia (Spain). Nutr Hosp 28: 683-689.

10. Zafar S, ul Haque I, Butt AR, Mirza HG, Shafiq F, et al. (2007) Relationship of body mass index and waist to hip ration measurements withhypertension in young adult medical students. Pak JMed Sciec 23: 1-9.

11. Sakamaki R, Toyama K, Amamamoto R, Liu CJ, Shinfuku N (2005) Nutritional Knowledge, Food habits and attitude of Chinese University students: a cross sectional study. Cenral Nutri J 4: 1-9.

12. Karl P, Pengpid S (2012) Body Weight and Body Image among a Sample of Female and Male South African University Students. Gender & Behaviour 10.

13. Park JH, Yoon SJ, Lee H, Jo HS, Lee SI, et al. (2006) Burden of disease attributable to obesity and overweight in Korea. Int J Obes (Lond) 30: 1661-1669.

14. WHO (2005) Obesity Task Force. Global strategy on diet, physical activity and health: obesity and overweight.

15. Cavaco S, Eriksson T, Skalli A (2014) Life cycle development of obesity and its determinants in six European countries. Econ Hum Biol 14: 62-78.

16. Centre for Disease Control (CDC) (2011) Higher Income and Education Levels linked to better Health.

17. van der Merwe MT, Pepper MS (2006) Obesity in South Africa. Obes Rev 7: 315-322.

18. Kaester R (2007) Obesity: obesity causes, consequences and public solution.

19. Reddy SP, Ken R, James S, Funani NI, Nilen NSK, et al. (2012) Rapid increases in overweight and obesity among South African Adolescents: Comparison of data from the South African Youth Risk Behaviour Survey in 2002 and 2008. Am J Public Health 102: 262-268.

20. Teshome T, Singh R, Moges D (2013) Prevalence and associated factors of overweight and obesity among urban communities of Hawassa, Southern Ethiopia. J Nutr Food Sci 5: 397.

21. Dalton KA (2013) 'Students' consumption of healthy food items using a social marketing intervention', Master's thesis.

22. Public Health Agency of Canada (2014) Obesity in Canada-Healthy Living-Determinants and contributing factors.

23. Krisela S (2007) Heart Disease in South Arica. Chronic Diseases of lifestyle. Medical Research Council, publishing.

24. Mulvihill C, Quigley R (2003) The management of obesity and overweight. An analysis of reviews of diet, physical activity and behavioural approaches, Evidence briefing.

25. Murray C (2014) Institute for Health Metrics and Evaluation, University of Washington, USA.

26. Pengpid S, Peltzer (2014) Prevalence of overweight/obesity and central obersity and its associated factors among a sample of University students in India. Obes res clin prac 8: e558-e570.

27. Steyn NP, Senekal M, Brtis S, Nel J (2000) Urban and rural differences in dietary intake,weight status and nutritional knowledge of black female students. Asia Pacific J Clin Nutr 9: 53-59.

28. Lubell J (2012) Study links lower education levels to higher obesity rates. American Medical News.

29. Stephens S (2013) More education, not income, fights obesity. Health behaviour news service (HBNS). Am J Hea Prom.

30. Labree W, van de Mheen D, Rutten F, Rodenburg G, Koopmans G, et al. (2015) Differences in Overweight and Obesity among Children from Migrant and Native Origin: The Role of Physical Activity, Dietary Intake, and Sleep Duration. PLoS One 10: e0123672.

31. Dabrowska J, Dabrowska-Galas M, Naworska B, Wodarska M, Plinta R (2015) The role of physical activity in preventing obesity in midlife women. Prz Menopauzalny 14: 13-19.