

# Body mass index and associated lifestyle and eating behaviours of female students at a South African university

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**Objective:** To determine the prevalence of obesity and the physical activity, sitting time, and eating behaviours associated with BMI in a group of undergraduate female students at a South African university.

**Methods:** A cross-sectional study of 110 female undergraduate students, registered at the University of the Witwatersrand, Johannesburg. Validated self-reported questionnaires were used for physical activity and eating behaviours; and body mass index (BMI) was collected using standardised methods.

**Results:** The presence of obesity in the sample was 17.3%, with a mean BMI of  $25.4 \pm 4.63$  kg/m<sup>2</sup>. Those with BMIs  $\geq 25$  kg/m<sup>2</sup> were less likely to be physically active and purchase fruits than those with normal BMIs. Close proximity to food vendors ( $\leq 500$ m) ( $\beta$ : 0.25), peer influence ( $\beta$ : 0.26), sitting time ( $\beta$ : 0.20) and purchasing fried foods  $\geq 4$  times/week ( $\beta$ : 0.87) were positively associated with BMI (all  $p < 0.05$ ).

**Conclusion:** Given the period of susceptibility and potential for shaping healthy behaviour, public health initiatives addressing obesity should target the high sitting times of students and eating behaviour, particularly during the period of transition from adolescence to adulthood.

**Keywords:** eating behaviour, female, obesity risk, South Africa, university students

## Background

South Africa is an example of a sub-Saharan African country undergoing epidemiological transition, characterised by an increasing prevalence of obesity. Evidence on the determinants of this disease is growing,<sup>1</sup> but data on the aetiology of the disease in young adults are limited. Young adulthood is a period of human development characterised by a myriad of influencing factors which help to shape adolescents into mature adults, positively or otherwise.<sup>2</sup> It is also an important period in which to consider the obesity risk in the population.<sup>2</sup> It is also an important period in which to consider the obesity risk in the population. Given that a relatively large proportion of the South African young adult population attend tertiary institutions and that there is a higher risk of overweight and obesity in females compared with males,<sup>3</sup> the purpose of this study was to determine the prevalence of the disease and behavioural correlates of body mass index (BMI) of a cohort of females registered for undergraduate degrees at a selected South African university. Our hypothesis was that those with obesity have higher sitting times, less physical activity and poor eating behaviour choices compared with lean participants.

## Methods

### Participants

This cross-sectional study included 110 female students registered for undergraduate degree programmes at the University of the Witwatersrand, Johannesburg. All female students were eligible, but only those who provided written consent were included. For the purposes of this study, food vendors were defined as food outlets that are officially sanctioned by the university governing body to sell food and beverage products within the confines of the university grounds. The human research ethics committee at this institution granted

permission to conduct the study (ethical clearance number: M160496). Simple anthropometry, body mass index (BMI) and waist and hip circumference were collected as per standard procedures. Normal, overweight and obese BMI status was defined as BMI values  $\geq 18.5$  and  $< 25$ ,  $\geq 25$  to  $< 30$ ,  $\geq 30$  kg/m<sup>2</sup>, respectively. The validated global physical activity questionnaire (GPAQ) was used to calculate participants' self-reported moderate vigorous physical activity (MVPA), a value composed of the sum of total MVPA during work, active travel and recreation.<sup>4</sup> The GPAQ was also used to elicit the sitting time (mins/day) of the sample. Eating behaviour was collected using an adapted food frequency questionnaire,<sup>5</sup> including questions on food purchasing behaviour and frequency of food items purchased. Descriptive statistics and multivariable linear regression analyses were used. Statistica® version 13 (Tibco Software Inc, Palo Alto, CA, USA) was used for all analyses and significance was determined at  $p < 0.05$ .

## Results

The mean age of the sample was  $21.4 \pm 3.29$  years (Table 1), and 32.3% of the participants were in their first year of study. Mean BMI and mean waist circumference were  $25.4 \pm 4.63$  kg/m<sup>2</sup> and  $70.6 \pm 18.2$  cm, respectively. The presence of overweight and obesity in the sample was 37.3% and 17.3%, respectively, while 45.5% of the sample were considered to have a normal BMI ( $< 25$  kg/m<sup>2</sup>). This groups with normal BMIs were more likely to be physically active compared with the overweight or obese groups ( $p < 0.05$ ), and less likely to purchase a high amount from food vendors or to purchase due to pressure from peers. Sitting time was not different between the groups, but MVPA was significantly lower in the overweight and obese categories compared with those in the normal category ( $< 0.05$ ). Those in the overweight/obese groups were also more likely to eat less fruit and buy more fried foods ( $p < 0.05$ ).

**Table 1:** Sample characteristics, lifestyle behaviour and eating behaviours by BMI category

	Total sample (n = 110)	Normal (n = 50)	Overweight (n = 41)	Obese (n = 19)
Proportion of sample (%)	100%	45.5	37.3	17.3
Age (years)	21.4 ± 3.29	21.3 ± 3.14	20.9 ± 2.57	23.0 ± 4.50
<b>Anthropometry:</b>				
BMI (kg/m <sup>2</sup> )	25.4 ± 4.63	21.3 ± 2.37	27.3 ± 1.39*	32.2 ± 2.20***
WC (cm)	70.6 ± 18.2	59.7 ± 15.8	75.1 ± 14.3*	89.5 ± 10.7***
HC (cm)	83.2 ± 21.8	70.8 ± 19.5	87.6 ± 15.4*	106 ± 16.8***
<b>Physical activity measures:</b>				
Sitting time (mins/day)	330 (240, 420)	300 (240, 420)	360 (240, 420)	360 (240, 480)
MVPA (mins/week)	190 (90, 582)	370 (108, 600)	190 (120, 582)*	90 (60, 240)*
<b>Eating behaviour:</b>				
Do you walk less than 500 m to get to the food vendor (Yes, %)	69.1	56	75.6*	89.5**
Do you spend more than R100/week on purchases at the food vendor (Yes, %)	15.5	20	9.75	15.8
Do you feel that the food bought at the food vendors is mostly considered as unhealthy? (Yes, %)	92.7	92	92.7	94.7
Do you feel that you buy food from vendors because your friends are buying? (Yes, %)	20.9	12	19.5	47.4**
<b>Frequency of purchases from food vendors:</b>				
Low (%)	23.6	57.7	23.1	19.2
Moderate (%)	33.6	62.2	32.4	5.4
High (%)	42.7	25.5	48.9	25.6
<b>Food vendor purchases/week</b>				
Vegetables	3.39 ± 1.87	3.84 ± 2.11	3.02 ± 1.54	3.00 ± 1.67
Salads	2.21 ± 1.90	2.66 ± 2.01	1.87 ± 1.79	1.74 ± 1.63
Fruits	3.55 ± 2.34	3.88 ± 2.31	3.73 ± 2.66	2.26 ± 0.93*
Fish	1.46 ± 1.45	1.50 ± 1.42	1.39 ± 1.66	1.53 ± 1.07
Meats	3.85 ± 2.28	4.02 ± 2.17	3.73 ± 2.50	3.68 ± 2.14
High frequency fried foods (≥ 4 times/week) (%)	30.9	16	39**	52.6**

\* $p < 0.05$ ; \*\* $p < 0.005$ ; \*\*\* $p < 0.005$  versus normal body mass index (BMI).

Data presented as mean ± SD or median (interquartile range) or percentage.

HC = hip Circumference; WC = waist circumference; MVPA = moderate vigorous physical activity.

In the multivariable linear regression model, 28.4% of the variance in BMI could be explained by a high frequency of fried foods (≥ 4 times/week) ( $\beta$  0.87), purchasing because of friends ( $\beta$  0.26), sitting time ( $\beta$  0.20), and distance ≤ 500 m to the food vendor ( $\beta$  0.22) (all  $p < 0.05$ ).

## Discussion

Obesity risk amongst South Africans is high and growing, particularly in females.<sup>1</sup> The prevalence of overweight and obesity in the present study population was high. The global call to further understand this disease is therefore important and the current study provides some contextual relevance. To the best of our knowledge, this is the first study to examine the influence of eating behaviour on BMI in a cohort of females registered at a South African tertiary institution. Our study findings showed that BMI increases with sitting time, which was not surprising; however, the finding of access to food vendors, type of purchases, and peer pressure was novel. Food vendors on campus have a wide variety of options available, ranging from classic burgers and fries to fresher salad choices. Variations in dietary diversity are also apparent. The presence of these food vendors on campus is competitive and is usually determined through a tender process. These food vendors are visible and usually within walking distance of lecture theatres and residences. Despite the

university's regulations surrounding marketing, such as limiting the branding coverage to specific locations on campus, these vendors seem to be well frequented. This ease of access and close proximity is one of the key reasons for the high prevalence of obesity in the population. The composition of products is wide, but our study shows that the less healthy options are preferred, especially in the overweight and obese groups. Further, the satiety and fulfilment with more energy-dense foods are higher, particularly in the student population who are not entirely economically independent whilst at university.<sup>6</sup> However, the physiological gains of these cheaper foods are usually short-lived due to lower glycaemic indices, resulting in a higher frequency of food purchases to maintain satiety for longer.<sup>6</sup>

Our study also showed that peer influence to purchase foods is associated with BMI. This is another finding that is novel, though the study population is transitioning into adulthood and therefore the potential to be influenced by peers is understandable. Interestingly, a South African study has shown that students may not be following nutritional guidelines, and could be basing their food choices on emotion.<sup>7</sup> This could also explain the high prevalence of unhealthy food purchases in the obese group.

The use of self-reported physical activity and dietary data, although validated, could result in over- or under-reporting, and the small sample size and cross-sectional study design are some limitations worth mentioning.<sup>4</sup> Therefore the findings should be inferred with caution.

### Conclusions

In this study we have highlighted some novel correlates of BMI in a young adult population. Our data suggest that strategies to prevent obesity during this period of developmental transition should be targeted at reducing sedentariness and improving the eating behaviour of students.

### Contributors

All authors contributed to the conceptual design of the study. PJG conducted the study and performed the statistical analysis. All authors wrote and approved the final version of the manuscript.

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### References

1. Ng M, Fleming T, Robinson M, et al. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the global burden of disease study 2013. *Lancet*. 2014;384:766–81. [https://doi.org/10.1016/S0140-6736\(14\)60460-8](https://doi.org/10.1016/S0140-6736(14)60460-8)
2. Patel V, Flisher AJ, Hetrick S, et al. Mental health of young people: a global public-health challenge. *Lancet*. 2007;369:1302–13. [https://doi.org/10.1016/S0140-6736\(07\)60368-7](https://doi.org/10.1016/S0140-6736(07)60368-7)
3. Shisana O, Labadarios D, Rehle T, et al. South African national health and nutrition examination survey (SANHANES-1). S. Cape Town: HSRC Press; 2013.
4. Gradidge PJ, Crowther NJ, Chirwa ED, et al. Patterns, levels and correlates of self-reported physical activity in urban Soweto women. *BMC Public Health*. 2014;14:178. <https://doi.org/10.1186/1471-2458-14-934>
5. Mulligan AA, Luben RN, Bhaniani A, et al. A new tool for converting food frequency questionnaire data into nutrient and food group values: FETA research methods and availability. *BMJ Open*. 2014;4:e004503. <https://doi.org/10.1136/bmjopen-2013-004503>
6. Ali AT, Crowther NJ. Factors predisposing to obesity: a review of the literature. *JEMDSA* 2009;14:81–4.
7. Peltzer K. Nutrition knowledge and food choice among black students in South Africa. *Cent Afr J Med*. 2002;48:4–8.

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