Trends in prevalence & determinants of overweight and obesity among women of reproductive age in Zimbabwe, 2005–2015

Fadzai Mukora-Mutseyekwa[1]
Hajo Zeeb[2, 3]
Lydia Nengomasha[4]
Nicholas Kofi Adjei[1, 2,3]

For submission to
Population Association of America annual meeting
Austin, TX, April 10-13, 2019

[1] Africa University Clinical Research Centre, Zimbabwe; mutseyekwaf@africau.edu
[2] Health Sciences Bremen, University of Bremen; adjei@leibniz-bips.de
[3] Leibniz Institute for Prevention Research & Epidemiology -BIPS, Germany.zeeb@leibniz-bips.de
[4]Africa University Department of Health Sciences, Zimbabwe;nengomashal@africau.edu

Abstract

Background: The prevalence of non-communicable diseases is rising in Low and Middle-Income Countries (LMICs) such as Zimbabwe, yet, the risk factors associated with overweight and obesity among women in the country have not been explored. This study investigated the trends in prevalence and demographic, socioeconomic and behavioral risk factors of overweight and obesity among Zimbabwean women of reproductive age (15-49 years) from 2005 - 2015.

Methods: Data from the 2005/2006, 2010/2011 and 2015 Zimbabwe Demographic and Health Survey (ZDHS) were analyzed. Multiple logistic regression models were used to examine the associations between demographic, socioeconomic, behavioural risk factors and obesity and overweight (body mass index [BMI] ≥ 25.0 kg/m^2). We further estimated the prevalence of overweight and obesity over the period covered by the surveys.

Results: The prevalence of overweight and obesity increased substantially from 25.0% in 2005 to 36.6% in 2015. Some of the risk factors for overweight and obesity were older age, being married, high economic status, being employed, residence in the urban areas and alcohol use. Educational attainment and smoking status were not associated with overweight and obesity across all surveys.

Conclusions: We provide the first detailed analysis of trends and risk factors for overweight and obesity between 2005 and 2015 among women in Zimbabwe. The findings indicate that women of reproductive age are at high – and increasing - risk of excess weight. Thus, prevention and control measures are needed to address the high prevalence of overweight and obesity in Zimbabwe.

Keywords

Obesity, Overweight, Determinants, Trends, Non-communicable diseases, Zimbabwe

Background

The prevalence of non-communicable diseases (NCDs) is on an upward trajectory in many Low and Middle-Income Countries (LMICs) and it is projected that NCDs will be the leading cause of death in every region globally by 2030 [1].

Obesity is associated with increased risk for various important NCDs such as diabetes, certain types of cancer and cardiovascular diseases (CVD) like hypertension, coronary heart disease, and stroke [1]. The World Health Organization (WHO) defines a person to be overweight if their Body Mass Index (BMI) is >25kg/m^2, and obese if BMI is ≥30kg/m^2[2]. It has been estimated that overweight and obesity contributed to 3.4 million global annual deaths, 3.9 % of years of life lost and 3.8 % of global disability-adjusted life years (DALYs) in 2010 [3,4].

Worldwide prevalence of obesity was noted to have tripled between 1975 and 2016 with women being particularly affected [5]. Among women globally, a significant increase in the prevalence of excess weight has been observed over a relatively short period, with the proportion of women with overweight and obesity increasing from 29.8 to 38% between 1980 and 2013 [6]. In Sub Saharan African (SSA) in particular, prevalence of obesity and overweight have also been increasing at alarming pace [7]. A 2015 review of obesity in SSA shows that while overweight and obesity rates are increasing in all African regions, Southern Africa is most affected [8]. A recent analysis of Demographic and Health Survey (DHS) data from 32 SSA countries revealed a pooled prevalence of overweight of 15.9 %, ranging from 5.6% in Madagascar to 27.7% in Swaziland. Obesity ranged from 1.1% in Madagascar to 23% in Swaziland [9].

In developing countries, an association has been found between socioeconomic inequalities and the risk factors for NCDs such as obesity [10]. In the SSA 32-country DHS analysis, wealth index (rich vs. poor) was the strongest predictor for overweight and obesity among women in most of the countries [9]. Other respective demographic factors that have been implicated as key determinants of overweight and obesity in other studies in LMICs include urban residence, high education and older age [9,11–14]. Of note is the observation that these socioeconomic status associations of overweight/obesity are different compared to some Western High-Income-Countries where overweight and obesity are generally concentrated in lower socioeconomic strata [15,16].

Prior literature shows that socioeconomic status, age, parity, marital status, physical inactivity, bodyweight perceptions, and increased energy intake to be factors highly predictive of excess weight in SSA [8,17]. Results from epidemiologic data have shown mixed relationship between excessive body weight and other lifestyle factors such alcohol consumption or smoking. For alcohol, the general consensus in more recent literature is that consumption patterns as well as the effect of other risk exposures such as high-fat diet, sedentary behaviors have to be taken into account when reporting associations [18–20]. It has been shown in some studies that smoking is associated metabolically with adverse fat distribution resulting in higher abdominal circumferences and waist-hip ratios [21]. However, other studies suggested that the prevalence of overweight and obesity is significantly lower among current smokers compared to non-smokers [22]. This complex relationship also emerged in a longitudinal study carried out in South Africa [23]. Smoking was associated with larger baseline waist circumference yet showed lower BMI increase rate over time. Findings confirmed that smoking cessation was significantly associated with BMI increase pointing towards the need for concurrent weight loss support for individuals who quit smoking.

Even though sound epidemiologic data are scarce, NCDs are recognised to be an important public health issue in Zimbabwe, coming second on the prioritization list in the current National Health Strategy (2016-2020). In terms of implementation, however, limited effort has been invested towards addressing overweight and obesity or its risk factors. This study aimed to describe the trends in the prevalence of overweight and obesity among Zimbabwean women aged 15 to 49. The investigation of prevalence and trends is crucial to inform advocacy efforts on the need for political prioritization of interventions aimed at mitigation of risk factor exposure and enabling lifestyle modification. This study also sought to explore the social, demographic, economic and lifestyle risk factors of overweight and obesity in this population, as this has not been explored nor documented in Zimbabwe at the scale made possible by the DHS dataset so far. Findings should therefore also provide evidence to direct policy-makers and implementers to tailor their interventions for this public health problem towards the appropriate socio-demographic groups.

Methods

Data

The data used in the present study were derived from the 2005/2006, 2010/2011 and 2015 Zimbabwe Demographic and Health Survey (ZDHS). These surveys were undertaken by the Zimbabwe National Statistical Agency, and they were nationally representative surveys of men and women in their reproductive age. The surveys used a two-stage stratified cluster sampling method based on census enumeration areas (EAs) and household samples. The first stage was the selection of EAs with probability proportional to the size. The second stage involved household selection, where households were selected based on the EAs. For this study, we limited our sample

to non-pregnant women aged 15-49 years whose anthropometric measurements were taken at the time of surveys. The samples for the final analyses after the exclusions were (survey year: 2005/2006; n=8,185), (survey year: 2010/2011; n=8,448) and (survey year: 2015; n=9,066).

Measurement of outcome variable

The outcome variable was overweight and obesity. This variable was derived from the body mass index data of non-pregnant women in the various surveys. The body mass index [BMI; weight (kg)/height (m) squared] is a widely used measure for defining overweight and obesity [2]. According to the WHO standard cut-offs, a BMI of 25.0-29.9 kg/m^2 is classified as overweight, and a BMI $\geq$ 30.0 kg/m^2 is classified as obese (ibid). In this study, women with a BMI of 25.0 kg/m^2 or above were categorized as overweight and obese and coded "1" while those below 25.0 kg/m^2were categorized otherwise and coded "0".

Independent variable

The independent variables used in this study were categorized into three groups: Socioeconomic status (SES), demographic and behavioural factors. SES was measured using three indicators: Wealth (poorest, poorer, middle and richer), Educational level (no formal education, primary, secondary or higher education), Employment status (currently employed, not currently employed). The demographic factors included age (15-19, 20-24, 25-29, 30-34, 35-39, 40+) and marital status (never married, currently married, living together, widowed, divorced or separated). Tobacco smoking and alcohol consumption were the two behavioural factors considered. Currently smoking (yes or no), was defined as smoking at least one cigarette or any form of tobacco a day over the past 30 days. Currently drinking (yes or no), was also defined as consuming one or more bottles of alcoholic drink in a week. Other explanatory variables include the place of residence (rural or

154 urban) and region or province. Administratively, Zimbabwe has been divided into ten regions or
155 provinces.
156
157 *Statistical Analysis*
158 Both descriptive and regression analyses were performed in this study. The first part of the analysis
159 was primarily descriptive, where prevalence and trends of overweight and obesity were calculated.
160 In the second part, binary logistic regression models were fitted to examine the associations
161 between the independent variables and the outcome variable. The binary logistic models estimate
162 the probability of the outcome variable (overweight and obesity) to be 1 (h=1). More formally, the
163 conditional probability of experiencing the event (overweight and obesity) can be expressed as:

164 $$pr(h=1|x)=\frac{\exp(x\beta)}{1+\exp(x\beta)}$$

165 Prevalence and odds ratios with 95% confidence intervals (95% CI) were calculated using Stata
166 Version 14 (Stata Corp, College Station, Texas, USA).
167

168 ## Results

169 *Trends over time in the prevalence of overweight and obesity*

170 The prevalence of overweight and obesity (BMI $\geq$ 25.0 kg/m^2) by socioeconomic status (SES),
171 demographic and behavioural factors is shown in Table 1.

172 **[Insert table 1 about here]**
173

The prevalence of overweight and obesity increased substantially from 25.0% in 2005 to 36.6% in 2015. Age showed a marked and continuous increase in the trend of the prevalence of overweight and obesity across all surveys. While the highest increase from 2005 to 2015 was among those who were 35 years and above, the prevalence decreased slightly from 15.5% in 2010 to 13.7% in 2015 for the 15-19 years age groups. Regarding marital status, while the prevalence remains relatively unchanged among never-married women between 2010 (20.2%) and 2015 (19.3%), it increased remarkably among married and cohabiting women over the same period from 37.9% to 44.3%.

Similar observations were made when stratifying data by socioeconomic status (SES) of women. Although the prevalence of overweight and obesity was relatively lower among the poorest, we observed a slight increase in the prevalence among this sub-group from 14.3% in 2005 to 19.1% in 2015. Meanwhile, the prevalence of overweight and obesity among the rich increased considerably from 38.5% in 2005 to 49.5% in 2015 (**Figure 1**). Considering employment status, the prevalence of overweight and obesity was higher among women who were employed. While the prevalence of overweight and obesity showed a substantial increase from 41.0% in 2010 to 46.9% in 2015 among those who were currently employed, it basically remained stable (2010: 28.6%; 2015: 29.3%) among those who were not employed. Regarding educational attainment, we observed that the prevalence of overweight and obesity was fairly similar across all educational levels and the trends did not show a consistent pattern across the sub-groups.

[Insert figure 1 about here]

The trend analysis also showed a consistent increase in the prevalence of overweight and obesity over time for the behavioural factors. Current smokers had the highest prevalence of overweight

and obesity during the entire period (2005-2015). The prevalence increased substantially from 22.1% in 2005 to 51.0% in 2015. Current drinkers of alcohol had the highest prevalence of overweight and obesity in 2015 (55.3%). However, due to the unavailability of data for alcohol consumption before 2015, we could not examine trends for those consuming alcohol.

An exploration with respect to place of residence showed that women in the urban areas had the highest prevalence. However, we observed an increase in prevalence of overweight and obesity among women who live in the rural areas from 18.9% in 2005 to 28.5% in 2015. Nevertheless, the prevalence of overweight and obesity showed a striking geographical pattern where overweight and obesity were most frequent in provinces or regions that are mostly urban. For instance, provinces such as Harare, Bulawayo, and Manicaland had the highest prevalence of overweight and obesity, and it increased gradually over the period covered by these surveys.

Logistic regression

The results of the adjusted OR and 95% CI for the relationship between demographic factors, socioeconomic status, behavioural factors and overweight and obesity are shown in Table 2.

[Insert table 2 about here]

Relationship between socioeconomic status and demographic factors with overweight and obesity

Results from Table 2 revealed that wealth and employment status were the two important socioeconomic determinants of overweight and obesity. Interestingly, educational attainment was

not associated with overweight and obesity across all surveys. The wealth index showed a positive association with overweight and obesity and a consistent gradient was found. Richer women had higher odds of being overweight and obese (aOR=3.02; 95% CI=2.34–3.90) for 2005 (aOR=2.95; 95% CI=2.39–3.64) for 2010 and (aOR=3.48; 95% CI=2.79–4.33) for 2015 compared to the poorest. We also observed a strong association between employment status and overweight and obesity. Women who were employed were slightly more likely to be overweight and obese (aOR=1.26; 95% CI=1.12–1.41) for 2005 and (aOR=1.18; 95% CI=1.07–1.31) for 2015 compared to those who were not employed.

Regarding demographic factors, Table 2 shows that age is another important determinant of overweight and obesity. Older women (40+) years were more than 5 times likely to be overweight and obese e.g. aOR=5.55 (95% CI=4.48–6.86) in 2015 compared to younger women (15-19) years. We also found marital status to be strongly associated with overweight and obesity, where married women had higher odds of being overweight and obese at all survey waves (aOR ranging from 1.42 to 1.89) compared to never married women.

The regression analysis also confirmed the role of geographical area or location. Women living in the rural areas were about 30% less likely to be overweight and obese than their counterparts in the urban areas. For instance, those from the largely rural Mashonaland West province were less likely to be overweight and obese (aOR=0.79; 95% CI=0.69–0.91) in 2015 than residents from the Manicaland Province.

Overweight and obesity and potential modifiable risk factors

Smoking cigarette or any form of tobacco had no significant association with the risk of being overweight or obese over the period covered by the surveys. Meanwhile, we found that non-consumers of alcoholic beverages were much less likely to be overweight and obese (aOR=0.49; 95% CI=0.38–0.64) in 2015 compared to those who consume alcoholic beverages.

Discussion

According to the most recent ZDHS (2015), women in Zimbabwe exhibit a high prevalence of overweight and obesity (1 in every 3 women aged 15 to 49). The evidence over time has persistently shown that the burden of excess weight is higher among women than in men [6,24–26]. In Zimbabwe, the prevalence among women (35%), is considerably higher than their male counterparts at 12% [27]. In this study, we explored the trends in the prevalence of overweight and obesity among Zimbabwean women aged 15 to 49. We further examined the social, demographic, economic and lifestyle risk factors of overweight and obesity in this population.

Our study revealed a substantial 11.6 percentage point increase in the prevalence of overweight and obesity among women of reproductive age in Zimbabwe from 2005 to 2015. Several previous studies have also reported obesity and overweight to be on the rise in other developing countries [6,28,29]. The dire public health implication of these findings is the predictable risk of a high burden of obesity related morbidity and mortality in the future.

We found, older age of women, being married, higher wealth status, being employed and urban residence to be significantly associated with overweight and obesity; but no significant association

could be established between excess weight and level of education and smoking. Notably, however, even among 'lower-risk' groups such as women of lower wealth status or those residents in rural areas, trends still show a steady increase in the prevalence of overweight and obesity over time.

Our age-related findings are in line with the literature which consistently shows the prevalence of overweight and obesity to be higher in older women [14,30,31]. It has been advanced that as women grow older they tend to engage in less physical activity and consume a higher intake of energy [32].

Associations between marital status and overweight have been found in our and numerous other studies [14,17,31]. Married women are likely to have higher parity which may be linked to adopting more sedentary lifestyle [31]. It is also suggested that women tend to be offered high energy foods during the postpartum period [31]. Other explanations are that while unmarried people devote more time to exercise and eat healthy [33], their married counterparts lack this motivation and spend more time on sedentary activities [17]. In Zimbabwe, cultural notions advance the expectation of weight gain among women following marriage, considered a sign of contentment in a happy union.

Women in higher economic position were also seen to have higher odds of being overweight or obese. Although this finding is not in keeping with literature from some developed world settings where higher SES has been shown to be associated with reduced risk of excess weight [15,16], it is consistent with studies conducted in other LMICs [9,14,31]. In the latter setting, these economic sub-groups tend to be more exposed to unhealthy lifestyle choices because they find access to energy-dense foods more affordable while also more likely to follow a sedentary lifestyle. Studies suggest that although wealthier women may be exposed to resources & education on healthy lifestyles, and their knowledge may not automatically translate into practice because of several

socio-cultural barriers [29,34]. Cultural norms biased towards fatter body size have been advanced as significantly contributing towards the observed excess weight SES differences in Africa[35].

Physical activity related to occupation is known to be protective against excess weight [36]. Employed women in our study had higher odds of overweight and obesity. In the 2005 Zimbabwe STEPS survey, 57% of employed women reported physical inactivity during working hours (defined as work involving mostly sitting or standing with walking for no more than 10 minutes at a time). Job characteristics such as irregular schedules, shift work, short breaks, lack of physical job demands, and limited food options have been shown to be among the contributors to poor eating and exercise behaviors at the workplace [37]. Work environments for most employed Zimbabwean women tend to support inactive pursuits such as sitting at the market-place and selling wares or office work.

Contrary to findings in most of the literature from similar settings, level of education did not emerge as an important factor for being obese and overweight among Zimbabwean women. We noted that this observation may be stirred on by the generally high literacy levels pegged at 88.2% among women aged 15+ according to 2014 data from the United Nations Educational Scientific & Cultural Organization (UNESCO) [38]. Elsewhere in similar settings, prevalence of overweight and obesity seems significantly higher among women who have attained at least high school education and above [11,14,31] which is thought to be explained by the resultant shifts from manual labor to more sedentary occupations among the more educated [31].Residence in the urban areas also emerged as a key determinant of overweight and obesity among Zimbabwean women in this study. This is alarming given the ongoing urbanization in Zimbabwe in similar countries. It is projected that by 2020, half of the African population will be residing in urban environments [39], and the increasing level of urbanization in Africa, with its associated nutritional transition including increased access

to fast food outlets [39], has been cited as one of the most important factors contributing to the emerging prevalence of overweight and obesity in the region[8,17].

Rural residents are more likely to access healthier fresh and more natural food options [9]. It has also been suggested, however, that rural women are just unable to afford enough food due to raised food prices resulting from hostile economic environments and climate change in most developing countries[40,41].

A significant statistical association was found between alcohol consumption and overweight and obesity among Zimbabwean women of reproductive age. Although the evidence for this relationship is conflicting in different places, a relationship between heavy alcohol consumption and excessive weight has been found repeatedly [19,20]. In our analysis, smoking did not emerge a predictor for overweight and obesity among Zimbabwean women aged 15 to 49, with an overall very low prevalence (1%) of smoking among women in Zimbabwe compared to 17% among men[27]. Other studies in countries with higher smoking frequencies among women showed current smokers had decreased odds of being overweight or obese compared to nonsmokers, however among overweight/obese women, heavy daily smokers were the most vulnerable for abdominal obesity [42,43].

Strengths and limitations

The major strength of this study is that nationally representative DHS data was used. The DHS survey employs standardised data collection protocols administered by trained study personnel with standardized measurement equipment using validated questionnaires. Nonetheless, some study limitations were also observed. Because secondary data was used, information on other

important behavioural factors that could have explained the prevalence of excess weight in this population was not available. This includes diet (nutritional history) and physical inactivity. Data on alcohol consumption was only available for the most recent ZDHS (2015). Additionally, causality of associations cannot be established because of the cross-sectional methodology employed in the DHS. There was also no data on waist circumference which would have allowed examination of trends in central obesity.

Conclusions

We provide the first evidence of trends and associations between risk factors and overweight and obesity among women of reproductive age in Zimbabwe between 2005 and 2015. The findings indicate that women of reproductive age are at high risk of being obese, and long-term adverse health consequences are foreseeable if the trends remain uncurbed.

Public health interventions particularly targeting employed/ well to do/older/ married/ urban women with weight reduction, lifestyle modification and maintenance strategies as well as setting based interventions are urgently needed to address the high prevalence of overweight and obesity in Zimbabwe.

References

1. WHO: Global Status Report on Noncommunicable Diseases 2014 [Internet]. World Health Organization; Available: http://www.who.int/nmh/publications/ncd-status-report-2014/en/ (2014)

2. WHO Obesity: preventing and managing the global epidemic. World Health Organization; 2000 pp. 1–253. Report No.: 894.

3. Lim SS, Vos T, Flaxman AD, et al. A comparative risk assessment of burden of disease and injury attributable to 67 risk factors and risk factor clusters in 21 regions, 1990–2010: a systematic analysis for the Global Burden of Disease Study, 2010. Lancet. 2012;380: 2224–60. doi:10.1016/S0140-6736(12)61766-8

4. Stevens GA, et al. National, regional, and global trends in adult overweight and obesity prevalence. Popul Health Metrics. Popul Health Metr. 2012;10. doi:10.1186/1478-7954-10-22

5. Obesity and overweight. In: World Health Organization [Internet]. [cited 20 Aug 2018]. Available: http://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight

6. Ng M, Fleming T, Thomson B, et al. Global, regional and national prevalence of overweight and obesity in children and adults 1980-2013: A systematic analysis. Lancet. 2014;384: 766–781. doi:10.1016/S0140-6736(14)60460-8

7. Abubakari AR, Lauder W, Agyemang C, et al. Prevalence and time trends in obesity among adult West African populations: a meta-analysis. Obes Rev. 2008;9: 297–311. doi:10.1111/j.1467-789X.2007.00462.x.

8. Agmeyang C, Boatemaa S, Agyemang FG, de-Graft AA. Metabolic Syndrome. Metabolic Syndrome. Switzerland: Springer International Publishing; 2015.

9. Neupane S, Prakash KC, Doku DT. Overweight and obesity among women: analysis of demographic and health survey data from 32 Sub-Saharan African Countries. BMC Public Health. 2016;16. doi:10.1186/s12889-016-2698-5

10. Sommer I, Gieber U, Mahlknecht P, Thaler K, Bouskill K, Gartlehner G, et al. Socioeconomic inequalities in non-communicable diseases and their risk factors: an overview of systematic reviews. BMC Public Health. 2015;15. doi:10.1186/s12889-015-2227-y

11. Abdhalah KZ, Jean CF, Rhoune O. Abdhalah KZ, Jean CF, Rhoune O. Overweight and obesity in urban Africa: A problem of the rich or the poor? BMC Public Health. 2009;9. doi:10.1186/1471-2458-9-465

12. Campbell T. Emerging disease burdens and the poor in cities of the developing world. J Urban Health. 2007;84: 54–64. doi:10.1007/s11524-007-9181-7

13. Sodjinou R, Agueh V, Fayomi B. Obesity and cardio-metabolic risk factors in urban adults of Benin: relationship with socio-economic status, urbanization, and lifestyle patterns. BMC Public Health. 2008;8. doi:10.1186/1471-2458-8-84

14. Tebekaw Y, Colon-Ramos U, Teller CH. Rising Overweight-Obesity and its socio-demographic correlates in Addis Ababa, Ethiopia, 2000-2011. Poster Session 7. Sheraton, New Orleans; 2013. doi:10.13140/2.1.1559.9044

15. Roskam A-JR, Kunst AE, Van Oyen H, Demarest S, Klumbiene J, Regidor E, et al. Comparative appraisal of educational inequalities in overweight and obesity among adults in 19 European countries. Int J Epidemiol. 2010;39: 392–404. doi:10.1093/ije/dyp329

16. McLaren L. Socioeconomic status and obesity. Epidemiol Rev. 2007;29: 29–48. doi:10.1093/epirev/mxm001

17. Sartorius B, Veerman LJ, Manyema M, Chola L, Hofman K. Determinants of Obesity and Associated Population Attributability, South Africa: Empirical Evidence from a National Panel Survey, 2008-2012. PLOS ONE. 2015;10: e0130218. doi:10.1371/journal.pone.0130218

18. Suter PM, Tremblay A. Is alcohol consumption a risk factor for weight gain and obesity? Crit Rev Clin Lab Sci. 2005;42: 197–227. doi:10.1080/10408360590913542

19. Sayon-Orea C, Martinez-Gonzalez MA, Bes-Rastrollo M. Alcohol consumption and body weight: a systematic review. Nutr Rev. 2011;69: 419–31. doi:doi: 10.1111/j.1753-4887.2011.00403.x

20. Traversy G, Chaput J-P. Alcohol Consumption and Obesity: An Update. Curr Obes Rep. 2015;4: 122–130. doi:10.1007/s13679-014-0129-4

21. Fujiyoshi A, Miura K, Kadowaki S, Azuma K, Tanaka S, Hisamatsu T, et al. Lifetime cigarette smoking is associated with abdominal obesity in a community-based sample of Japanese men: The Shiga Epidemiological Study of Subclinical Atherosclerosis (SESSA). Prev Med Rep. 2016;4: 225–232. doi:10.1016/j.pmedr.2016.06.013

22. Xu F, Yin X-M, Wang Y. The association between amount of cigarettes smoked and overweight, central obesity among Chinese adults in Nanjing, China. Asia Pac J Clin Nutr. 2007;16: 240–247.

23. Cois A, Day C. Obesity trends and risk factors in the South African adult population. BMC Obes. 2015;2. doi:10.1186/s40608-015-0072-2

24. Kamadjeu RM, Edwards R, Atanga JS, et al. Anthropometry measures and prevalence of obesity in the urban adult population of Cameroon: an update from the Cameroon Burden of Diabetes Baseline Survey. BMC Public Health. 2006;6. doi:10.1186/1471-2458-6-228

25. Omran AR. The epidemiologic transition theory: a preliminary update. J Trop Pediatr. 1983;29: 305–16. doi:10.1093/tropej/29.6.305

26. Popkin BM, Doak CM. The obesity epidemic is a worldwide phenomenon. Nutr Rev. 1998;56: 106–14. doi:10.1111/j.1753-4887.1998.tb01722.x

27. Zimbabwe Demographic and Health Survey 2015: Final Report. Rockville, Maryland, USA: Zimbabwe National Statistics Agency (ZIMSTAT) and ICF International; 2016.

28. Kelly T, Yang W, Chen C-S, Reynolds K, He J. Global burden of obesity in 2005 and projections to 2030. Int J Obes 2005. 2008;32: 1431–1437. doi:10.1038/ijo.2008.102

29. Subramanian SV, Perkins JM, Özaltin E, Davey Smith G. Weight of nations: a socioeconomic analysis of women in low- to middle-income countries. Am J Clin Nutr. 2011;93: 413–421. doi:10.3945/ajcn.110.004820

30. Uthman OA. Patterns, distribution, and determinants of under- and overnutrition among women in Nigeria: a population-based analysis. J Public Health. 2009;17: 289–99.

31. Abrha S, Shiferaw S, Ahmed KY. Overweight and obesity and its socio-demographic correlates among urban Ethiopian women: evidence from the 2011 EDHS. BMC Public Health. 2016;16. doi:10.1186/s12889-016-3315-3

32. Alemu E, Atnafu A, Yitayal M, Yimam K. Alemu E, Atnafu A, Yitayal M, Yimam K. Prevalence of Overweight and/or obesity and associated Factors among High School Adolescents in Arada Sub city, Addis Ababa, Ethiopia. J Nutr Food Sci. 2014;4.

33. Kruger HS, Venter CS, Vorster HH, Margetts BM. Physical inactivity is the major determinant of obesity in black women in the North West Province, South Africa: the THUSA study. Transition and Health During Urbanisation of South Africa. Nutr Burbank Los Angel Cty Calif. 2002;18: 422–427.

34. Griffiths P, Bentley M. Women of higher socio-economic status are more likely to be overweight in Karnataka, India. Eur J Clin Nutr. 2005;59: 1217–1220. doi:10.1038/sj.ejcn.1602228

35. Gupta N, Goel K, Shah P, Misra A. Childhood obesity in developing countries: epidemiology, determinants, and prevention. Endocr Rev. 2012;33: 48–70. doi:10.1210/er.2010-0028

36. Monda KL, Adair LS, Zhai F, Popkin BM. Longitudinal relationships between occupational and domestic physical activity patterns and body weight in China. Eur J Clin Nutr. 2008;62: 1318–1325. doi:10.1038/sj.ejcn.1602849

37. Strickland JR. Enhancing Workplace Wellness Efforts to Reduce Obesity: A Qualitative Study of Low-Wage Workers in St Louis, Missouri, 2013-2014. Prev Chronic Dis. 2015;12. doi:10.5888/pcd12.140405

38. United Nations Educational Scientific & Cultural Organizationn. Adult literacy rate, population 15+ years (both sexes, female, male). In: UIS Data Centre [Internet]. [cited 20 Aug 2018]. Available: http://data.uis.unesco.org/Index.aspx?DataSetCode=EDULIT_DS&popupcustomise=true&lang=en#

39. Kennedy G, Nantel G, Shetty P, Food and Agriculture Organization of the United Nations. Globalization of food systems in developing countries: impact on food security and nutrition. FAO Food Nutr Pap. 2004;83: 1–300.

40. Popkin BM. The nutrition transition: an overview of world patterns of change. Nutr Rev. 2004;62: S140-143.

41. Popkin BM, Lu B, Zhai F. Understanding the nutrition transition: measuring rapid dietary changes in transitional countries. Public Health Nutr. 2002;5: 947–953. doi:10.1079/PHN2002370

42. Patel K, Hargreaves MK, Liu J, Schlundt D, Sanderson M, Matthews CE, et al. Relationship Between Smoking and Obesity Among Women. Am J Health Behav. 2011;35: 627–636.

43. Tuovinen E-L, Saarni SE, Männistö S, Borodulin K, Patja K, Kinnunen TH, et al. Smoking status and abdominal obesity among normal- and overweight/obese adults: Population-based FINRISK study. Prev Med Rep. 2016;4: 324–330. doi:10.1016/j.pmedr.2016.07.003

463 **Table 1.** Prevalence of overweight and obesity by demographic, socioeconomic and behavioural risk factors
464 among women of reproductive age (15-49 years), Zimbabwe, 2005-2015

Variables	2005/2006 (n=8,158)	2010/2011 (n=8,448)	2015 (n=9,066)
	Overweight&Obese (%)	Overweight&Obese (%)	Overweight&Obese (%)
Age			
15-19	11.5	15.5	13.7
20-24	18.2	22.9	25.5
25-29	25.7	34.9	37.5
30-34	31.9	41.1	47.5
35-39	37.7	44.3	52.3
40+	39.7	52.2	52.3
Marital Status			
Never married	15.4	20.2	19.3
Currently married	28.8	37.9	44.3
Living together	35.0	32.3	44.3
Widowed	32.9	41.4	46.0
Divorced/separated	24.7	35.7	40.3
Place of residence			
Urban	35.5	44.5	46.5
Rural	18.9	26.0	28.4
Educational Level			
Noeducation	26.9	36.3	32.6
Primary	21.9	30.3	29.7
Secondary and higher	26.4	34.0	29.7
Employment Status			
Not currently employed	21.6	28.6	29.3
Currently employed	30.6	41.0	46.9
Wealth (Index)			
Poorest	14.3	18.7	19.1
Poorer	17.0	25.0	25.2
Middle	25.0	25.0	37.8
Richer	38.5	45.4	49.5
Region			
Manicaland	26.9	34.3	35.8
Mashonaland Central	14.7	26.0	33.3
Mashonaland East	22.1	28.2	33.3
Mashonaland West	20.5	29.6	33.2
Matebeleland North	16.1	24.7	30.2
Matebeleland South	24.6	26.3	31.8
Midlands	21.3	32.5	34.2
Masvingo	20.9	31.0	35.1
Harare	36.2	47.0	47.7
Bulawayo	36.2	44.0	45.2
Currently Smoking			
Yes	22.1	34.6	51.0
No	25.0	33.0	36.5
CurrentlyDrinking			
Yes	-	-	55.3
No	-	-	35.8
Total	**25.0**	**33.0**	**36.6**

Table 2. Multivariate associations between demographic, socioeconomic, behavioural risk factors and overweight and obesity among women of reproductive age (15-49 years), Zimbabwe, 2005-2015

Variables	2005/2006	2010/2011	2015
	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Age			
15-19 (ref)			
20-24	1.41 (1.14-1.74)***	1.29 (1.06-1.57)**	1.51 (1.24-1.83)***
25-29	2.25 (1.78-2.85)***	2.35 (1.92-2.88)***	2.46 (2.01-3.01)***
30-34	3.13 (2.46-4.01)***	3.06 (2.47-3.79)***	3.64 (2.95-4.48)***
35-39	4.03 (3.12-5.20)***	3.82 (3.05-4.78)***	4.59 (3.68-5.72)***
40+	5.28 (4.11-6.79)***	5.66 (4.54-7.06)***	5.55 (4.48-6.86)***
Marital Status			
Never married (ref)			
Currently married	1.42 (1.18-1.71)***	1.53 (1.30-1.81)***	1.89 (1.61-2.22)***
Living together	1.73 (1.12-2.67)**	1.20 (0.86-1.68)	1.18 (0.86-1.63)
Widowed	1.11 (0.86-1.44)	1.07 (0.83-1.37)	1.34 (1.03-1.75)*
Divorced/separated	1.01 (0.77-1.29)	1.26 (1.01-1.54)*	1.36 (1.11-1.68)**
Place of residence			
Urban (ref)			
Rural	0.73 (0.59-0.90)**	0.64 (0.54-0.75)***	0.79 (0.69-0.91)***
Educational Level			
Noeducation (ref)			
Primary	0.97 (0.74-1.27)	1.01 (0.74-1.38)	1.13 (0.70-1.84)
Secondaryandhigher	1.14 (0.85-1.51)	1.08 (0.79-1.48)	1.32 (0.82-2.13)
Employment Status			
Not currently employed (ref)			
Currently employed	1.26 (1.12-1.41)***	1.08 (0.97-1.21)	1.18 (1.07-1.31)***
Wealth (Index)			
Poorest (ref)			
Poorer	1.24 (1.01-1.53)*	1.56 (1.29-1.88)***	1.45 (1.19-1.76)***
Middle	1.76 (1.45-2.14)***	2.14 (1.80-2.55)***	2.34 (1.96-2.79)***
Richer	3.02 (2.34-3.90)***	2.95 (2.39-3.64)***	3.48 (2.79-4.33)***
Region			
Manicaland (ref)			
Mashonaland Central	0.49 (0.37-0.64)***	0.68 (0.54-0.84)***	0.93 (0.75-1.15)
Mashonaland East	0.69 (0.53-0.88)**	0.72 (0.57-0.89)**	0.87 (0.70-1.08)
Mashonaland West	0.61 (0.48-0.79)***	0.75 (0.60-0.92)**	0.81 (0.66-1.01)*
Matebeleland North	0.68 (0.51-0.90)**	0.83 (0.65-1.06)	0.93 (0.74-1.17)
Matebeleland South	0.97 (0.75-1.25)	0.81 (0.65-1.02)	0.87 (0.69-1.09)
Midlands	0.64 (0.51-0.81)***	0.92 (0.75-1.14)	0.91 (0.74-1.12)
Masvingo	0.86 (0.68-1.09)	1.01 (0.80-1.25)	0.98 (0.80-1.21)
Harare	0.86 (0.68-1.10)	0.99 (0.80-1.24)	1.13 (0.93-1.38)
Bulawayo	0.85 (0.65-1.10)	0.96 (0.75-1.21)	0.98 (0.78-1.21)
Currently Smoking			
Yes (ref)			
No	1.69 (0.95-3.02)	1.44 (0.77-2.67)	0.82 (0.44-1.52)
CurrentlyDrinking			
Yes (ref)	-	-	
No	-	-	0.49 (0.38-0.64)***
Observations	8,158	8,448	9,066
Pseudo R2	0.1119	0.1150	0.1410

Log Likelihood	-4072.5443	-4741.7493	-5113.3932

Notes: aOR- adjusted Odd Ratio, *** p<0.001, ** p<0.01, * p<0.05.

Figure 1. Prevalence of overweight and obesity by wealth index among women of reproductive age (15-49 years), Zimbabwe, 2005-2015