Weight gain, physical activity and dietary changes during the seven months of first-year university life in Malawi

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Abstract

Objective: The objective of the study was to assess weight gain, physical activity and dietary changes during the first year of university life in Malawi.

Setting: The setting was Bunda College of Agriculture, University of Malawi.

Subjects: The subjects were first-year students (n = 47) enrolled for the 2008/2009 academic year.

Method: A prospective cohort study was carried out, with repeated measures (November 2008 and June 2009). It included residential and nonresidential students. Data were collected using self-administered structured questionnaires. Weight, height and mid-upper-arm circumference were measured.

Results: There was a significant difference in mean weight gain between female (7.1 ± 3.2 kg, n = 26) and male students (9.6 ± 3.5 kg, n = 21) (p-value = 0.013). Overall, within the first year of university life, the students gained 8.5 ± 3.6 kg (p-value < 0.001), and a modest but significant height of 0.2 cm (p-value = 0.04). Body mass index (kg/m^2) increased from 20.7 ± 3.2 to 23.9 ± 3.2 (p-value < 0.001). At the baseline, in general, the students lived sedentary lives, with 6.6 hours spent resting, 2.1 hours engaged in light activities, and 0.9 hours engaged in heavy activities. No significant changes were observed at the end of the study. Daily consumption of wheat products, meat and meat products, sugar, milk and milk products and margarine increased, while that of other foods such as fish, and fruits and vegetables declined.

Conclusion: Unprecedented freshman weight gain was observed in this study. Transition to university life in Malawi might be the beginning of poor dietary and lifestyle changes. If not restrained, these could elevate the risk of lifestyle diseases in people who have attained tertiary education and who are important to national development.

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Introduction

Worldwide, there is an understanding that chronic diseases, such as diabetes, stroke, cancer and heart disease, are on the increase in low- and medium-income countries.[1] Although undernutrition and infectious diseases dominate the health agendas of low- and medium-income countries, rapidly changing lifestyles (predominantly sedentary) and calorie-rich diets are increasing the occurrence of overweight and obesity, which are the most important modifiable risk factors of chronic diseases. Sufficient evidence suggests that if weight is well managed and kept within ideal levels, significant reductions in the burden of noncommunicable diseases and associated premature deaths can be realised.[2] It has been argued that even with meagre public healthcare resources, low- and medium-income countries can implement strategies, including weight control, to address the growing problem before it reaches proportions that are difficult to control.[3,4]

The 2004 Malawi Demographic and Health Survey indicated that 11.2% and 2.4% of 15- to 49-year-old women were overweight and obese, respectively.[5] Urban residence and increasing periods of exposure to education and wealth were shown to be associated with overweight and obesity.

University life is associated with the adoption of lifestyles that are likely to be sustained into adulthood. During this period, students transform into adults and start making independent decisions. Consequently, college students engage in various risky health behaviours, including alcohol and tobacco use, physical inactivity

and unhealthy dietary practices which may have negative long-term implications for their health.[6] Despite being considered to be in good health, others extensively take supplements, including vitamins, minerals and herbals and hold poor perceptions about their body shape.[7,8]

Freshman weight gain, colloquially referred to as the "Freshman 15", is a well-established phenomenon that describes the tendency of first-year college students to gain weight, initially believed to be roughly 6.8 kg.[9] While some first-year students gain ≥ 6.8 kg,[10] recent studies have shown that typical weight gain averages between 3.3-3.7 kg.[9-11] Men consistently gain more weight than women.[12] A reduction in physical activity[13,14] and an increased intake of high-calorie foods[15] are major factors that predict weight gain in adolescents, including first-year students.

The authors sought to assess weight gain, physical activity and dietary changes during the first year of university life in Malawi. It was understood that there was a paucity of local data on the contribution of college life to overweight and obesity. The hypothesis was that despite the high prevalence of undernutrition in Malawi, college life exposes first-year students to weight gain which they may sustain into adulthood.

Method

Study area and population

The study was conducted at Bunda College of Agriculture, a constituent college of the University of Malawi, situated 30 km from Lilongwe city centre, the capital of Malawi. In the 2008/2009 academic year, the College enrolled 966 undergraduate students, of whom 302 were first-year students. Eligible participants were 2008/2009 first-year residential and nonresidential students.

Proportionate stratified sampling was used to generate a sample size of 100. Two sets of strata were identified comprising residential and nonresidential students, from which study participants were randomly selected in proportion to the percentage of each stratum. An announcement of the selected participants was made to the class, and the time for data collection agreed upon by both the researcher and the participants. Of the 100 people who were sampled, 62 responded to the call for participation and were assessed in November 2008 [Round 1 (R1)]. At the end of the academic year in June 2009 [Round 2 (R2)], only 47 students had completed the study (75.8%). Therefore, the results are based on the 47 students who provided data for the two rounds to enable repeated measures analysis. Despite the researchers' efforts to publicise the study, the response rate was poor, probably because students did not see the value of participating in such a study. The sample size further declined at the end of the study which coincided with examinations.

Data collection

Data were collected at the beginning of the academic year in November 2008, and at the end of the academic year in June 2009. National policy changes in public universities in Malawi delayed the selection of first-year students into the University of Malawi in 2008. As a result of this, the starting time for this cohort was peculiar since the academic year normally begins in August. A self-administered structured questionnaire was used to collect data on social, demographic, health and physical activity characteristics, as well as food frequency and preferences. Anthropometric measurements of weight, height and mid-upper-arm circumference (MUAC) were taken. A calibrated beam balance (Detecto®, Merr, Montana, USA) was used to measure weight. A microtoise (Microtoise Mabo® 4116, Brevete, France) was used to measure height and a nonstretchable measuring tape was used to measure MUAC. Upon completion of the survey in each round, every participant was given a centrally processed nonalcoholic local beverage worth US$0.35 as a modest token of gratitude for their participation in the study.

Data analysis

Data were entered in Epi Info® 6.04d and analysed in SPSS® for Windows 15 (SPSS, Chicago, Illinois, USA). Weight and height measurements were used to compute body mass index (BMI). Descriptive statistics [mean ± standard deviation (SD) and percentages] were generated to summarise dependent variables. Significant deviations from baseline values were examined using the χ^2-test for proportional differences, while repeated measures analysis of variance was conducted to test for significant differences in the means of continuous dependent variables. The critical value for statistical significance was set at p-value ≤ 0.05.

The homogeneity of variance for weight, height, BMI and MUAC was examined using the Levene's test. All variables yielded nonsignificant results (p-value > 0.05). This suggests that there was equality of variance for each variable. Furthermore, normality of the data was examined using the Shapiro-Wilk test and nonsignificant results (p-value > 0.05) were observed. Therefore, the data were analysed parametrically.

Results

The social and demographic characteristics of the study participants are presented in Table I. Of the 47 students who completed the study, 55.3% were male. The overall mean (± SD) age was 19.0 ± 1.7 years (a range of 15-23 years). During the vacation, most of the students were resident in urban areas (87.2%). Their primary guardians were their parents (78.7%), the majority of whom (90.9%) had a post-secondary education. Those who dropped out of the study had similar characteristics: a mean age 19.2 ± 2.1 years, mean weight 55.7 ± 7.1 kg, mean height 165.8 ±7.6 m and mean BMI 20.3 ± 2.8 kg/m^2.

Anthropometric characteristics and nutritional status

The students' anthropometric characteristics and nutritional status are presented in Table II. In the seven-month period, the students gained an overall weight of 8.5 ± 3.6 kg, more so among male students (9.6 ± 3.5 kg) than female students (7.1 ± 3.2 kg), (p-value = 0.013). There was a modest, but significant, increase in height (0.176 cm, p-value = 0.037), while the increase in MUAC was not significant.

At both the beginning and the end of the study, the average BMI was within normal range. However, a significant three-unit increase towards the higher end of normality was observed at the end of the study (p-value < 0.001). At the beginning of the study, 32 students had a normal BMI, 11 were underweight, three were overweight and one student was classified as obese. By the end of the study, 29 students had a normal BMI, one was underweight, 13 were overweight and three were obese. Only one student lost weight (0.2 kg).

The small sample size restricted the researchers from categorising weight gain into meaningful equal groupings, such as tertiles or quartiles. Based on recent studies, which showed weight gain of approximately 4 kg during the first year,[9,11] arbitrary groups were devised based on a 5-kg weight-gain margin. Therefore, the participants were categorised into two groups: low-weight gainers (those who gained less than 5 kg) and high-weight gainers (those who gained 5 kg or more). There were significantly more high-weight gainers (85.1%) than low-weight gainers (14.9%) ($\chi^2 = 46.3$, p-value < 0.001). When analysed according on the basis gender basis, the results showed that male students were more likely to be high-weight gainers than female students. Students who increased their "very light physical activity" were more likely to be high-weight gainers.

Table I: Socio-demographic characteristics of participants

Characteristic	n	%
Sex		
Male	26	55.3
Female	21	44.7
Region of origin		
North	14	29.9
Centre	16	34.0
South	17	36.1
Residence		
Rural areas	6	12.8
Urban areas	41	87.2
Type of secondary school attended		
Unisex	32	68.1
Co-educational	15	31.9
Guardian		
Parents	37	78.7
Relatives	7	14.9
Self	1	2.1
Others	2	4.3
Guardians' education level		
None	1	1.1
Standard 1-4	0	0
Standard 5-8	1	1.1
Form 1-2	1	1.1
Form 3-4	2	5.8
Post-secondary	40	90.9

Physical activity

Figure 1 shows the mean number of hours that the students spent resting compared to participating in heavy exercise at the beginning (R1) and the end of their first year of college (R2). A slight but nonsignificant increase in the mean resting period was observed in male students (6.17-6.67 hours/day, p-value = 0.36), with no change in female students (7 hours/day). There was also a nonsignificant increase in very light activity by male students (4.13-5.13 hours/day, p-value = 0.31) and female students (4.06-4.35 hours/day, p-value = 0.81). Overall, male students increased the time they spent in each category between R1 and R2, while female students' data portrayed no consistent pattern. However, all the changes were not statistically significant (p-value > 0.05) between rounds. The fact that the hours did not add up to a full day shows that the respondents did not fully account for their daily activities, most likely in the resting and very light exercise categories.

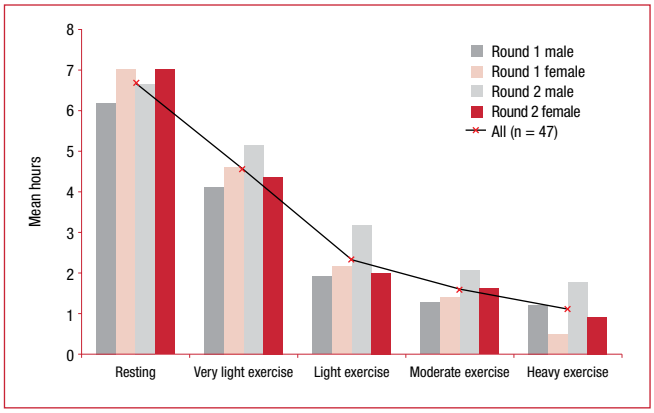

Figure 1: Average number of hours that students spent on usual activities

Table II: Anthropometric characteristics and nutritional status of participants

Variable	Round 1*	Round 2*	Difference**	p-value
Weight (kg)	57.1 ± 8.3	65.6 ± 8.4***	8.5	< 0.001
Height (cm)	166.3 ± 6.5	166.4 ± 6.7***	0.176	0.037
MUAC (cm)	25.9 ± 3.2	26.6 ± 4.1	0.671	0.136
BMI (kg/m^2)	20.7 ± 3.2	24.0 ± 3.2***	3.2546	< 0.001

*: Values are mean ± standard deviation
**: Difference between Round 1 (November 2008) and Round 2 (June 2009)
***: Significantly increased from Round 1
BMI: body mass index, MUAC: mid-upper-arm circumference

Table III: Participants' food frequency

Food or food group	More than once per day (%)		Once per day (%)		3-6 times per week (%)		Once or twice per week (%)		Once per month or less (%)		Never (%)	
	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2	R1	R2
Staples												
Maize meal	40.0	6.8	11.1	0	20.0	43.2	4.4	4.5	17.8	27.3	6.7	18.2
Pasta	0	0	2.3	2.5	9.1	2.5	18.2	10.0	54.5	42.5	15.9	42.5
Rice	8.7	10.9	10.9	19.6	50.0	60.9	26.1	6.5	4.3	0	0	2.2
Wheat products	13.0	24.4	32.6	36.6	21.7	12.2	21.7	2.4	6.5	17.1	4.3	7.3
Roots, e.g. cassava	4.4	2.5	4.4	2.5	20.0	10.0	33.3	7.5	33.3	45.0	4.0	32.5
Tubers, e.g. potatoes	7.0	0	7.0	4.7	25.6	39.5	37.2	23.3	23.3	20.9	0	11.6
Foods from animals												
Eggs	10.6	2.3	8.5	14.9	51.1	55.3	25.5	19.1	2.1	2.1	2.1	4.3
Meat and meat products	12.8	25.5	12.8	10.6	38.3	48.9	27.7	10.6	6.4	2.1	2.1	2.1
Milk and milk products	15.2	48.9	30.4	21.3	28.3	10.6	15.2	8.5	6.5	0	4.3	10.6
Fish	4.3	0	6.4	0	23.4	11.4	44.7	11.4	19.1	36.4	2.1	40.9
Legumes and nuts												
Peas, beans and cowpeas	6.4	0	6.4	6.7	27.7	44.4	42.6	33.3	14.1	4.4	2.9	11.1
Groundnuts	0	0	6.5	6.8	15.2	13.6	39.1	11.4	30.4	34.1	8.7	34.1
Fruits												
Lemons	6.7	0	11.1	5.0	13.3	12.5	35.6	12.5	22.2	30.0	11.1	40.0
Other fruits	9.1	0	22.7	20.9	25.0	25.6	22.7	14.0	11.4	16.3	6.8	23.3
Vegetables												
Dark-green leafy vegetables	31.0	8.9	16.7	26.7	35.7	51.1	7.1	6.7	7.1	2.2	2.4	4.4
Medium-green vegetables	18.6	0	27.9	12.2	20.9	39.0	18.6	22.0	11.6	12.2	2.3	14.6
Light-green vegetables	7.3	4.8	19.5	7.1	29.3	40.5	17.1	19.0	4.6	14.3	12.2	14.3
Indigenous vegetables	12.8	0	15.4	5.3	23.1	7.9	15.4	13.2	28.2	26.3	5.1	47.4
Fats and other food												
Margarine	15.6	13.0	37.8	60.9	26.7	8.7	8.9	0	2.2	2.2	8.9	15.2
Butter	7.1	2.4	35.7	11.9	11.9	14.3	19.0	14.3	14.3	16.7	11.9	40.5
Animal fat	9.8	9.5	17.1	23.8	17.1	26.2	12.2	2.4	26.8	11.9	17.1	26.2
Sugar	41.3	54.5	39.1	25.0	15.2	13.6	4.3	6.8	0	0	0	0
Sugar-sweetened beverages	23.9	17.8	30.4	24.4	26.1	28.9	13.0	22.2	6.5	2.2	0	4.4

Food frequency and preferences

Table III shows the consumption frequency of several food items at the beginning and the end of the first year. The results indicate that there was an increase in the percentage of students who consumed certain foods. The consumption of wheat and meat products almost doubled, 13.0-24.4% and 12.8-25.5%, respectively. There was an increase in the proportion of students who consumed sugar, milk and margarine. The results also showed a decline in the consumption of foods such as fish (44.7-11.4%), dark-green leafy vegetables (31.8-8.9%), indigenous vegetables (12.8-0%), and lemons (6.7-0%) and other fruits (9.1-0%).

Most of the study participants (78.3% in R1; 81.8% in R2) reported eating three meals a day, while 37.0% and 40.0% of participants reported skipping some meals in R1 and R2, respectively. Breakfast was most likely to be skipped by the majority of the students in both R1 (76.5%) and R2 (64.3%).

Table IV shows food preferences among students. The most preferred foods, i.e. those that were consumed often by at least two-thirds of the respondents, were rice, eggs, meat and meat products, milk and milk products, medium-green vegetables and sugar (R1), and rice, meat and meat products, milk and milk products, margarine and sugar (R2). The least preferred foods, i.e. those that were rarely consumed by at least one-third of the respondents, were maize meal and animal fat, although the trend of maize meal appears to average out across the two rounds for all three descriptions of preference.

Discussion

In this study, the researchers sought to assess weight gain, physical activity and dietary changes during the first year of university life in Malawi. To the best of the authors' knowledge, this is the first time that an attempt has been made to characterise the effect of first-year university life on dietary practices and nutrition indicators

Table IV: Participants' food preferences

Foods	Eat often (%)		Eat sometimes (%)		Rarely eat or do not like (%)	
	R1	R2	R1	R2	R1	R2
Maize meal	48.9	34.1	35.6	31.7	15.6	34.1
Pasta	15.6	11.4	60.0	56.8	24.4	29.5
Rice	73.3	87.0	26.7	13.0	0	0
Wheat products	47.6	61.0	38.1	31.7	14.3	7.3
Roots, e.g. cassava	13.6	7.3	75.0	65.9	11.4	26.8
Tubers, e.g. potatoes	41.3	39.5	58.7	51.2	0	9.3
Eggs	73.9	64.4	19.6	31.1	6.5	4.4
Meat and meat products	69.6	84.1	26.1	13.6	4.3	2.3
Milk and milk products	69.6	82.6	23.9	13.0	6.5	4.3
Fish	47.8	30.2	45.7	41.9	6.5	25.6
Peas, beans and cowpeas	55.6	42.2	26.7	51.1	17.8	6.7
Groundnuts	28.6	17.8	57.1	53.3	14.3	26.7
Lemons	51.1	13.3	42.2	61.4	6.7	22.7
Other fruits	25.7	50.0	57.1	41.3	17.1	8.7
Dark-green leafy vegetables	56.4	61.7	43.6	34.0	0	4.3
Medium-green vegetables	63.6	28.6	29.5	59.5	4.5	11.9
Light-green vegetables	42.2	41.5	44.4	46.3	11.1	12.2
Indigenous vegetables	32.6	27.3	53.5	47.7	11.6	25.0
Margarine	25.6	68.9	48.7	26.7	20.5	4.4
Butter	48.9	22.0	42.2	58.5	8.9	19.5
Animal fat	37.2	31.0	44.2	35.7	18.6	33.3
Sugar	82.6	73.3	13.0	20.0	4.3	6.7
Sugar-sweetened beverages	63.0	48.9	34.8	46.7	2.2	4.4

among students at the University of Malawi. The study showed an unprecedented weight gain of 8.5 kg in the 2008/2009 freshman cohort at Bunda College of Agriculture.

Child malnutrition is a significant public health concern in Malawi. 47.1% of children under the age of five years (40.7% in urban, and 48.2% in rural areas) are stunted,12.8% are underweight and 4% are wasted.[16] According to the World Health Organization,[17] these rates are classified as high to very high, suggesting that despite the fact that most of the students' guardians were reported to have a post-secondary education, poor nutrition could still manifest in this population. This is evidenced by the fact that 23.4% of the students were underweight at the beginning of college life. This decreased to 2.2% seven months later. This is not surprising in Malawi, as indicators for undernutrition have remained poor for many decades.[18]

This study showed nonsignificant changes in the amount of time that was allocated to various activity categories. Men showed an increase in the time that was spent on every type of activity between R1 and R2, while women's data portrayed no consistent pattern. The small sample size reduced the statistical power of the study. This made it difficult to observe statistically significant differences between the rounds.

Typically, physical activity accounts for approximately 25-35% of total energy expenditure,[19] depending on the type of activity performed and the time spent on it. Resting activities expend the least energy, while heavy activities expend more.[20] Jung et al[14] observed that a reduction in physical activity is a defining characteristic in freshman weight gain. Surprisingly, this is contrary to the results of the present study, where despite increased physical activity, there was a positive energy balance. One of the limitations of this study was that researchers did not account for energy and nutrient intake, which could have helped to provide further insight into the most important contributors to the weight gain that was observed. A previous study showed that, among other reasons given, university students used supplements to supply energy.[8] Although this was not investigated in this study, it is possible that there were other dietary practices in which students engaged and which the researchers did not capture. These might have ultimately increased the positive energy balance. From the present study, it appears that the respondents did not fully account for their daily activities since the hours did not add up to a full day. It is likely that they underestimated the time spent resting and participating in very light exercises. This is a commonly encountered challenge of self-administered questionnaires. The results on physical activity and its implications for energy balance in this population should be interpreted cautiously.

Despite the average BMI being within the normal range (18.5-24.9 kg/m^2) throughout the study period, the increase from 21-24 kg/m^2 within a seven-month period is worrisome but not surprising, considering the overall weight increase of 8.5 kg against a 0.2 cm increase in height. With no further substantial linear growth expected in this population, the BMI increase is concerning, particularly as the students did not make a deliberate effort to attain an ideal body weight. The majority of them might not even know what this should be. Initially, the researchers planned to collect data annually. However, the high drop-out rate forced them to terminate the study. Therefore, it is not known whether or not there were further increases in weight as the students moved into higher years. The authors hypothesised that having survived the first year of university, which is the most difficult year for students, the rate of weight gain would substantially decrease as the students continued with their studies. After the first year, students tend to engage in more physical activity such as sport as a result of having more time because of a decline in academic pressure, although they may maintain their first-year dietary practices. These propositions warrant a more detailed follow-up study.

A reduction in the consumption of fruits and vegetables was observed (see Table III). In Malawi, it is not uncommon for the consumption of foods such as vegetables and legumes to be neglected, because of the "*ndinadya kale ndiri mwana*" ("I already consumed a lot of these in my childhood") phenomenon, which is partly evident in Table III. Because of widespread economic deprivation, vegetables and legumes constitute a significant portion of people's diets in Malawi until they are able to afford other foods, particularly meats, wheat

products and processed foods. The results contrast with a study of Chinese university students which showed a higher consumption of fruits (32.5%) and vegetables (47.9%).[21] Similarly, a study on university students in Hong Kong showed an increased consumption of fruits (36.4%) and vegetables (55%).[22] These results reaffirm the generally held cautious wisdom that dietary behavioural patterns should not be generalised across societies, cultures and times, unless empirically demonstrated.

The present study provides the university, and possibly other public tertiary institutions in Malawi, with a framework that should be considered when developing and implementing initiatives that aim to improve the health of students, especially first-year students. Lifestyle issues such as healthy eating and weight management should form part of such a comprehensive programme.

This study should be interpreted with caution, because there was a high (24.2%) drop-out rate. This limited both statistical conclusions and external validities. Originally, the researchers aimed to repeat the study using the same subjects every year until they graduated. This project was derailed by the high attrition rate at the end of the first year, apparently due to disinterest in continuing with the study. The study also did not determine energy and nutrient intake, which compounded the challenge of explaining the observed weight gain. However, in spite of the limitations, insights into the risk of overweight and obesity have emerged from this study.

Conclusion

This study has shown that, as in other countries in which similar studies were conducted, transition to university life in Malawi might be the beginning of poor dietary and lifestyle changes which, if not restrained, could exacerbate the risk of lifestyle diseases in people who have attained a tertiary education and who are important to national development. Malawian public universities should consider developing and implementing programmes that aim to improve student health, beginning in the first year.

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