Dietary supplement use and associated factors among university students

Department of Physiological Sciences, Stellenbosch University, W Cape
Maria Steele, BSc Hons
Marjanne Senekal, PhD

Objective. To examine the regularity of dietary supplement use and related information in a sample of 400 university students.

Design and outcome measures. An interview schedule was developed for these purposes containing questions on demographic and health and lifestyle-associated variables, regularity of supplement use, reasons for non-use or sporadic use and regular supplement use-related questions.

Setting. Stellenbosch University, South Africa.

Subjects. Four hundred undergraduate and postgraduate students.

Results. Non-use of supplements was reported by 38.5% of students. The main reason given for not using supplements at all was 'not necessary' and 'don't know/no reason'. Sporadic supplement use was reported by 19.5%, with the main reason for sporadic supplement use being 'use when stressed' and 'use when tired/ill'. Regular supplement use was reported by 42% of the students interviewed, with vitamin-mineral combination supplements being the most commonly used supplements. Regular supplement users showed no specific demographic or health and lifestyle-associated characteristics. Reasons provided by the regular supplement users were similar for most supplement types and seem to reflect the advertising strategies used by producers of supplements. The main reasons cited in this regard were 'physical health', 'dietary reasons' and 'body conditioning and energy'. Family and friends, doctors and advertising were the main sources of information on the need for supplementation. Students chose to use supplements instead of food because of perceived dietary inadequacy, convenience and the belief that food does not contain sufficient nutrients. Significant gender differences were found with regard to reasons for sporadic use of supplements, reasons for regular use of two specific supplements and reasons why a supplement was chosen instead of food in the case of a specific supplement.

Conclusion. Supplement use was found to be common practice in this student population, as has been found among students elsewhere.

Health authorities generally recommend that individuals meet their dietary requirements by eating a wide variety of foods and that dietary supplementation only be considered necessary in special circumstances.[1] According to the South African Foodstuffs, Cosmetics and Disinfectants Act of 1972, dietary supplements (referred to as supplements hereafter) are defined as 'products containing any natural-occurring molecules and molecules synthesized by chemical or biological means or botanical extracts, derivatives, concentrates, enzymes, coenzymes, co-factors, naturally occurring hormones and precursors, animal source substances or metabolites intended to be consumed for its nutritional value in the maintenance and improvement of human health and includes but is not limited to vitamins, minerals, co-factors, essential fatty acids, amino acids, enzymes, animal or botanical extracts and derivatives, probiotics and non-nutrient dietary phytoprotectants in a dosage form such as capsules, tablets, liquids or powders' (Act No. 54 of 1972, **http://www.doh.gov.za** 2003/05/02, last accessed February 2004). This definition is in line with the definition of the US Dietary Supplement Health and Education Act of 1994.[2]

Despite the emphasis by health authorities on obtaining nutrients from food sources, the supplement industry is a growing market, with sales in the USA almost doubling from $8.8 billion in 1994 to $15.7 in 2000.[3] The third National Health and Nutrition Examination Survey (NHANES III, 1988 - 1994)[4]

reported that 40% of American adults used a vitamin or mineral supplement in the month preceding the survey. Data from surveys conducted in the USA from 1996 to 1999 showed an increase in supplement use, with 48% of American adults reporting regular use of some type of supplement.[3] Supplement use has also increased in Britain. According to the National Diet and Nutrition Survey of British adults (NDNS) conducted in 2000 - 2001, 40% of women and 29% of men reported supplement use, which is double the figures found in the NDNS conducted from 1986 to 1987.[5,6] Supplement use seems to be slightly lower among Australian adults, with 23.8% of a sample (N = 5 422) reporting use of at least 1 supplement on the day before the survey,[7] and also among European adults where use was found to range from 19% to 23%.[8-10] No similar published data were available for South Africans.

Several studies[4,11-14] have shown that compared with non-users, regular supplement users are more likely to be female, white, older, well-educated and non-smoking, to have high income levels and a normal body mass index (BMI), to follow an active lifestyle, and to perceive their health as very good or excellent.

Supplement users give a variety of health and dietary-related reasons for using supplements. Some people believe that diet alone does not supply enough micronutrients and therefore supplementation is necessary to meet daily requirements,[15] or they believe claims that the soil is depleted resulting in a nutritionally inadequate food supply.[16] Many believe (correctly or incorrectly) that supplements can prevent or treat diseases such as colds and flu, skin problems, heart attacks and cancer.[3,15,17] Others take supplements to increase energy levels, help cope with stress and increase concentration.[18]

Information on supplement use in specific subgroups, such as among students, is sparse. In a survey of 502 USA college students, Eldridge and Sheehan[19] reported that 36.8% of the students surveyed were regular supplement users, 25.3% were sporadic users and 37% did not use supplements. A more recent survey in the USA[20] reported that 62% of students used supplements, 78% on a regular basis. According to a survey by Driskell[21] of 176 graduate students in the USA, a higher percentage of female than male students (67% v. 52%) reported using dietary supplements. Similar findings were reported by Krumbach *et al.*[22] in their survey of American university athletes. No information on supplement use among South African university students could be traced.

The dietary habits of students are characterised by frequent meal skipping, poor choice of foods, i.e. more focus on fast foods and take-aways, fad diets and energy restrictions, and less focus on fresh fruit and vegetables, all of which could contribute to an increased risk of nutritional inadequacy.[23,24] This 'inadequate diet' is a common reason students give as to why they take dietary supplements.[21] Other reasons given by students for using supplements include prevention or treatment of illness, to increase energy, to improve athletic performance, to help them cope with stress, for weight loss and to improve general health.[19-21,25]

From the literature it is clear that supplement availability and use are on the increase. This inevitably raises certain questions, viz. whether it is really necessary to use supplements, whether supplementation has a positive effect, and whether it could have any negative effects. These questions are especially relevant in groups where supplement use is highly prevalent and the questions should be discussed in such groups. As a starting point it is therefore important to determine the supplement use patterns of specific groups. As there is a paucity of data on dietary supplement use among South African students, the aims of this study were: (*i*) to determine the regularity of supplement use among students attending Stellenbosch University and to relate this to demographic and health and lifestyle-associated variables; (*ii*) to describe the reasons for non-use of supplements or sporadic use of supplements and to relate this to gender; and (*iii*) to identify the type of supplements used by regular users, and related information and gender differences in this regard.

Methods and procedures

Definition of terms

For the purposes of this study, dietary supplements (supplements) were defined as products containing one or more vitamins, minerals, herbals or botanicals. Amino acid and protein supplements were not recorded in this study. Regular supplement users were defined as respondents who used supplements at least once a week, sporadic users as respondents who used supplements less than once a week, and non-users as respondents who did not use supplements at all. These definitions are similar to those used by Eldridge and Sheehan[19] in their survey of American college students. The term non-vitamin, non-mineral (NVNM) supplements refers to supplements that do not include vitamins or minerals.

Sample and sampling procedure

A convenience sample of 400 undergraduate and postgraduate students was drawn from the 21 879 students enrolled at Stellenbosch University in 2003 (**http://www.sun.ac.za/admin/ManageInfo/BI_feiteboek_afd1.htm**, 2003/10/23, last accessed March 2004). For sampling purposes students were approached and the purpose of the interview was explained to them. They were then asked whether they

were willing to participate in the study and, if willing, were included. Sampling was done in the student centre at different times of the day and on different days of the week in order to obtain a sample representative of the students frequenting the centre. To ensure inclusion of both private and residence students, sampling was done over lunchtime and during the rest of the day.

Survey instrument

The survey instrument consisted of an interviewing schedule consisting of closed and open-ended questions. The interviewing schedule was developed using questions adapted from similar published studies,[11,15,22] from personal communication with Dr N J Temple (Centre for Science, Athabasca University, Alberta, Canada, 2003), and from some newly developed questions. The first part of the interviewing schedule included open-ended questions on the regularity of vitamin, mineral and/or other dietary supplement use (i.e. regular use, sporadic use or no use); the main reason for not using supplements or only using supplements sporadically; if there was regular use, the type of supplement used and frequency of use; the main reason for using specific supplements; and the source of information and why a supplement was chosen to obtain the nutrients instead of obtaining the nutrients from food. Although these were open-ended questions, respondents were asked to give their main reason only. Respondents were asked to rate their overall health and dietary intake as excellent, very good, good, fair or poor. The second part of the interviewing schedule contained questions on demographics, including study direction and year as well as competitive sport participation at university or provincial level. The questionnaire was pilot tested for comprehension on 12 students and some pertinent changes were subsequently made.

Data collection

All interviews were conducted by the first author. Once students indicated that they were willing to participate the interview was conducted immediately in the student centre.

Data processing and analysis

All data were processed and analysed using the SPSS (version 11.0, 2003). Frequencies were tallied for closed-ended questions. For open-ended questions similar answers were grouped together and frequencies tallied. Where necessary, categories (response options) were collapsed. To assess the relationship between regularity of supplement use and demographic and health and lifestyle-associated variables, cross-tabulations were constructed, with regularity of supplement use as classification variable. To determine the effect of gender on reasons for not using or sporadically using supplements, and the effect of gender of regular users on supplement type, the main reason for using a supplement, the main source of information and the main reason for using a supplement instead of food, cross-tabulations were constructed with gender as the classification variable. Pearson's chi-square test (χ^2) or Fisher's exact test (for two-by-two tables) was used to determine whether there were any significant differences in the profiles of regular supplement users, sporadic users and non-users for the specified variables, as well as the profiles of male and female regular supplement users for the specified variables. In cases where 1 or more cells had an expected count of less than 5, it is indicated that results need to be interpreted with caution. The mean ± standard deviation (SD) age was computed and the one-way analysis of variance (ANOVA) was used to test for significant between-group differences. Differences were considered significant at $p < 0.05$.

Results

Sample

Of the 400 students interviewed, 43% were male and 57% were female, which reflects the demographics of Stellenbosch University in 2003, namely 47% male and 53% female students (**http://www.sun.ac.za/admin/ManageInfo/BI_feiteboek_afd1.htm**, 2003/10/23, last accessed February 2005). The mean age of the participants was 20.8 ± 2.47 years. The sample was predominantly white, with coloureds representing almost one-fifth of the respondents. Only a very small number of black, Indian and foreign students were included. This is line with the demographics of Stellenbosch University for 2003 for all students except black students (white 71%, coloured 12%, black 15% (70% postgraduate) and Indian 2%) (**http://www.sun.ac.za/admin/ManageInfo/BI_feiteboek_afd1.htm**, 2003/10/23, last accessed February 2005). Underrepresentation of black students can be explained by the fact that 70% of black students are postgraduate, and are less likely to frequent the student centre. More than one-third of the respondents were in their first year, while only about one-fifth were in their second or third years. A small number of fourth-year and postgraduate students were included. Science, arts and commerce were the predominant study directions. Only one-fifth of the respondents reported competitive sport participation at university or provincial level.

Regularity of supplement use and relation to demographic and health and lifestyle-associated variables

Regular supplement use was reported by 42.0% of the students interviewed. While 19.5% of the respondents used supplements sporadically, 38.5% did not use supplements at all. When regularity of supplement use

Table I. **Mean ± SD of age* and column percentage† of demographic and health and lifestyle-associated variables by regularity of supplement use**

Demographic characteristic	Non-users (%)	Sporadic users (%)	Regular users (%)	Total (%)
Age (yrs)	*N* = 153	*N* = 77	*N* = 168	*N* = 398
(mean ± SD)	20.6 (2.45)	21.0 (2.29)	20.9 (2.57)	20.8 (2.47)
Gender	*N* = 154	*N* = 78	*N* = 168	*N* = 400
Male	46.1	39.7	41.7	43.0
Female	53.9	60.3	58.3	57.0
Population group	*N* = 152	*N* = 78	*N* = 168	*N* = 398
Black	5.3	7.7	4.8	5.5
Coloured	24.3	12.8	13.1	17.3
Indian	0.7	1.3	1.2	1.0
White	66.4	76.9	80.4	74.4
Other	3.3	1.3	0.6	1.8
Study direction	*N* = 151	*N* = 78	*N* = 167	*N* = 396
BSc	31.8	30.8	30.5	31.1
BA	19.2	16.7	19.2	18.7
BComm	33.8	24.4	29.9	30.0
Law	2.6	3.8	4.8	3.8
Engineering	4.0	11.5	4.8	5.8
Education	4.0	7.7	4.2	5.6
Other	4.6	5.1	6.6	4.8
Year	*N* = 150	*N* = 75	*N* = 166	*N*= 391
First	47.3	30.7	40.4	41.2
Second	15.3	25.3	18.1	18.4
Third	19.3	24.0	23.5	22.0
Fourth	3.3	5.3	5.4	4.6
Postgraduate	14.7	14.7	12.7	13.8
Sport participation‡	*N* = 152	*N* = 78	*N* = 168	*N* = 398
Yes	20.8	16.7	20.8	20.0
No	79.2	83.3	78.0	79.5
Health	*N* = 154	*N* = 78	*N* = 168	*N* = 400
Excellent	14.9	14.1	9.5	12.5
Very good	31.2	26.9	34.5	31.8
Good	48.1	55.1	45.8	48.5
Fair	5.8	3.8	8.3	6.5
Poor	0	0	1.8	0.8
Dietary intake	*N* = 154	*N* = 78	*N* = 168	*N* = 400
Excellent	3.9	2.6	4.2	3.8
Very good	14.3	14.1	16.7	15.3
Good	46.8	42.3	48.2	46.5
Fair	27.9	32.1	25.6	27.8
Poor	7.1	9.0	5.4	6.8

* One-way ANOVA; no significant differences, *p*-values not included in the table.
† Pearson's chi-square; no significant differences, *p*-values not included in the table.
‡ Competitive participation at university or provincial level.
SD = standard deviation.

(non-users, sporadic users, and regular users) was related to demographic and other variables (Table I), no significant differences were evident. However, regular supplement users were more likely (non-significantly) to be female, white and to rate their health as fair or poor than sporadic supplement users or non-users.

Reasons for not using supplements or using supplements sporadically

The main reasons given by respondents (*N* = 154) for not using supplements included 'not necessary', 'no reason/don't know', and 'adequate diet' (Fig. 1). The

'other' option included reasons such as 'side-effects', 'don't know which ones', 'don't believe they work', and 'not healthy to use supplements'. Each of these reasons was given by less than 3% of the respondents. No significant gender differences were evident with regard to the reasons given (Fig. 1).

In the sporadic user category, the main reasons for using supplements sporadically included 'use when stressed', 'use when I feel tired or ill', or 'forget to take supplements' (Fig. 2). The 'other' option included reasons such as 'only use when I need to lose weight', 'supplements didn't work', and 'only use in winter'. Each of these reasons was given by less than 4% of the respondents. A significant gender difference was found with regard to reasons given (Fig. 2). Males were more inclined to take supplements when they felt stressed and females when they felt tired or sick (Fig. 2).

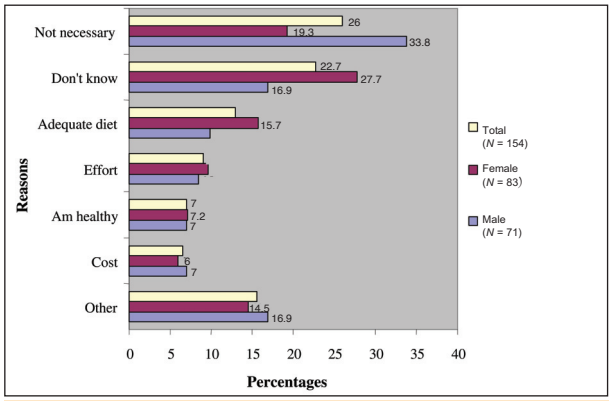

Fig. 1. Main reasons cited by respondents for not using supplements ($\chi^2 = 6.337$; df = 6; p = 0.386).

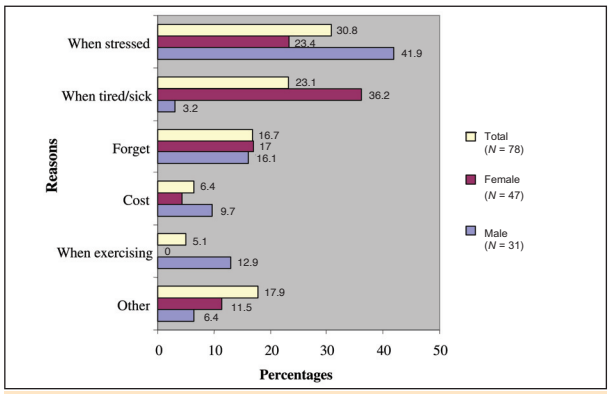

Fig. 2. Main reasons cited by respondents for sporadic use of supplements ($\chi^2 = 17.895$; df = 5; p = 0.003; results need to be interpreted with caution).

Types of supplements used by regular users and related information

The most popular type of dietary supplement used by regular users was a vitamin/mineral combination, with almost two-thirds of regular supplement users reporting use (Table II). Vitamin C was the most frequently used supplement of the single-nutrient type (Table III). The use of single-nutrient mineral supplements was generally low (Table IV). Spirulina was the most commonly used NVNM supplement (Table V). Although there was no significant difference, females were equally likely or more likely than males to take all types of supplements with the exception of 'other vitamin combination' supplements, vitamin B_6, and fatty acid supplements. 'Other vitamin combination' supplements included supplements containing 2 or more vitamins and no minerals. All the supplements were most often used daily, with the exception of 'other vitamin combination' supplements (Tables II - V).

Results regarding the main reasons given for using a specific supplement were similar for most supplements; the most popular reasons included physical health, body conditioning, and dietary reasons (i.e. 'inadequate diet', 'ensure adequate intake', 'food low in nutrients') (Tables II - V). There were no significant differences between reasons given by male and female respondents, except for iron supplements (Table IV). Males were more inclined to cite 'other' as a reason, which included 'habit', 'increases absorption of other nutrients', 'sport', 'supplement loss of vitamins by water'. Females were inclined to cite 'physical health' as their reason for using iron.

The main sources of information on specific supplements were similar for most supplements (Tables II - V). Family and friends seemed to be the main source of information, followed by doctors and advertising. No significant differences between male and female respondents were evident in this regard.

Reasons why participants chose to obtain the nutrient from a supplement instead of from food were also similar for most supplements (Tables II - V). The most common responses included 'dietary reasons' ('poor diet', 'ensure adequate intake'), 'convenience' and 'food does not contain sufficient nutrients'. Male and female participants differed significantly in their reasons given for using a supplement instead of food with regard to vitamin/mineral combination supplements (Table II), and calcium supplements (Table IV). Males were more likely to give 'convenience' as the reason for taking both supplements, while females were more inclined to cite dietary reasons (i.e. 'poor diet', 'ensure adequate intake').

Discussion

Results from this survey suggest that dietary supplement use is a common practice among the group of university students investigated. Dietary supplements were used by almost two-thirds of the students interviewed, with 42% reporting regular use and 19.5% reporting sporadic use, which is in line with findings of other reported surveys in student populations.[19-21] More female than male students reported supplement use, although this difference was not significant. This finding is similar to that observed

Table II. Use of vitamin/mineral combination supplements by regular users and related information (N = 168)

Supplement type	Frequency of use (%)		Gender		Main reason (%)		Main source of information (%)		Main reason for using supplement instead of food (%)	
	7 d/week	< 7 d/week	Male	Female						
Vitamin-mineral combination (N = 107, 63.7%)	72.9	27.1	42.1	57.9	Physical health	32.7	Family or friends	33.6	Dietary*	39.3
					Body conditioning and energy	25.2	Pharmacist	23.4	Convenience	30.8
					Dietary related	24.3	Doctor	15.9	Food depleted	9.3
					Don't know	10.3	Advertising	15.0	Supplement more effective	6.5
					Mental health	4.7	Other	6.5	Food source unknown	6.5
					Other	2.8	Other non-medical persons	2.8	Don't know	5.6
							Don't know	2.8	Vegetarian	1.9
Vitamin B complex (N = 22, 13.1%)	72.7	27.3	36.4	63.6	Body conditioning and energy	36.4	Pharmacist	27.3	Dietary	54.5
					Physical health	27.3	Family or friends	22.7	Convenience	18.2
					Mental health	18.2	Doctor	18.2	Food depleted	9.1
					Dietary	9.1	Advertising	9.1	Don't know	9.1
					Don't know	4.5	Other non-medical persons	9.1	Supplement more effective	4.5
					Other	4.5	Don't know	9.1	Vegetarian	4.5
							Other	4.5		
Other vitamin combination (N = 3, 1.8%)	33.3	66.6	66.7	33.3	Body conditioning and energy	33.3	Family or friends	66.7	Dietary	33.3
					Mental health	33.3	Pharmacist	33.3	Convenience	33.3
					Don't know	33.3			Food depleted	33.3
Calcium + magnesium (N = 8, 4.8%)	75.0	25.0	50	50	Physical health	37.5	Family or friends	50.0	Convenience	37.5
					Don't know	25.0	Advertising	25.0	Dietary	25.0
					Dietary	12.5	Doctor	12.5	Food depleted	25.0
					Mental health	12.5	Other	12.5	Food source unknown	12.5
					Other	12.5				
Other mineral combination (N = 1, 0.6%)	100	0	1	100	Physical health	100	Doctor	100	Food depleted	100

*Reasons given differed significantly with regard to gender ($\chi 2$ = 13.51; df = 6; p = 0.036; results need to be interpreted with caution).

Table III. **Use of single vitamins by regular supplement users and related information (N = 168)**

Supplement type	Frequency of use (%)		Gender		Main reason (%)		Main source of information (%)		Main reason for using supplement instead of food (%)	
	7 d/week	< 7 d/week	Male	Female						
Vitamin C (N = 26, 15.5%)	68.0	32.0	42.3	57.7	Physical health	68.0	Family or friends	52.0	Dietary	28.0
					Don't know	20.0	Doctor	24.0	Convenience	24.0
					Dietary	4.0	Advertising	8.0	Food depleted	12.0
					Body conditioning and energy	4.0	Pharmacist	8.0	Food source unknown	12.0
					Other	4.0	Other non-medical persons	4.0	Supplement more effective	12.0
							Other	4.0	Don't know	12.0
Vitamin A (N = 3, 1.8%)	66.7	33.3	33.3	66.7	Dietary	33.3	Advertising	33.3	Dietary	33.3
					Body conditioning and energy	33.3	Family or friends	33.3	Convenience	33.3
					Don't know	33.3	Pharmacist	33.3	Food depleted	33.3
Vitamin E (N = 1, 0.6%)	100	0	0	100	Dietary	100	Advertising	100	Dietary	100
Vitamin D (N = 2, 1.2%)	100	0	50	50	Dietary	50	Advertising	50	Dietary	100
					Other	50	Family or friends	50		
Vitamin B_{12} (N = 3, 1.8%)	100	0	33.3	66.7	Body conditioning and energy	66.7	Advertising	33.3	Dietary	33.3
					Dietary	33.3	Family or friends	33.3	Food source unknown	33.3
							Doctor	33.3	Supplement more effective	33.3
Vitamin B_6 (N = 1, 0.6%)	100	0	100	0	Don't know	100	Family or friends	100	Dietary	100

Table IV. Use of single mineral supplements by regular users and related information (N = 168)

Supplement type	Frequency of use (%)		Gender		Main reason (%)		Main source of information (%)		Main reason for using supplement instead of food (%)	
	7 d/week	< 7 d/week	Male	Female						
Calcium (N = 6, 3.6%)	100	0	16.7	83.3	Dietary	33.3	Family or friends	33.3	Dietary*	66.7
					Physical health	33.3	Other	33.3	Convenience	16.7
					Body conditioning and energy	16.7	Other non-medical persons	16.7	Don't know	16.7
					Don't know	16.7	Don't know	16.7		
Iron (N = 9, 5.4%)	55.6	44.4	11.1	88.9	Physical health†	55.6	Doctor	44.4	Food depleted	33.3
					Dietary	22.2	Advertising	22.2	Dietary	33.3
					Don't know	11.1	Pharmacist	22.2	Vegetarian	22.2
					Other	11.1	Family or friends	11.1	Food source unknown	11.1
Magnesium (N = 3, 1.8%)	66.7	33.3	33.3	66.7	Body conditioning and energy	66.7	Doctor	66.7	Food depleted	66.7
					Don't know	33.3	Pharmacist	33.3	Dietary	33.3
Zinc (N = 4, 2.4%)	75.0	25.0	0	100	Body conditioning and energy	50.0	Family or friends	50.0	Dietary	75.0
					Physical health	25.0	Advertising	25.0	Food depleted	25.0
					Don't know	25.0	Doctor	25.0		

* Reasons given differed significantly with regard to gender (χ^2 = 6.0; df = 2; p = 0.05; results need to be interpreted with caution).
† Reasons given differed significantly with regard to gender (χ^2 = 9; df = 3; p = 0.029; results need to be interpreted with caution).

Table V. **Use of NVNM supplements by regular users and related information (N = 168)**

Supplement type	Frequency of use (%)		Gender		Main reason (%)		Main source of information (%)		Main reason for using supplement instead of food (%)	
	7 d/week	< 7 d/week	Male	Female						
Spirulina (N = 8, 4.8%)	75.0	25.0	50.0	50.0	Body conditioning and energy	25.0	Family or friends	50.0	NA	
					Mental health	25.0	Advertising	37.5		
					Dietary	12.5	Doctor	12.5		
					Physical health	12.5				
					Don't know	12.5				
					Other	12.5				
Ginkgo biloba (N = 4, 2.4%)	75.0	25.0	25.0	75.0	Mental health	50.0	Advertising	25.0	NA	
					Physical health	25.0	Family or friends	25.0		
					Don't know	25.0	Doctor	25.0		
							Pharmacist	25.0		
Moducare (N = 4, 2.4%)	100	0	25.0	75.0	Physical health	75.0	Family or friends	50.0	NA	
					Don't know	25.0	Doctor	50.0		
Fatty acids (N = 3, 1.8%)	100	0	66.7	33.3	Dietary	33.3	Family or friends	66.7	Convenience	66.7
					Physical health	33.3	Doctor	33.3	Food source unknown	33.3
					Don't know	33.3				
Other (N = 1, 7.7%)	84.6	15.4	15.4	84.6	Physical health	69.2	Family or friends	61.5	Dietary	33.3
					Body conditioning and energy	15.4	Pharmacist	15.4	Convenience	16.7
							Advertising	7.7	Food source unknown	16.7
					Don't know	15.4	Doctor	7.7	Supplement more effective	16.7
							Other	7.7	Vegetarian	16.7

NVNM = non-vitamin, non-mineral supplements.

in other student populations[18,21,22] and in the general population.[3,4] Like other researchers, we found that age, race, study direction and year, as well as competitive sport participation at university or provincial level, did not relate significantly to supplement use.[18,19]

Regular supplement users tended to be more likely to perceive their health as fair or poor than sporadic supplement users and non-users, which is in line with the findings of others.[12,13] It could be argued that this is one of the reasons why they could have chosen to take supplements. However, in their survey of an older population Bender *et al.*[11] found the opposite to be true, namely that supplement users reported better health.

Perceptions regarding adequacy of dietary intake were not associated with supplement use in our study population. Although Lyle *et al.*[12] did not investigate self-reported perception of dietary adequacy, they found that the actual dietary intake of supplement users was more 'healthful' than that of non-users. The users had more nutrient-dense diets, higher intakes of fruit and vegetables and lower intakes of fat. Because actual dietary intake and adequacy were not assessed, it cannot be stated conclusively that there was no relationship between supplement use and actual dietary adequacy in our study population.

Information on why individuals choose *not* to use supplements is scarce and only 2 published studies[21,22] were found that examined the reasons students gave for not taking supplements. The main reasons reported by respondents in our study, namely 'not necessary', 'no reason/don't know', and 'adequate diet', are in line with those reported in the 2 studies mentioned.[21,22] It can be speculated that the fact that so many students either did not know why they were not taking supplements or gave no reason, could indicate that they do not think about nutrition and health, or are uninformed about or not interested in such issues.

Reasons provided by sporadic users of supplements in our study relate to definite problems such as stress (especially males) and sickness and tiredness (especially females). No similar information on reasons for sporadic supplement use could be found in the literature. It can be speculated that sporadic supplement users in our study were possibly more informed as they did not always use supplements as a 'blanket-type' intervention, but did realise that it might be necessary under specific circumstances.

As reported by others,[20,21] regular supplement users in our student population were most likely to take vitamin-mineral combination supplements. Vitamin C, B-complex vitamins, iron, calcium and magnesium complex, and calcium alone were the other more frequently used supplements, with the frequency of intake ranging from 3.6% to 15.5%, which is similar but slightly lower than the frequency reported by other researchers.[15,18,19-21] Spirulina, gingko biloba and Moducare were the most commonly used NVNM supplements taken by our study population. Surveys conducted in other student populations[19,20,25] found ginseng, echinacea, protein powders/amino acids, ginkgo biloba, garlic and aloe vera to be the most commonly used NVNM supplements. As mentioned, the use of protein powders/amino acids was not recorded in this study. It is important to note that in general the reasons provided for using supplements were similar for most supplements, with 'physical health', 'body conditioning and energy' and 'dietary reasons' (i.e. 'inadequate diet', 'ensure adequate intake' and 'food is low in nutrients') cited most frequently. These reasons concur with the findings of other researchers. Driskell[21] reported that 'present illness', 'inadequate diet' and 'increased energy/makes me feel better' were the main reasons students gave for using supplements. Dundas and Keller[20] also reported that students took supplements mainly to improve their health, to prevent colds and flu, and for increased energy. Schulz[18] found that 'nutritional insurance', 'avoiding illness' and 'increasing energy, vitality or strength' were the most common reasons cited by students for taking supplements. As in our study, none of the abovementioned studies investigated the link between supplement use and actual health status, energy levels and so forth. However, in studies where the improvement of health upon supplementation was examined, results are controversial and more research is needed in this regard to determine whether supplements actually contribute to improved health.[1] It is therefore not possible to state conclusively whether the reasons given by students for supplement use are actually valid or not. The fact that diet-related reasons were also often mentioned with regard to supplement use, might reflect the fact that many students felt that their dietary intake was inadequate. This belief is possibly well founded as some studies have reported that the dietary intake of young adults and students is inadequate for some nutrients.[26-28]

The results of this study clearly indicate that family and friends, doctors and advertising are the most important sources of information on the need for supplement use. Our findings are similar to those of Neuhouser *et al.*[15] for a general population sample in the USA and to those of Dundas and Keller[20] and Eldridge and Sheehan[19] for student populations in the USA. This is contrasts with what was reported by the American Dietetic Association (ADA) for consumers in the USA, namely that television and magazines seem to be the primary sources of information on the need for supplement use.[29] Information from sources such as family and friends, advertising and so forth is not always correct and reliable.[30] Irrespective of the actual source of information, it is important that accurate and scientifically based nutrition information be brought to the public via accessible sources.

When asked why they chose to take a supplement to obtain the nutrients instead of obtaining nutrients from food, the main reasons given included the fact that dietary intake was perceived to be inadequate, food was thought to be low in nutrients often because of a belief that the soil is depleted, and supplements were perceived to be more convenient. These reasons are similar to the most often-cited reasons reported by Neuhouser *et al.*,[15] namely 'I find it hard to eat a balanced diet' and 'foods do not supply enough nutrients'. It can be speculated that these reasons reflect specific marketing strategies that use unsupported claims and unscientific theories, such as that the soils are depleted, to promote supplements.[16]

Although the intake of high doses of specific supplements was not highly prevalent in our sample, the public, including students, need to be warned against excessive use of supplements, especially single-nutrient supplements and unconventional supplements. High intakes of certain vitamins and minerals may increase the risks of toxicities. For example, high doses of vitamin A, vitamin B_6, vitamin D, niacin, selenium, and iron are potentially toxic or are known to cause toxicities.[1,31] Furthermore, many unconventional supplements have not been thoroughly tested for safety and efficacy and therefore their use poses a potential health risk.[32] However, it is always important to bear in mind that although supplements can supply the necessary vitamins and minerals, replacing food with supplements contradicts the general recommendations by health authorities that nutrients should be obtained from a wide variety of foods, as foods contain additional beneficial components such as fibre and phytochemicals that supplements cannot supply.[1]

Finally, it must be mentioned that because the sample was a convenience sample taken from a specific university, the results from this study may not apply to the entire Stellenbosch University student population or other population groups. However, the fact that the results of this research follow the trends reported for student populations in other countries does point to the possibility that similar results might be found at other South African tertiary institutions. The fact that only a small number of respondents reported taking specific supplements in our study also needs to be remembered when interpreting the results.

Conclusions and recommendations

It can be concluded that students at Stellenbosch University are regular supplement users, with vitamin-mineral combination-type supplements being the most commonly used. Furthermore, regular supplement users showed no specific demographic or health and lifestyle-associated characteristics. Reasons for supplement use focused largely on health and dietary improvement, and family and friends were the most important source of information regarding supplement use among students. The types of supplements used regularly by this student population and the reasons for using them were similar to those of other student populations and those of the general population.

As the prevalence of supplement use was high in this population group, it is recommended that the link between supplementation and actual nutritional status and health of students be investigated. The results of such research could be combined with our findings to promote the dissemination of reliable and accurate information on the need for dietary supplements and should be made available to students in order to limit unnecessary or harmful supplement use practices.

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