Enhanced dietary awareness and lifestyle changes in first-year medical students following exposure to problem-based nutrition education

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Abstract

Background

The ever-increasing prevalence of chronic lifestyle-associated diseases has resulted in greater awareness of the importance of preventative medicine and its incorporation as an integral component of modern undergraduate medical curricula. As excessive dietary intake and physical inactivity are widely acknowledged as leading risk factors for the onset of chronic lifestyle-associated diseases, the promotion of a healthy lifestyle is regarded as a priority for today's primary care physicians. For this reason, it was deemed appropriate by the designers of the problem-based learning (PBL) curriculum, which was introduced at the Nelson R. Mandela School of Medicine in 2001, to include a six-week Nutrition theme early in the medical students' five-year curriculum. This study set out to determine the impact of this theme, which included a specific focus on the importance of nutrition in avoiding lifestyle-associated disorders, on the dietary awareness and lifestyle of the 2004 intake of medical students.

Methods

First-year medical students (n = 213) spent the first six weeks of their curriculum (following an orientation period) engaged in a problem-based learning Nutrition theme, which included active, personalised learning experiences such as analysing their own dietary intakes and recording their personal anthropometric measures. They were questioned two weeks after conclusion of the theme regarding (i) the impact of the theme on their dietary awareness and lifestyles, (ii) whether they had, since the start of the theme, shared their newly acquired insights with others, and (iii) the extent to which they recalled their personal measured anthropometric data and calculated kilojoule (kJ) intakes derived during the practical sessions.

Results

Nearly 84% of the students responded to the anonymous survey (n = 178). A greater awareness of their personal dietary intake following the completion of the Nutrition theme was acknowledged by 88.2% (n = 157), while 65.1% (n = 116) reported improvements to their general lifestyle. Eighty-five percent reported having counselled family members and friends about diet and lifestyle-related issues in the eight-week period since the start of the theme. While recall of body mass indices was higher ($p > 0.01$) in females (85.8 %) than in males (61.5 %), recall of daily kJ intakes was independent of gender. Unsolicited mention by the students surveyed in this study of components of the South African Food-based Guidelines and recent alternative food pyramids suggests that these models were recognised as health priority areas by this student cohort.

Conclusion

The introduction of a Nutrition theme at the start of the problem-based medical learning curriculum appeared to have impacted significantly on the dietary awareness and lifestyles of the students surveyed, with a tendency among students to share this awareness with others. From the open-ended responses of the students, the findings of this study appear to confirm that medical students appreciated learning about their own health factors, and that personalising the information made the learning experience more valuable to them. Attitudinal changes and apparent internalisation of the newly acquired nutritional awareness were reflected by the high percentage of students who acknowledged that they had advised others within the two-week period following the completion of the theme. This augurs well for the potential preventative counselling practices of these future medical graduates. It will, however, be of interest to survey this student cohort longitudinally to establish whether their changed perceptions have a longer term impact and result in attitudes and practices that support preventative health care.

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Introduction

Medical students and practitioners graduating from traditional Western medical curricula, in which the paradigm is disease centred and curative, generally do not emphasise the importance of a prudent dietary intake and an active lifestyle in reducing the incidence and severity of chronic diseases of lifestyle.[1,2,3,4] In addition, the practice profiles of many health practitioners also reveal personal lifestyle patterns that include smoking, poor eating habits and sedentary modes of life.[5]

Globally, deaths from non-communicable, lifestyle-associated diseases were projected to increase by 77% between 1990 and 2020, with most of these deaths being predicted to occur in developing countries.[6] In South Africa, the HIV/Aids epidemic has resulted in an additional competing health priority and underestimation of the magnitude of the burden of emerging chronic diseases associated with industrialisation and a Westernised lifestyle.[7] The Medical Research Council (MRC) report (2003) listed lifestyle-associated diseases, including metabolic syndrome (Syndrome X), obesity, hypertension and atherosclerosis, as the greatest causes of mortality in South Africa.[8] These diseases of lifestyle were shown to account for 28.5% of deaths of all South Africans between the ages of 35 and 64 years. In addition, more than 50% of all South Africans between the ages of 35 and 64 years were found to have at least one modifiable risk factor for chronic diseases of lifestyle.[8]

Excessive dietary intake and physical inactivity are widely acknowledged as leading risk factors for the onset of these chronic lifestyle-associated diseases.[9,10,11,12] The promotion of a healthy lifestyle, which includes an awareness of the importance of diet and regular physical activity, should therefore be a priority for physicians. This is particularly important in developing countries, where chronic lifestyle diseases are placing additional strain on often under-resourced health services. Preventative, as opposed to curative, medicine should therefore be an integral component of undergraduate medical curricula. For this reason, it was deemed appropriate by the designers of the five-year problem-based learning (PBL) curriculum, introduced at the Nelson R. Mandela School of Medicine in 2001, to include a six-week Nutrition theme early in the medical students' training. We sought to determine the impact of this theme, which included a specific focus on the importance of nutrition in avoiding lifestyle-associated disorders, on the dietary awareness and lifestyle of the 2004 intake of medical students.

Method

Student experiences in the Nutrition theme

In 2004, the first formal learning unit, following a three-week orientation period, was a six-week theme focusing on Nutrition (Figure 1a).[13] In accordance with the PBL philosophy, learning was primarily self-directed and integrated, revolving around one case per week. This was supplemented by large group resource sessions (LGRS) and complementary active learning experiences, which included at least one two-hour practical and/or skills session per week (Figure 1b).[14]

Following a weekly introduction to a new case, students were required to conduct self-initiated learning that related to learning outcomes established during a facilitated small group (n = 10 students) tutorial. Students were introduced to biochemical fundamentals, nutrients and their sources in Weeks 1 and 2, while the concept of balanced, prudent nutrition was the focus in Week 3 (see Figure 1b).[14] The case for Week 2 was entitled *Fast foods slow you down*, and related the impact of a female medical student's change of eating patterns and lifestyle on her wellbeing (see Figure 2).[14] In Week 3, a two-hour LGRS was presented to the full cohort of students (n = 213; see Figure 1b).[14] This included an introduction to the use of direct and indirect calorimetry to measure energy output; the relation of daily physical activity, age, gender and mass to daily kilojoule (kJ) expenditure; a conceptual introduction to daily reference intakes;[15] the dietary recommendations of the United States Dietetics Association;[16] the Food-Based Dietary Guidelines of South Africa (see Figure 3);[17] traditional and alternative food pyramids;[16,18] and dietary adaptations required by sportsmen, diabetics and individuals wishing to lose weight.

Each student was asked to complete a record of their dietary intake during the first 24 hours of the theme. During a practical session in Week 2 (see Figure 1b),[14] the students were subsequently guided through an analysis of their individual dietary record using a computerised dietary analysis programme (Dietary Manager, Program Management, Randburg, South Africa). The final report generated by the

Figure 1a: Placement of the nutrition theme in the 2004 PBL undergraduate medical curriculum.[13]

Year	Theme* 1	Theme 2	Theme 3	Theme 4	Theme 5	Theme 6	Theme 7
1	**Nutrition****	Diabetes	Growth & Development	Infection & In ammation	Reproductive Health I	Trauma & Emergency Care	
2	Cardio-Respiratory Disorders	Uro-genital Disorders	Digestion & Absorption	People & Bugs	Central Function	Body in Motion I	
3	Body in Motion II	Hormonal Orchestra	Cell Dysfunction	Fever	Lifestyles	Reproductive Health II	
4	Sight and Sound***	Abdominal complaints & Jaundice	Higher Mental Function	Nuts and Bolts (Psychiatry)	My Skin doctor (Dermatology) A Bloody Business (Haematology)	Man, Environment and Health	Practice Management****
5	CLINICAL ROTATIONS in Family Medicine, Medicine, Obstetrics & Gynaecology, Surgery, Paediatrics & Psychiatry						

* Theme = 6 weeks; **preceded by a three-week Orientation period ***4 weeks only****1.5 weeks only

programme detailed the total kJ intake, the percentage of kJ intake derived from carbohydrate (CHO), fat and protein intake, as well as fibre, unsaturated vs. saturated fat, refined vs. complex CHO intake, mineral, trace element and vitamin content of their diets. These intakes were related to the current Recommended Daily Allowances (RDAs) for each individual.[19]

Following an introduction to simple adult anthropometry, students were given the opportunity to perform measurements on one another during a skills session (see Figure 1b).[14] These measurements included mass, stature, waist, hip and upper arm girth, and triceps, biceps, suprailiac and subscapular skinfold thicknesses. Using these data, Body Mass Index (BMI), waist-hip ratios, estimated somatic protein stores and percentage body fat were calculated by each student from their own data and related to norms for their age group, gender and body mass.[20]

During subsequent weeks of the theme, the students were introduced to the aetiology of weight gain and

Figure 1b: The overall structure of the nutrition theme, highlighting weekly topics, relevant cases, large group resource sessions (LGRS), practicals and skills sessions pertinent to the content of this paper.[14]

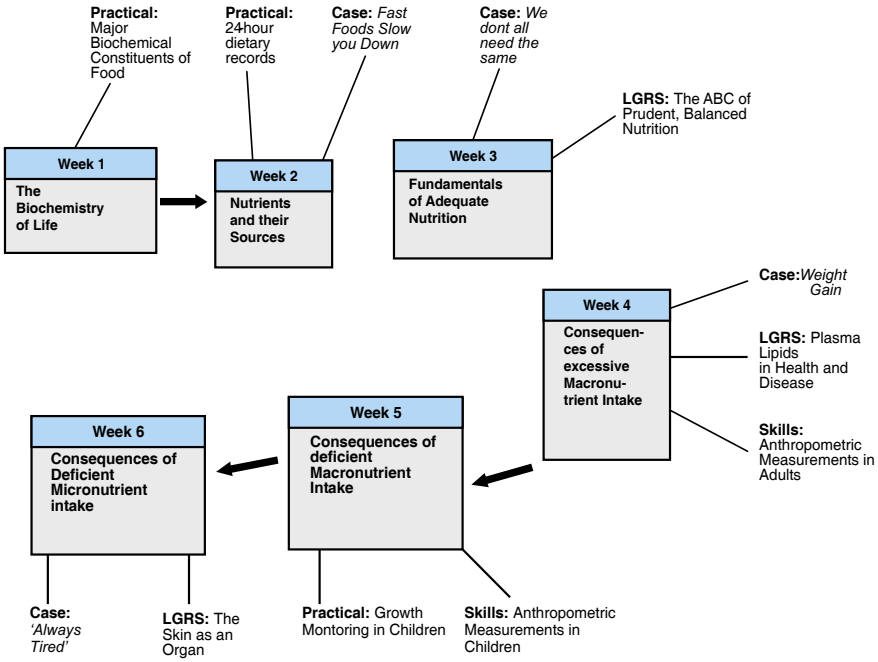


Figure 2: A case scenario with accompanying learning outcomes (set by theme designers and given to the facilitators only), which was designed to stimulate self-directed learning.

Fast Foods Slow You Down

Mondi Mkhize, a 22-year old fourth year medical student, reports to her local general practitioner. She complains of general lethargy, ina-bility to concentrate and feels that she is "underachieving" academically. In recalling her personal history, she relates how she had grown up on a farm on the north coast of KwaZulu-Natal, and always possessed a strong and healthy physical make-up. "I used to have endless energy; would walk 7 kilometres to school and 7 km back home each day, played in the school netball team and loved athletics. At the end of an active day, Mama always had a nutritious stew, made from a selection of home-grown vegetables and a generous piece of chicken or mutton, which we enjoyed with a good helping of phuthu or home-baked bread. Breakfast consisted of maas and phuthu and during the day, we always seemed to have access to one of the fruits which were in season (mostly bananas, mangoes, mulberries and paw-paws). Since arriving at Medical School, my life-style has, however, changed dramatically. I live on my own in private digs in Umbilo. Most of my day is spent in lectures and the remaining hours either studying or behind a computer and, as Mama is not there, I live off the fast foods available at the cafeteria at Medical School and our local take-away restaurant. I seem to always feel tired and exhausted. There is no time and no energy to participate in sport."

Learning Outcomes :
At the end of this session the students should be able to:

1. Analyse and compare the nutrient content of Mondi's diet during her young years and since going into private accommodation in terms of
- kJ content
- saturated fat, trans-fat and cholesterol intake
- carbohydrate (CHO) intake; refined vs. complex CHO
- protein intake; complete and in-complete proteins, essential amino-acids
- the relative contributions of macronutrients (CHO, fats, protein) to total kJ
- salt intake
- vitamin and fibre intake
- mineral and trace-element intake
- content of artificial preservatives, flavourants and colourants

2. Demonstrate an understanding of the
- effects of long-term reliance on the type of student diet described above
- merits of obtaining protein from fat-free chicken when compared with red meat and meat pies
- health impact of eating French fries which have been deep-fried in heated sunflower oil

(Abridged with permission from the School of Undergraduate Medical Education, Nelson R. Mandela School of Medicine)[14]

Figure 3: South Africa's food-based guidelines[17]

The Food-Based Dietary Guidelines for South Africa 17

- Enjoy a variety of foods
- Be active
- Make starchy foods the basis of most meals
- Eat plenty of vegetables and fruits every day
- Eat dry beans, peas, lentils and soya often
- Meat, fish, chicken, milk and eggs can be eaten every day
- Eat fats sparingly
- Use salt sparingly
- Drink lots of clean, safe water
- If you drink alcohol, drink sensibly

loss, and the consequences of deficient macro- and micro-nutrient intake. The theme was concluded with a summative assessment, which was set in the context of case studies or specific nutritionally related scenarios.

Data collection

Permission to conduct this study was granted by the Biomedical Ethics Committee of the University of KwaZulu-Natal.

Two weeks following the completion of this theme, each student in the first-year cohort (n = 213) was invited to complete an anonymous questionnaire. Participation was entirely voluntary. In addition to selected biographical details, including age, gender and previous educational experience, this survey elicited both binomial (YES/NO) and open-ended responses (e.g. "if YES, explain"). These related to the impact of the theme on their dietary awareness and lifestyle patterns, advice given to members of the community and their ability to recall personal data that they had collected during the dietary practical and anthropometry skills sessions.

Data analysis

Student responses to the open-ended questions were categorised and tabulated by experienced, trained personnel. To determine the significance of differences in gender, age and previous tertiary educational experience, discrete variables were analysed using the appropriate Chi-square/Fisher's exact statistic. Continuous numerical data (presented as mean ± SD) were analysed using a two-tailed Student's t test for independent samples. Data were analysed in EPICALC 2000 version 1.02 (1998) and a significance level of 0.05 was preset.

Table I: Aspects of changed dietary awareness (n = 186)* reported by 157 first-year students (88.2%) following a six-week Nutrition theme

Categories of dietary awareness reported by students (n = 157)	No of responses (n = 186)	%
Improved awareness of:		
General characteristics of the diet	**71**	**45.2**
"Healthiness" of diet, nutrient content of foods (n = 11), functions/values of foodstuffs (n = 13); prudence of diet (n = 3)	27	
Balance in the diet (n = 17); food groups (n = 3)	20	
Personal eating habits/diet	17	
"Good" vs. "bad" foods/diets; dos & don'ts	9	
Consequences of incorrect eating/diet-induced diseases	6	
Intake of macronutrients	**35**	**22.2**
Fats (not classified)	15	
Carbohydrate; refined vs. complex	8	
Trans-fats	5	
Saturated fats	2	
Cholesterol	2	
Protein	2	
Essential fatty acids	1	
Energy expenditure and intake	**25**	**15.9**
Daily kilo joule/kilocalorie/energy needs/intake	15	
Kilo joule expenditure and exercise/activity levels	7	
RDAs	3	
Reduced adherence to Western dietary practices including intake of	**20**	**12.8**
Junk foods	8	
Fast foods, "takeaways"	6	
Excess salt	2	
Fad diets	2	
Fried foods	1	
Tinned foods	1	
Special nutritional needs	**15**	**9.61**
Diet and Obesity, BMI, weight control	12	
Needs of lactating mother	1	
Infants/babies	1	
Attempts to gain weight	1	

*Question was open-ended. Several students identified more than one factor in their response.
RDA: Recommended Daily Intake[15]

Categories of dietary awareness reported by students (*n* = 157)	No of responses (*n* = 186)	%
Improved awareness of:		
Specific additional factors including	**13**	**8.33**
Nutrition Labelling/product information	5	
Frequency of eating	5	
Cooking methods	3	
Intake of micronutrients and other dietary components	**11**	**7.05**
Fresh fruits and vegetables	5	
Minerals, iron deficiency	2	
Vitamins, deficient intake	1	
Fibre	1	
Water	1	
Caffeine	1	

Table II: Lifestyle changes specified by male and female first-year students* following a six-week Nutrition theme

Students* who specified positive lifestyle changes** (*n* = 109)				
Category of lifestyle change specified	**Male (*n* = 34)**	**Female (*n* = 75)**	**Total (*n* = 109)**	***p* value***
Dietary adaptations	21 (61.8%)	56 (74.7%)	77 (70.6%)	**0.171**
Increased levels of physical activity	12 (35.3%)	28 (37.3%)	40 (36.7%)	**0.838**
Reduced use of harmful substances				
Caffeine	0 (0.00%)	1 (1.33%)	1 (0.09%)	**0.495**
Cigarette smoking	2 (5.88%)	2 (2.66%)	4 (3.67%)	**0.421**

* the total cohort surveyed comprised 65 male and 113 female students (*n* = 178)
** not all students who reported positive lifestyle changes (*n* = 117; 37 males, 80 females) specified the type of lifestyle changes
*** Chi-square/Fisher's Exact statistic: male vs. female

Results

Demographic data

Almost 84% (*n* = 178; 113 females, 65 male) of the first-year students completed the survey. The age range in the males was 17 to 42 years (mean: 20.8 ± 3.14) and in the females it was 17 to 34 years (mean: 20.5 ± 4.33). Fifty-one percent of students (n = 91) entered the medical school curriculum directly after completing high school, whereas the remainder had completed one or more years of tertiary study in other disciplines prior to their medical studies.

Impact of the Nutrition theme on:

Personal dietary awareness

Eighty-eight percent of the respondents (*n* = 157) acknowledged greater awareness of their personal dietary intake following completion of this theme (see Table I). Over 45% (*n* = 71) of the responses related to greater general awareness of their personal eating habits and the nutrient content and importance of balance and prudence in the diet. Specific awareness of daily energy expenditure and intake (15.9%), macro-nutrient intake (22.2%) and weight control (6.4%) were also among the most frequently mentioned elements.

Lifestyle changes

Of the 117 students (65.7%) who acknowledged that the theme had resulted in improvements in their general lifestyle, 109 students specified the type of change (see Table II). Relatively more female than male respondents (74.7% vs. 61.8%; *p* = 0.17) reported positive dietary changes. Of the female respondents (*n* = 56), 80.4 % (*n* = 45) reiterated an improvement in the balance and prudence of their diet, while only 16.1% (*n* = 9) specifically mentioned that their goal was weight reduction. The reported increased levels of physical activity in 36.7% of the students (*n* = 40) ranged from running three times per week and joining a sports club, to walking instead of catching a bus or using the staircase in preference to the lift. Four students reported "quitting" smoking, while only one mentioned a deliberate reduction in caffeine intake. No mention was made of the use of drugs and alcohol in response to this question.

When the data were categorised according to age, students aged 22 years and older reported the greatest relative percentage (84.8%) of lifestyle change. Almost 90% of this group of students reported previous tertiary educational experience (see Table III). Statistical analyses revealed a significant association (*p* = 0.03; <0.001) between both age and previous tertiary educational experience and reported lifestyle change in this cohort of first-year medical students (*n* = 178).

Advising others about their dietary habits and lifestyles

Eighty-five percent of the first-year cohort (*n* = 151) acknowledged having advised friends and family about diet

Table III: Lifestyle changes specified by first-year students (n = 178) of different age-groups and previous educational experience following a six-week Nutrition theme

Age (yr)	≤18 (n = 43)	19 (n = 49)	20 (n = 34)	21 (n = 19)	>22 (n = 33)	Total (n = 178)	p value**
Respondents who specified positive lifestyle changes*	24 (55.8%)	28 (57.1%)	17 (50.0%)	12 (63.2%)	28 (84.8%)	**109 (61.2%)**	**0.033**
Respondents who specified positive lifestyle changes, and reported previous educational experiences	0 (0%)	5 (17.9%)	12 (70.6%)	11 (91.7%)	25 (89.3%)	**53 (48.6%)**	**<0.001**

*Not all students (n = 117) specified the type of lifestyle changes
** Chi-square/Fisher's Exact statistic: age group /previous tertiary education experience vs. reported lifestyle changes

and lifestyle-related issues in the eight-week period since the start of the theme. Thirty-six students (23.8%) specifically mentioned giving advice to younger siblings and family members in general; 35 students (23.1%) referred to advice given to fellow students, roommates and friends, while 17 (11.3%) mentioned advice given to parents and 13 (8.6%) specified extended family members (including grandparents, aunts and cousins). Details regarding the subject matter of the advice that was given by these students are presented in Table IV.

Recall of anthropometric measures and kilojoule intake

The mean anthropometric and kilojoule intake data (mean SD) reported by students are presented in Table V. Body mass ranged from 32-100 kg amongst the females, and 47-103 kg in the males. Recall of mean body mass index (BMI) by female students was significantly higher than that by male students (85.8% versus 61.5%; p = 0.002). Only four men and six women remembered the percentage body fat they had calculated from the sum of four skinfold measurements, while 33.6% of the women and 40.0% of the men recorded the daily kJ consumption which they had determined when analysing their 24-hour dietary records (see Table V).

Discussion

In interpreting the specific student responses provided in Tables I to III, it is important to bear in mind that these are viewed in terms of the open-endedness of the explanations requested, viz. "If yes, explain." Unsolicited mention of specific factors can therefore be viewed as reflecting priority considerations, which

Table IV: Subjects of advice* given by first-year students (n = 151) within eight weeks following the start of a six-week Nutrition theme

Subjects of advice given	Number of times mentioned	%
Decreased intake of	**39**	**25.8**
saturated fats (n = 15), trans-fats (n = 2), red meat (n = 1)	18	
junk and fast foods, cafeteria foods and "takeaways"	9	
caffeine	4	
cigarettes	3	
salt	2	
alcohol	2	
refined sugars	1	
Special diets	**21**	**13.9**
Weight reducing	12	
Weight gaining	1	
For pregnant (n = 3) and lactating women (n = 3)	6	
Infant nutrition	1	
Health in later life	1	
Disease interventions	**19**	**12.6**
Diabetes and diet	6	
Cardiovascular disease and diet	7	
Diet and the anaemias	4	
Diet and colon cancer, hypotension	2	
Benefits of activity and exercise	**14**	**9.3**
Increased intake of	**11**	**7.3**
fruit and vegetables	6	
specific vitamins	2	
fibre	1	
complex carbohydrates	2	
Effects of irregular meals & dietary deficiencies	**9**	**6.0**

* 38 students made general comments/failed to specify the subject matter of the advice given

Table V: Mean (SD) anthropometric and mega joule intake data reported by first-year medical students following a six-week Nutrition theme

	Women (*n* = 113)		Men (*n* = 65)		P value*	P value**
	Mean (SD) *n*		Mean (SD) *n*			
Body mass (kg)	60.0 (14.4)	106	64.7 (12.0)	61	0.03	0.99
Body Mass Index (kg/m^2)	22.6 (5.00)	97	21.6 (3.70)	40	0.21	0.002
% Body fat	21.3 (9.90)	6	27.0 (6.8)	4	0.35	0.81
Daily mega joule intake	8.28 (3.08)	38	9.56 (6.48)	26	0.29	0.39

* Student's *t* tests for independent samples; males vs. females
** Chi-square: percentage of men and women reporting data

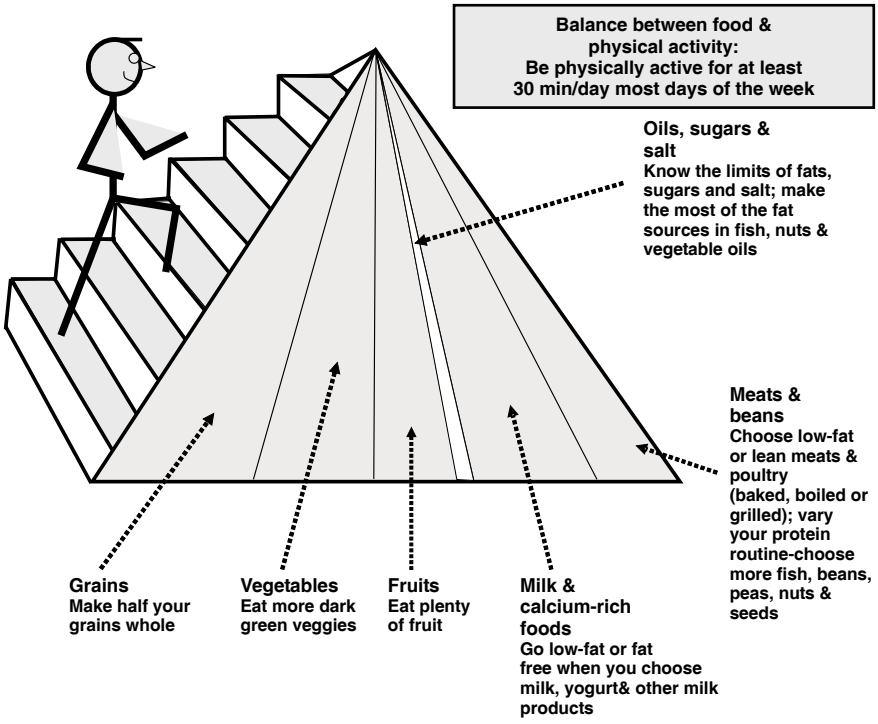
students expressed spontaneously without being "prompted", as no pre-categorisation of possible responses was included in the questionnaire.

Dietary Awareness

Perhaps the most rewarding response for theme designers and those responsible for teaching and facilitating on the Nutrition theme is that 88.2% of the respondents acknowledged greater awareness of their personal dietary intake two weeks after completion of the theme. The comment of one student that her *"eyes were opened"* and that she began to pay attention to the food she was eating is an apt reflection of the general student response. One student claimed to have lost five kilograms in the first two weeks of the theme as a result of a changed awareness of the importance of diet.

These findings support those of Snetselaar *et al.*, who reported that a personalised, practical approach to nutrition education, during which students participated in a two-day nutrition and fitness programme and educational nutrition at the University of Iowa, appeared to close the gap between the "science" and the "application" of nutrition.[21] In the present study, the 15 spontaneous references to daily energy and/or dietary intake support the effectiveness of the active learning experienced by students when they recorded, calculated and interpreted their own dietary intakes, as well as those of Mondi Mkhize in Week 2's case study (see Figure 2). The second of the South African Food-based Dietary Guidelines[17] (see Figure 3), namely "Be active!", was, however, specifically identified by only seven students in their open-ended responses to changed dietary awareness. The overriding importance of physical activity and related increased energy expenditure in determining nutritional status, which has also recently been confirmed in the 2005 USDA food pyramid[18] (see Figure 4), is an area that appears to require greater emphasis in the theme. Perhaps reinforcement of this concept could be achieved by introducing a practical in which oxygen consumption is measured during various forms of physical activity and the corresponding kilojoule expenditure is estimated. It would be of interest to compare the results of such an approach with the integrated physical activity counselling model used by Bass et al.[22] and the physical fitness intervention programme used by Rogers *et al.*[23]

Figure 4: The 2005 USDA Food Pyramid (adapted)[18]



Reduced macronutrient intake, in particular a reduction in the general fat intake, was a frequently cited response (*n* = 25). If viewed in association with the 12 responses that focused on obesity, weight reduction and dietary strategies, this emerges as an apparent priority area among this student cohort. A further component of both traditional and more recent food pyramids[16,18] and of the South African Food-based Guidelines[17] that emerged in the student responses was an awareness of the value of a high intake of fresh fruits and vegetables. This was addressed in the theme in terms of the current debate surrounding the value of a balanced and synergistic intake of antioxidants derived from the diet[24] in preference to the use of synthetic "nutrient pills".[25]

Lifestyle changes

With regard to the effect of the programme on lifestyle, 65.7% (*n* = 117) of the students surveyed acknowledged that the six-week

theme had resulted in improvements in their general lifestyle. Although a higher percentage of female students mentioned dietary adaptations (74.7% vs. 61.8%), the difference between the men and women was not statistically significant (p = 0.17; Table II). There was no apparent gender bias (p = 0.92) in the responses of male and female students regarding changed patterns of physical activity (see Table II). The increased physical activity levels reported by 36.7% of the students, however, confirm an awareness amongst the students of the importance of energy expenditure as a determinant of nutritional status. This is also emphasised in the South African Food-based Guidelines[17] and the 2005 USDA food pyramid.[18] The failure to mention use of abusive substances, including drugs and alcohol, perhaps reflects the absence of an association of these parameters with "lifestyle" by this group of medical students at this early stage of their careers.

Of further interest was the significant association found between lifestyle change and age group (p = 0.03) and prior tertiary experience before entering medical school (p > 0.001). This may be related to the fact that the more mature students, with wider educational exposure, may have greater concerns about their personal physical wellbeing.

Advice given

There are numerous reports indicating that few physicians provide nutrition or physical activity counselling to their patients.[1,2,3,5] It was therefore reassuring to note that 84% (n = 151) of this student cohort acknowledged having advised those with whom they came into contact about diet and lifestyle-related issues in the eight-week period since the start of the theme. This lends support to recent findings that a physician's lifestyle habits are thought to affect both the frequency and quality of physician counselling of patients about lifestyle change.[22] It also augurs well in terms of the possible later transfer of this desire to share their dietary and lifestyle awareness with their own patient populations by this student cohort.

Although it must be emphasised that medical doctors who graduate with a greater general awareness of the importance of good nutritional practices will not replace the expertise of the registered dieticians required for the prescription of specialised diets, they can provide invaluable support to these healthcare professionals. The determination of the long-term impact of the reported changed attitudes towards the personal health of this cohort of medical students will therefore be an important future research direction. This will be of particular interest, since these students will be exposed to a theme focusing on the role of lifestyle in the onset of non-communicable chronic disease in their third year of study (see Figure 1a).

Anthropometrical data recalled

Despite the various personalised and active learning sessions during which students measured their anthropometric statistics and recorded, assessed and interpreted their daily dietary intakes, relatively few students remembered their percentage body fat and daily kilojoule intake. There was also no significant gender difference in their ability to recall these data (see Table V). Interestingly, those who did recall the data recorded a mean below the recommendations for their age and gender,[15,16,19] perhaps reflecting better memory in those least uncomfortable with their personal statistics.

Conclusion

From the open-ended responses of the students, our findings appear to concur with those of *Snetselaar et al.*, who reported that medical students appreciated learning more about their own health factors, and that personalising the information made the learning experience more contextually relevant to the students.[21] Unsolicited mention by students surveyed in this study of components of the South African Food-based Guidelines and recent alternative food pyramids suggests that these models are recognised as health priority areas by this student cohort.

Furthermore, there appeared to be substantial attitudinal changes and apparent internalisation of the newly acquired nutritional awareness, as evidenced by the large percentage of students who acknowledged that they had advised others within the two-week period following completion of the theme, with the greatest prevalence being among the more mature students. It will, however, be imperative to survey these future "new medical graduates" longitudinally to establish whether their changed perceptions have a longer term impact and result in attitudes and practices that will ultimately support preventative health care once they graduate and enter the profession as practitioners.

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