

# Dietary intake of first- and third-year female dietetics students at a South African university

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**Objective:** A survey was undertaken to evaluate and compare dietary intakes of first- and third-year female dietetics students.

**Design:** This was a cross-sectional survey.

**Setting:** The University of Pretoria (UP) was the site of the survey.

**Population:** The study encompassed first- (2012–2015) and third- (2012–2017) year female dietetics students ( $N = 368$ ).

**Outcome:** Dietary intake data from multiple-day weighed food records were analysed on nutrient, food group and meal and snacking pattern levels.

**Results:** Recorded energy intakes of participants ( $n = 105$  first years,  $n = 166$  third years; response rate: 73.6%) were below Estimated Energy Requirements. Across year groups, intakes exceeded and fell below the Acceptable Macronutrient Distribution Range for fat and carbohydrates respectively; however, third years consumed cereals, grains and starchy vegetables more often. Over 50% of first and third years exceeded Estimated Average Requirements of respectively 3 and 6 of 10 tested micronutrients. Third years recorded higher (all  $p < 0.001$ ) intakes of protein, magnesium, calcium, zinc and vitamin A than first years. Similarly, their Nutrient Adequacy Ratios were higher (all  $p < 0.001$ ) for magnesium, calcium and vitamins A, B6 and B12. Average Mean Adequacy Ratios were 70% (first years) and 77% (third years). The year groups differed in terms of food group intake. The number of daily eating occasions decreased over weekends for first and third year students, yet intakes of energy ( $p < 0.05$ ) and fat ( $p < 0.001$ ) were higher over weekends.

**Conclusions:** Amidst likely under-recording and/or under-eating, UP female dietetics students' intakes of some micronutrients may be low. Recorded intakes of third years exceeded those of first years. Recorded nutrient intake improved from the first to the third year of the study in dietetics students.

**Keywords:** dietary intake, eating occasion, mean adequacy ratio (MAR), nutrient adequacy ratio (NAR), weighed food record (WFR)

## Introduction

There has been an increase in non-communicable diseases (NCDs) worldwide,<sup>1</sup> where they are one of the leading causes of death.<sup>2</sup> Chronic diseases, traditionally associated with older adults and the elderly, are presenting at an earlier age.<sup>3</sup> In South Africa, the general population does not meet dietary recommendations, largely due to a lack of dietary diversity.<sup>4</sup>

Students in post-secondary education make up a large number of the adult population, and have been found to be a group at risk of NCDs.<sup>5</sup> University students tend to consume unhealthy diets. This has been found in international studies,<sup>6,7</sup> in the African setting<sup>8,9</sup> and also in South Africa.<sup>10,11</sup> Eating habits at university can track into later life and may hence be part of an increased risk of developing NCDs.<sup>10–13</sup> Poor intakes of fruit, vegetables and dairy have been reported for most students together with high intakes of fats and sweets/sugar.<sup>10,11</sup> Poor diets of university students may, additionally, be associated with poor mental health<sup>14</sup> and academic performance.<sup>15</sup>

Students studying to be healthcare professionals, including dietetics students, can have an impact on the dietary intake and lifestyles of patients and clients when they have graduated and practise as healthcare professionals.<sup>10</sup> The professionals' own dietary intakes are important, because if they are seen to be making healthy food choices their own risk of developing NCDs will decrease and the patient or client may be more

inclined to eat a healthier diet,<sup>16</sup> thus decreasing their risk for NCDs too. Dietary intake has also been reported to be influenced by nutrition knowledge and improves as students' studies progress.<sup>17,18</sup> Informed by the work of Van der Kruk,<sup>17</sup> the researchers hypothesised that diets of dietetics students change as they become more senior and their nutrition knowledge increases.

The aim of this study was to evaluate and compare dietary intakes of first- and third-year female dietetics students at the University of Pretoria (UP). Dietary intake was conceptualised in terms of energy and nutrient intakes, intakes of food groups, and meal and snacking patterns.

## Methods

### Study design, setting and participants

A cross-sectional study of female students enrolled for the four-year degree in dietetics at the UP was conducted. The study commenced in 2012 and continued for four years for the first-year students and for six years in the third-year group. A total of 368 students were registered in two designated core modules in the specified periods. All these students were invited to participate. For the third-year students, the food recording was an academic activity, but they could volunteer on a confidential basis and without the knowledge of the module lecturer to make their records available for the study.

Ethical clearance was obtained from the UP Faculty of Health Sciences Research Ethics Committee in 2011 (S196C/2011) with an amendment in 2018 (2/2018).

### **Dietary assessment**

Data were collected using non-consecutive, multiple-day weighed food records (WFR). Since the target group was dietetics students, the use of WFR records was deemed appropriate as these students could be assumed to possess the necessary nutrition literacy, numeracy and motivation. They would also benefit by gaining food description and quantification skills. Per participant, the recording period included one to two weekdays and one weekend day in the period March to May every year. This allowed first-year students to adjust to university life and suited the third-year students' semester programme. The individuals who did not pass the previous year were excluded from the study as they had already taken part in the study. Apart from food description, the time and date of food intake had to be indicated in a study-specific recording booklet. Students who did not own a food scale were provided with a digital A5-sized scale for unobtrusive and immediate weighing of food. Detailed written instructions and standardised training – including a demonstration of using the scale's tare function to correct, for example, for plate weight and waste – were provided. One experienced dietitian entered all data into FoodFinder3<sup>19</sup> using consistent coding rules over time, which did not contain fortified foods. Based on the time of food consumption, each intake was assigned to one of seven predefined eating occasions: early morning (before 06:00), breakfast (06:00–10:00), in-between (10:00–12:00), lunch (12:00–15:00), afternoon (15:00–17:00), supper (17:00–21:00) and late-night (after 21:00).

### **Data analysis**

The WFR data were exported via Microsoft Excel (Microsoft Corp, Redmond, WA, USA) to IBM SPSS Statistics 25 (IBM Corp, Armonk, NY, USA).<sup>20</sup> Energy and nutrient intakes were evaluated by comparing the mean total daily intakes across the recording days to relevant Dietary Reference Intakes (DRI),<sup>21</sup> assuming an active physical activity level (PAL) of 1.6, as dietetics students had to move between two campuses and walk large distances on each campus between classes. In most cases the DRI referred to the Estimated Average Requirement (EAR). Iron was compared with the Recommended Dietary Allowance (RDA), as intakes should not be assessed using the EAR cut-point method in women of childbearing age.<sup>22</sup> Nutrient Adequacy Ratios (NAR) were calculated by dividing each participant's mean daily intake of 10 selected nutrients (calcium, folate, iron, magnesium, riboflavin, vitamins A, B6, B12 and C and zinc) across the recording days by the relevant Recommended Dietary Allowance, expressed as a percentage. Mean Adequacy Ratio (MAR) was calculated by dividing the sum of the NAR (capped at 100%) by 10 (number of nutrients investigated) and multiplied by 100.<sup>23,24</sup>

Ten food groups were extracted from the codes integral to FoodFinder3, with the following adjustments: legumes and legume products were grouped with nuts and seeds; all eggs, meat and meat products, fish and seafood were grouped together into protein-rich foods; and fruit juices were added to beverages. The other food groups consisted of cereals, grains and starchy vegetables; milk and milk products; fruit; all other non-starchy vegetables; fats, oils; and sugar, sweets and syrups. Meal and snacking patterns were operationalised in terms of the time of day an eating occasion occurred per

day,<sup>25</sup> where meals referred to breakfast, lunch and supper, and snacks referred to intakes in all other periods. In addition, weekday compared with weekend day intakes formed part of the description of dietary patterns. Following tests for normality (Kolmogorov–Smirnov test), Mann–Whitney U, Pearson's chi-square and Fisher's exact tests were performed to compare the first- and third-year groups' intakes. Wilcoxon 2-sided signed rank test was done to compare nutrient and food group intakes during the week with intakes over the weekend.

## **Results**

### **Study participants**

In total 283 students consented to participate in the study. Four participants were excluded due to incomplete WFRs and eight male records were excluded due to the small number of participants, resulting in a final sample size of 271 (final response rate: 73.6%, including 105 first-year students and 166 third-year students). From the final sample, 38 first-year students and one third-year student recorded only two days' intake. One weekday record was missing from both year groups. Two and nine weekend days were missing from the first- and third-year groups respectively.

### **Energy and nutrient intakes**

Intakes were not normally distributed and therefore central tendency and dispersion are reported as medians and interquartile ranges (IQR).

From Table 1 it is evident that the reported median energy intake of first- and third-year students was below the EER (66% and 69% of the EER of first- and third-year students respectively). For both year groups the NAR was lowest (about 50%) for folate, and over 80% for zinc and vitamins B6 and B12. Third-year students recorded higher (all  $p < 0.001$ ) intakes of protein, magnesium, calcium, zinc and vitamin A than first-year students. The mean MAR for the first-year students was 70% and 77% for the third-year students.

According to Table 2 most students fell within the Acceptable Macronutrient Distribution Range (AMDR)<sup>21</sup> for protein. Just more than a third of the first-year students and just under half of the third-year students exceeded the AMDR for fat. Conversely, more third-year students fell below the AMDR for carbohydrates compared with first-year students.

Figure 1 shows the proportion of first- and third-year students who exceeded the EAR for the selected micronutrients. It is evident that, overall, a higher percentage of third-year students' intakes exceeded the EAR compared with first-year students, yet for calcium, magnesium and folate less than 50% of both year groups' intakes reached the EAR.

The total median iron intakes were about 10 mg for both first- and third-year students, which is roughly 55% of the age and sex-appropriate RDA of 18 mg.

### **Food group intakes**

Table 3 shows the median total number of times per day a food group was recorded by the first- and third-year students. Only in respect of the food group 'sugar, sweets and syrups' did the year groups not differ significantly from another. For all the other food groups, third-year students' median total intakes were significantly (at least  $p < 0.05$  for all) higher than those of first-year students.

Table 1: Dietary intakes and NAR of first- ( $n = 105$ ) and third- ( $n = 166$ ) year students

Energy and nutrients	Median (IQR)		% energy contribution		<i>p</i> -value <sup>a</sup>	Mean NAR (%)		DRI
	First years	Third years	First years	Third years		First years	Third years	
Energy (kJ)	6491 (5104.5;7878.1)	6732 (5595.3;7867.7)	–	–	0.334	–	–	9 774 <sup>b</sup>
Total carbohydrates (g)	186 (139.6;232.9)	175 (129.8;220.1)	48.7	44.2	0.101	–	–	130 <sup>c</sup>
Total fat (g)	57 (41.2;72.3)	59 (46.1;71.6)	33.4	33.3	0.179	–	–	–
Total protein (g)	57 (43.2;70.8)	70 (57.8;81.4)	14.9	17.7	< 0.001	–	–	46 <sup>c</sup>
Calcium (mg)	502 (348.4;655.0)	666 (510.7;820.9)	–	–	< 0.001	55	66	800 <sup>d</sup> –2500 <sup>e</sup>
Folate (µg)	167 (103.9;230.1)	186 (132.0;239.0)	–	–	–	49	50	320 <sup>d</sup> –1000 <sup>e</sup>
Iron (mg)	9.8 (7.21;12.32)	10.2 (7.66;12.8)	–	–	0.321	56	59	18 <sup>f</sup>
Magnesium (mg)	218 (169.7;266.3)	246 (198.2;293.0)	–	–	< 0.001*	69	78	255 <sup>d</sup> –350 <sup>e</sup>
Riboflavin (mg)	1.3 (0.82;1.75)	1.3 (0.98;1.640)	–	–	0.820	90	92	0.9 <sup>d</sup>
Vitamin A (µg)	417 (112.4;712.6)	624 (423.9;824.8)	–	–	< 0.001	62	78	500 <sup>d</sup> –3000 <sup>e</sup>
Vitamin B6 (mg)	1.2 (0.79;1.69)	1.4 (1.11;1.70)	–	–	0.031	81	90	1.1 <sup>d</sup> –100 <sup>e</sup>
Vitamin B12 (mg)	2.5 (1.47;3.53)	3.3 (2.33;4.33)	–	–	0.005	85	93	2.0 <sup>d</sup>
Vitamin C (mg)	59 (13.1;104.9)	65 (33.2;96.5)	–	–	0.492	70	75	60 <sup>d</sup> –2000 <sup>e</sup>
Zinc (mg)	7.1 (5.05;9.16)	8.9 (6.95;10.90)	–	–	< 0.001	82	91	6.8 <sup>d</sup> –40 <sup>e</sup>

<sup>a</sup>Mann-Whitney U, <sup>b</sup>Estimated Energy Requirement, <sup>c</sup>adequate intake, <sup>d</sup>Estimated Average Requirements (EAR), <sup>e</sup>upper limit, <sup>f</sup>Recommended Dietary Allowance (RDA). IQR = interquartile range, NAR = Nutrient Adequacy Ratio, DRI = Dietary Reference Intakes.

Cereals, grains and starchy vegetables were consumed most often in both year groups, followed by milk and milk products and then protein-rich foods. Fruit and vegetable intakes combined were consumed a median of 1.7 times per day by first-year students and a median of 3.5 by the third-year students.

### Meal and snack patterns

Table 4 shows that on all six eating occasions from breakfast (06:00–10:00) onwards – on week and weekend days – a large percentage of all students recorded food consumption. Throughout, more third- than first-year students recorded intakes (exception: weekday early morning). In nine of the 14 comparisons this difference was statistically significant (at least  $p < 0.05$ ). Furthermore, per year group, fewer students recorded intakes per eating occasion on the weekend day compared with the first weekday (exception: lunch for first-year students).

Table 5 shows that, for all participants, intakes differed significantly for energy and magnesium ( $p < 0.05$ ) and total fat ( $p < 0.001$ ) on weekdays compared with weekend days. Specifically, in relation to fat intake, further analyses showed this significant

difference referred to saturated, mono-unsaturated, poly-unsaturated and trans fatty acids.

### Discussion

Dietetics students at the UP recorded low total intakes on multiple-day WFR. Differences between first- and third-year students in terms of intakes of nutrients, food groups and dietary patterns were noted.

Energy intakes below recommendations have been noted in previous studies involving students.<sup>26</sup> Whilst this can be a true reflection of actual intake on the recording days, it is unlikely to be reflective of usual intakes. Under-eating to simplify the recording process,<sup>18</sup> under-reporting as a general trait of females and particularly of weight-aware young females,<sup>27</sup> and the assumption of an 'active' PAL could explain the finding. The use of anthropometric data or other biomarkers of energy intake (e.g. doubly labelled water)<sup>28</sup> would have aided in checking the credibility of recorded intake. As it is not known whether the potential under-recording was of a general nature (i.e. affecting all foods similarly) or of a

Table 2: Number of first0 ( $n = 105$ ) and third0 ( $n = 166$ ) year students within and outside acceptable macronutrient distribution range

Macronutrient <sup>a</sup>	Participants within <sup>b</sup> AMDR		Participants outside AMDR			
	First years <i>n</i> (%)	Third years <i>n</i> (%)	First years		Third years	
			Below <sup>c</sup> <i>n</i> (%)	Above <sup>d</sup> <i>n</i> (%)	Below <sup>c</sup> <i>n</i> (%)	Above <sup>d</sup> <i>n</i> (%)
Carbohydrate	73 (69.5)	103 (62.0)	26 (24.8)	6 (5.7)	62 (37.3)	1 (0.6)
Fat	62 (59.0)	85 (51.2)	4 (3.8)	39 (37.1)	1 (0.6)	80 (48.2)
Protein	99 (94.3)	164 (98.8)	6 (5.7)	0 (0.0)	1 (0.6)	1 (0.6)

<sup>a</sup>Excludes alcohol energy, <sup>b</sup>acceptable carbohydrate distribution range: 45%–65% (inclusive); acceptable fat distribution range: 20%–35% (inclusive); acceptable protein distribution range: 10%–35% (inclusive), <sup>c</sup>below lowest value of AMDR (not inclusive), <sup>d</sup>above highest value of AMDR (not inclusive). AMDR = Acceptable Macronutrient Distribution Range.

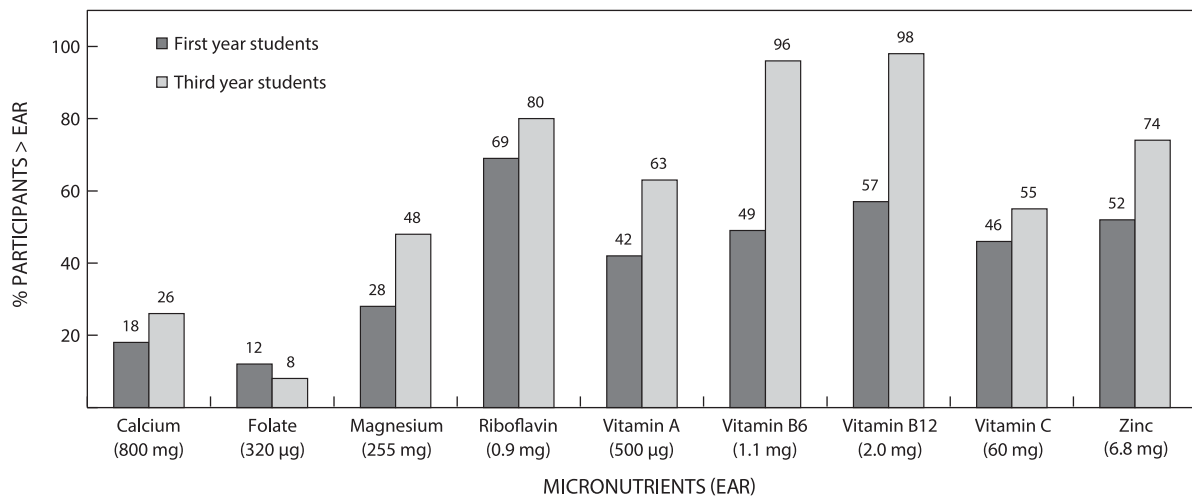


Figure 1: Percentage of first- ( $n = 105$ ) and third- ( $n = 166$ ) year students above the EAR for selected micronutrients.

differential nature (selective under-recording of certain foods or food groups), firm conclusions regarding the (in)adequacy of nutrient intake cannot be made. This is further complicated by uncertainty regarding the number of days necessary to capture usual intake.<sup>21</sup> Nonetheless, the three days of intake are generally considered the minimum.<sup>21</sup>

The energy contribution from the macronutrients is important in evaluating the dietary risk for NCDs.<sup>29</sup> Many students (particularly the third-year students) consumed lower carbohydrate and fat intakes. Similar findings have been reported in other studies amongst students.<sup>11,30</sup> At the time of data collection a 'Banting' style of eating was popular in South Africa and may have also influenced the students' eating habits to consume lower carbohydrates. The lower percentage contribution of energy from macronutrients indicated, however, a similar proportion of energy from fat in both year groups with a lower energy contribution from the carbohydrates in the third-year group. Third-year students consumed cereals, grains and

starchy vegetables more often per day compared with the first-year students, necessitating cautious interpretation.

Micronutrients are not only important in the prevention of nutritional deficiencies, but are also associated with health promotion and the prevention of NCDs.<sup>31</sup> Nutritional gaps found in the diets of South Africans include calcium, iron, magnesium, zinc, riboflavin, vitamin B6, vitamin C, folate and vitamin A.<sup>32,33</sup> On the one hand, despite low energy intakes, the intakes of many micronutrients exceeded the EAR, but, on the other hand, the large proportion of students with median intakes over the recording days below the EAR for calcium, magnesium and folate may put these individuals at risk of micronutrient deficiencies. This is noteworthy when looking at NCD risk, particularly because this was accompanied by few mentions of dairy, fruit and vegetable consumption. Micronutrient intakes changed over time where intakes improved as the students' studies progressed. The challenges associated with evaluating iron intake are well known,<sup>21</sup> yet the importance thereof in this target group is undisputed.<sup>34</sup> Similar to this study, previous research<sup>17,30</sup> reported intakes below recommendations among university students. It is, however, important to note that food and beverage intakes were the focus of the study. Whilst supplement intake will influence the total intake of micronutrients, South African research showed that this was not a common practice among the dietetics students studied.<sup>35</sup>

The finding of better micronutrient intakes among third-year students, compared with students in the first year of studying dietetics, is consistent with a study in Dutch dietetics students.<sup>17</sup> This could be related to improved dietary choices linked to increased nutrition knowledge over time in dietetics students,<sup>17</sup> even though Bernado *et al.*<sup>6</sup> found that students studying nutrition did not consume healthier diets when compared with non-nutrition students. Higher motivation to complete an assignment may also have played a role among the third-year students in this study.

A locally relevant evaluation of food group intake, for example the South African Food Based Dietary Guidelines (SAFBDG), is subjective, because neither the SAFBDG nor the researchers' assessment on food group-level refer to portions or exact quantities consumed. In both year groups, fruit and vegetable intakes combined were less than the common guideline of five times per day, which was also the case in other South African studies where fruit,

Table 3: Total number of times food group intake was recorded per day by first- ( $n = 105$ ) and third- ( $n = 166$ ) year students

Food group	Number of recordings per day median (IQR)		p-value <sup>a</sup>
	First years	Third years	
Cereals, grains and starchy vegetables	3.0 (2.17;3.84)	3.5 (2.84;4.17)	0.03*
Beverages	2.3 (0.83;3.83)	3.3 (2.12;4.54)	< 0.001
Milk and milk products	2.0 (1.00;3.00)	3.0 (2.00;4.00)	< 0.001
Protein-rich foods (including eggs, meat and meat products and fish and seafood)	1.3 (0.83;1.83)	1.7 (1.17;2.17)	< 0.001
Sugar, sweets and syrups	1.3 (0.17;2.50)	1.3 (0.50;2.17)	0.462
Vegetables	1.0 (0.00;2.09)	2.2 (1.17;3.17)	< 0.001
Fruit	0.7 (0.00;1.33)	1.3 (0.67;2.00)	< 0.001
Fats and oils	0.7 (0.00;1.33)	1.0 (0.46;1.54)	< 0.001
Legumes and legume products & nuts and seeds	0.0 (0.00;0.09)	0.0 (0.00;0.34)	0.008

<sup>a</sup>Mann-Whitney U. IQR = interquartile range.

**Table 4:** Number of first- and third-year students recording intakes per eating occasion and day of week

Eating occasion	First weekday			Weekend day		
	First years (n = 104)	Third years (n = 165)	p-value <sup>a</sup>	First years (n = 103)	Third years (n = 157)	p-value <sup>a</sup>
	n (%)			n (%)		
Early morning	12 (11.5)	6 (3.6)	<b>0.012**</b>	1 (0.97)	5 (3.2)	0.408*
Breakfast	90 (86.5)	162 (98.2)	<b>&lt; 0.001**</b>	81 (78.6)	143 (91.1)	<b>0.004**</b>
In-between	82 (78.9)	144 (87.3)	0.066**	72 (69.9)	117 (74.5)	0.414**
Lunch	89 (85.6)	156 (94.6)	<b>0.012**</b>	91 (88.4)	141 (89.8)	0.710**
Afternoon	73 (70.2)	138 (83.6)	<b>0.009**</b>	69 (67.0)	125 (79.6)	<b>0.022**</b>
Supper	95 (91.4)	161 (97.6)	<b>0.020**</b>	94 (91.3)	150 (95.5)	0.160**
Late-night	43 (41.4)	98 (59.4)	<b>0.004<sup>b</sup></b>	40 (38.8)	84 (53.5)	<b>0.021**</b>

<sup>a</sup>Significance of difference across study years are indicated in bold;  $p < 0.05$ , \*Fisher's exact (2-sided), \*\*Pearson chi-square (2-sided asymptotic significance), <sup>b</sup>Both Fisher's exact and Pearson chi-square.

vegetable and dairy intakes were low in most of the students.<sup>10,11</sup> The SAFBDG recommends a daily intake of 'plenty' of fruit and vegetables, making a quantitative comparison challenging. Furthermore, the food groupings in the two approaches are not a perfect match. Evaluating food-based dietary data remains a challenge.<sup>36</sup> Stroebel-Benschop *et al.*<sup>37</sup> found that most students did not meet the recommendations for most food groups. Based purely on mentions in the food records, we cannot conclude on this. The comparison of first- with third-year students did, however, again highlight changes over time.

Meal and snacking patterns in this study investigated the distribution of food intake within a day (eating occasions) and across days (weekday vs. weekend intakes). Frequent eating was common in this investigation, and significantly more so among the third-year students. Studies involving university students often highlight missing breakfast and frequent snacking of mostly unhealthy foods.<sup>38,39</sup> A large proportion of the participants in both the first- and third-year groups reported food intake in the period 06:00–10:00. Gresse *et al.*, using a different

dietary assessment methodology, reported that about half the South African Health Care Sciences students they studied did not usually consume breakfast.<sup>40</sup> Over weekends dietary intakes changed, which was consistent with the findings by Viljoen *et al.*<sup>10,11</sup> Higher energy – particularly higher fat – intakes were recorded as in other South African studies.<sup>10,11</sup> The difference in nutrient intakes between the first- and third-year students may well also have been evident as a difference between weekdays and weekend days, yet this was not statistically analysed.

#### Limitations, strengths and recommendations

The universal limitations of dietary assessments<sup>41</sup> and especially of WFR apply to the study. The study assessed only food and beverage intake. Supplement use may have considerably increased the total micronutrient intake.<sup>42</sup> The risk of deficiency and adherence to macronutrient distribution ranges should be interpreted with caution, as inter- and intra-individual variance was not adjusted for.<sup>43</sup> The comprehensive coverage of many aspects of dietary intake (nutrient, food group and pattern

**Table 5:** Energy and nutrient intakes on weekdays compared with weekend days for the whole group (n = 253)

Energy and nutrients	Weekday median (IQR)	Weekend day median (IQR)	p-value <sup>a</sup>
Energy (kJ)	6429 (5029.5; 7828.5)	6915 (4927.3; 8902.8)	0.043
Total carbohydrates (g)	175 (124.7; 225.3)	177 (130.1; 224.0)	0.956
Total fat (g) <sup>b</sup>	53 (34.8;71.2)	61 (40.5;81.6)	< 0.001
Saturated fatty acids (g)	17.3 (10.48;24.10)	19.8 (12.62;26.90)	< 0.001
Mono-unsaturated fatty acids (g)	16.8 (9.94;23.73)	19.8 (11.94;31.76)	< 0.001
Poly-unsaturated fatty acids (g)	7.4 (2.54;12.16)	8.6 (2.64;14.54)	0.007
Trans fatty acids (g)	0.6 (0.01;1.27)	1.1 (0.11;2.00)	0.01
Total protein (g)	62 (42.1;82.0)	64 (45.0;83.0)	0.128 <sup>c</sup>
Calcium (mg)	545 (343.0;747.0)	576 (364.5;787.5)	0.555
Folate (µg)	177 (105.5;248.5)	170 (99.0;241.0)	0.537
Iron (mg)	9.4 (6.03;12.78)	9.6 (6.15;13.05)	0.597
Magnesium (mg)	233 (167.3;298.8)	207 (149.0;265.0)	0.004
Riboflavin (mg)	1.2 (0.72;1.69)	1.1 (0.62;1.59)	0.650
Vitamin A (µg)	441 (103.8;778.3)	398 (159.5;636.5)	0.202
Vitamin B6 (mg)	1.3 (0.77;1.84)	1.2 (0.65;1.76)	0.961
Vitamin B12 (mg)	2.6 (1.25;3.95)	2.8 (1.4;4.2)	0.480
Vitamin C (mg)	51 (2.8;99.3)	45 (0.5;89.5)	0.199
Zinc (mg)	7.5 (4.79;10.21)	8.0 (5.29;10.71)	0.624

<sup>a</sup>Wilcoxon 2-sided signed rank test, <sup>b</sup> $p < 0.001$  for saturated and mono-unsaturated fatty acids;  $p = 0.007$  for poly-unsaturated fatty acids;  $p < 0.001$  for trans fatty acids. IQR = interquartile range.

level) and the use of three non-consecutive days of food weighing in this target group are a first in South Africa. Future studies should build on knowledge gained, forming the basis of nutrition-focused interventions targeted specifically at dietetics students. Assessing the credibility of recording, for example by applying the Goldberg cut-off,<sup>44</sup> based on more detailed anthropometric measurements, and the comparative advantages of alternative dietary assessments of usual intake, as well as a change in food awareness and knowledge of dietetics students following WFR are needed. This will clarify the role of WFR in this target group as future dietetics nutrition professionals.

## Conclusion

Female dietetics students, particularly the first-year students, recorded low intakes. Consumption of a 'lower-carbohydrate, higher-fat' type-diet was seen, particularly by the third-year students; however, they consumed cereals, grains and starchy vegetables more often, making interpretation challenging. Eating occasions were frequent among first- and third-year students. The number of eating occasions decreased over weekends, yet intakes of energy, macronutrients and some micronutrients increased. The NAR and MAR point to improved nutrient recording and intakes from the first to the third year of study in dietetics students, showing improved intakes as studies progressed.

**Acknowledgements** – The students are thanked for their participation in the study.

**Disclosure statement** – No potential conflict of interest was reported by the authors.

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Received: 29-05-2020 Accepted: 22-10-2021