

Original Article

Dietary health behaviour and beliefs among university students from 26 low, middle and high income countries

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The aim of this study was to assess the prevalence of six healthy dietary behaviours and associated factors in university students from 26 low, middle and high income countries. In a cross-sectional survey, we used a self-administered questionnaire (largely based on the European Health and Behaviour Survey) among 19503 undergraduate university students (mean age 20.8, Standard deviation=2.8, age range of 16-30 years) from 27 universities in 26 countries. Results indicated that for a total of six healthy dietary behaviours, overall, students scored a mean of 2.8 healthy dietary behaviours. More female than male students indicated healthy dietary behaviours. In multivariate linear regression among men and women, living in an upper middle income or high income country, dieting to lose weight, the high importance of dietary health benefits, high non-organized religious activity, high physical activity and currently a non-tobacco user were associated with the healthy dietary behaviour index. The study found a high prevalence of relatively poor dietary healthy behaviours.

Key Words: dietary behaviour, health beliefs, knowledge, university students, multi-country

INTRODUCTION

“Healthy diets play a key role in the prevention of cardiovascular diseases, cancer and diabetes.”¹ The benefits of limiting energy intake from total fats, limiting salt (sodium) consumption from all sources and maximizing fiber, fruit and vegetable intake has been supported by the World Health Organization.¹ Unhealthy nutritional habits in university students can be a risk factor for cardiovascular and other diseases.² During university life new health behaviours and practices are formed that are likely to be sustained into adulthood.³ Some studies have reported poor healthy dietary habits among university students, e.g., among nursing students in Thailand. Osaka et al⁴ found that about half of them avoided eating fat/cholesterol, enriched fiber foods, and having breakfast regularly. Wardle et al⁵ found among university students in 21 European countries that generally less than 55% tried to avoid fat, tried to eat fiber, ate fruit daily, limited red meat, and 68.5% limited salt consumption. Similar prevalence rates of these healthy dietary behaviours were reported by Wardle et al⁶ in a second survey among university students from 24 countries, including four developing countries.⁶

Several studies have investigated factors associated with healthy dietary behaviours, including (1) sociodemographic factors (female gender),⁵⁻⁹ higher socioeconomic status, including income,⁸ (2) dietary knowledge,⁵ (3) dietary health benefits,^{4-6,9} (4) dieting behaviour,^{4-6,9} (5) religious and personality factors such as internal locus of control,¹⁰ religious practices⁷ and (6) other health behav-

our, including exercise^{4,8} and not smoking.⁸

The purpose of this study was to assess the prevalence of healthy dietary behaviour and beliefs in university students from 26 low, middle and high income countries.

MATERIALS AND METHODS

Sample and procedure

This cross-sectional study was carried out with a network of collaborators in participating countries (see Acknowledgments). The anonymous, self-administered questionnaire used for data collection was developed in English, then translated and back-translated into languages (Arabic, Bahasa, Chinese, French, Lao, Russian, Spanish, Thai, Turkish) of the participating countries. The study was initiated through personal academic contacts of the principal investigators. These collaborators arranged for data to be collected from intended 400 male and 400 female undergraduate university students aged 16-30 years by trained research assistants in 2013 in one university in their respective countries. The universities involved were

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located in the capital cities or other major cities in the participating countries. Research assistants working in the participating universities asked classes of undergraduate students to complete the questionnaire at the end of a teaching class. In each study country, undergraduate students were surveyed in classrooms selected through a stratified random sample procedure. The students who completed the survey varied in the number of years for which they had attended the university. A variety of majors were involved, including education, humanities and arts, social sciences, business and law, science, engineering, manufacturing and construction, agriculture, health and welfare and services. Informed consent was obtained and confidentiality was assured from participating students, and the study was conducted in 2013. Participation rates were in most countries over 90%. Ethics approvals were obtained from institutional review boards from all participating institutions.

Dietary variables

Dietary behaviours

Dietary behaviours included the following: (a) trying to avoid eating foods that contain fat and cholesterol (yes, no); (b) trying to eat foods that are high in fibre (yes, no); (c) frequency of consumption of red meat (daily, 2-3 times a week, once a week, never); (d) addition of salt to food (usually, sometimes, occasionally, never); (e) number of servings [defined as 80 grams] of fruits eaten on a typical day (number); (f) frequency of having breakfast (almost every day, sometimes, rarely or never).^{5,11} Items a-d and f were taken from the European Health and Behaviour Survey.⁵ To produce a more quantifiable index, a healthy dietary behaviour index score was calculated including: (1) Makes a conscious effort to avoid eating foods that contain fat and cholesterol, (2) Makes a conscious effort to eat foods that are high in fibre, (3) Eats red meat less than daily, (4) Does not usually add salt to meals, (5) eats two or more servings of fruits daily, and (6) has breakfast almost every day.

Dietary knowledge or risk appraisal

Three items of knowledge of diet and disease relationships were assessed: the awareness of the links between animal fat and heart disease and breast cancer and between overweight and high blood pressure.⁵

Beliefs in dietary health benefits

Participants were asked to rate the importance of five dietary behaviours on 10-point scales, ranging from 1=low importance and 10=very great importance to health. The items included: (1) not to eat too much animal fat, (2) to eat enough fibre, (3) not to add too much salt, (4) to eat enough fruit, and (5) to eat breakfast almost every day.⁵

Socio-demographic

Socio-demographic questions included age, gender, and socioeconomic background were assessed by rating their family background as wealthy (within the highest 25% in "country", in terms of wealth), quite well off (within the 50% to 75% range for their country), not very well off (within the 25% to 50% range from "country"), or quite

poor (within the lowest 25% in their country, in terms of wealth).¹²

Religious and personality factors

Non-organized religious activity was assessed with one item from the Duke University Religion Index (DUREL).¹³ "How often do you spend time in private religious activities, such as prayer, meditation or Bible study?" Response options ranged from 1=rarely or never to 6=more than once daily.

Sense of control or personal control

This was operationalized with one dimension, personal mastery. Three items measured personal mastery. An example is, "I can do just about anything I really set my mind to".¹⁴ Cronbach's alpha for personal mastery in our sample was 0.75.

Other health behaviours

Physical activity was assessed using the self-administered International Physical Activity Questionnaire (IPAQ) short version, for the last 7 days (IPAQ-S7S). We used the instructions given in the IPAQ manual for reliability and validity, which is detailed elsewhere.¹⁵ We categorized physical activity (short form) according to the official IPAQ scoring protocol¹⁶ as low, moderate and high.

Tobacco use was assessed with the question: Do you currently use one or more of the following tobacco products (cigarettes, snuff, chewing tobacco, cigars, etc.)? Response options were "yes" or "no".¹⁷

Data analysis

The data were analysed using IBM SPSS (version 20.0). The proportion of dietary behaviours was calculated as a percentage and means and standard deviations, respectively. Linear regression analysis was done with STATA to calculate the crude odds ratio (OR) with 95% confidence interval (CI) to determine the associations between sociodemographic, dietary factors, religious and personality and other health behaviour variables, and the healthy dietary behaviour index. The country was entered as the primary sampling unit for survey analysis in STATA in order to achieve accurate CIs, given the clustered nature of the data.

RESULTS

Healthy dietary practices

The total sample included 19503 undergraduate university students (mean age 20.8, SD=2.8, age range of 16-30 years) from 26 countries. Table 1 shows the number of participants in each university or country, and the proportion of students endorsing six healthy dietary behaviours. Overall, 39.0% of university students tried to avoid fat, 39.8% tried to eat fiber, 54.4% limited eating red meat, 60.4% limited adding salt to meals, 35.9% ate two or more servings of fruits daily, and 53.8% ate breakfast regularly. From a total of six healthy dietary behaviours, overall, students scored a mean of 2.8 healthy dietary behaviours. Women had a higher healthy dietary behaviour index (2.9) than men (2.7) ($t: -8.54; p<0.001$). There were country variations in the mean of the healthy dietary behaviours (range 1-6), with high means (3.3 or more) in

Barbados, Mauritius, Thailand, and Tunisia, and low means (2.6 or lower) in Cameroon, Egypt, Kyrgyzstan, Namibia, Nigeria, Philippines, and Russia. There were also country variations in terms of the prevalence of the different healthy dietary behaviours. Avoiding to eat fat and trying to eat fiber was low (<30%) among university students in China, Kyrgyzstan, Russia and Turkey, and high (>40%) in Grenada, Indonesia, Mauritius and Thailand. Regarding limiting red meat, students from Barbados, Indonesia, Mauritius, South Africa, and Turkey were above 70%, while students from China and Singapore were below 30%. Limiting salt was high (>85%) in China, Columbia Mauritius and Thailand and low (<30%) in Cameroon and Kyrgyzstan. In terms of adequate daily fruit consumption, university students from Mauritius, South Africa, Thailand and Tunisia were above 45% and from China, Jamaica and Laos were below 25%. Having breakfast regularly was highest (<75%) in students from Madagascar and Venezuela, and lowest (<40%) in students from the Ivory Coast and Thailand. Considering differences in the regions of participating study countries, the healthy dietary behaviour index was highest in South Asia and China, and lowest in Central Asia (see Table 1).

Health beliefs and dietary knowledge

Beliefs about the importance of five dietary behaviours were assessed on a scale from 1 to 10, with 10 having the greatest importance. Overall, the lowest importance was given to avoiding animal fat (6.4) and the highest importance to eating enough fruit (7.7) and to eat breakfast regularly (7.5), while eating enough fiber and avoiding salt were given a 7.0 rating. For all the five dietary behaviours high endorsement rates (Odds ratio: >2.00) were found in Pakistan, Indonesia, Mauritius, and China, while low endorsement rates (Odds ratio: <0.65) were found in Egypt, Turkey, Madagascar, Nigeria, Laos and South Africa. Looking at the study region, higher endorsement rates were found in the study countries of South Asia, China, and Southeast Asia, and lower endorsement rates in study countries of the Caribbean, South America, North Africa, Near and Central Asia and sub-Saharan Africa.

Overall, 67.2% of participants were aware of the fat-heart disease association, 13.2% of the fat-breast cancer link and 62.5% of the overweight-high blood pressure association. The awareness of dietary health risks was, overall, a mean of 1.4 (range 0-3). There were also country and regional variations on the awareness of dietary health risks. The lowest awareness of dietary health risks was in the study countries from the sub-Saharan Africa region, and the highest awareness of dietary health risks was in the study countries from the Caribbean and South America and Southeast Asia. In terms of specific study countries, the highest awareness of dietary health risks was in university students from China, Philippines, and Singapore (see Table 2).

Associations with healthy dietary behaviour

In multivariate linear regression among men, living in an upper middle income or high income country, dieting to lose weight, the high importance of dietary health benefits, high non-organized religious activity, high physical

activity and currently a non-tobacco user were associated with the healthy dietary behaviour index.

Further, in multivariate linear regression among women, living in an upper middle income or high income country, dieting to lose weight, the high importance of dietary health benefits, high non-organized religious activity, personal control, high physical activity and currently a non-tobacco user were associated with the healthy dietary behaviour index (see Table 3).

DISCUSSION

The study found, among university students from 26 low, middle and high income countries, a similar poor prevalence of healthy dietary behaviours compared with previous studies among university students in high income countries, and also four developing countries (Columbia, South Africa, Thailand, Venezuela) from the previous International Health and Behaviour Survey.^{5,6} However, there were country variations in the mean of the healthy dietary behaviours (range 1-6), with good healthy dietary behaviour in university students in Barbados, Mauritius, Thailand, and Tunisia, and poor healthy dietary behaviours in Cameroon, Namibia, Nigeria, Egypt, Kyrgyzstan, Russia and Philippines. These international differences in dietary health practices could be related to cuisine such as more fruit in countries like Mauritius, Thailand, and Tunisia or less red meat in most Muslim or Hindu countries such as Bangladesh, India, Indonesia, Mauritius, Pakistan, and Turkey. Poor dietary practices have also been reported in populations in Russia¹⁸ and countries of the former Soviet Union, including Kyrgyzstan,¹⁹ as found in this study. In addition, in agreement with the current study, poor dietary practices were also found among university students in Nigeria.²⁰

In this study female students were more likely than male students to indicate healthy dietary behaviour, which is in agreement with previous studies.⁵⁻⁹ According to Wardle et al⁶ "gender differences in food choices appear to be partly attributable to women's greater weight control involvement and partly to their stronger beliefs in healthy eating." Further, the study found, in agreement with previous findings^{8,21} that higher socioeconomic status, in this case that living in an upper middle income or high income country compared with living in a low income or lower middle income country was associated with better dietary health behaviour.

Regarding health benefits of dietary behaviours, the study found that the lowest importance was given to avoiding animal fat, medium importance to eating enough fiber and avoiding salt and the highest importance to eating enough fruit and to eat breakfast regularly. For the first four food choices, similar results were also found in the study countries in Colombia, South Africa, Thailand and Venezuela from the previous International Health and Behaviour Survey.⁶ Looking at the different study regions of this study, higher endorsement rates were found in Asian countries compared countries in Africa and the Americas. It is possible that healthy dietary behaviours have a more central role in Asian than other cultures.

Contrary to a previous study⁵ and in agreement with another study among university students,²² this study did not find that dietary knowledge or risk awareness was

Table 1. Sample characteristics and healthy dietary behaviour by country among university students from 26 countries, 2013

	Sample	Try to avoid fat	Try to eat fiber	Limit red meat	Limit salt	2 or more fruits daily	Eating breakfast regularly	Healthy dietary index	
	N	%	%	%	%	%	%	M (SD)	$\beta^{\dagger\dagger}$
All	19503	39.0	39.8	54.4	60.4	35.9	53.8	2.8 (1.4)	
Caribbean and South America	3056	43.8	37.3	57.4	72.7	26.9	56.1	2.9 (1.4)	0.13***
Barbados [¶]	523	42.0	40.7	74.8	73.3	29.5	58.8	3.3 (1.4)	0.47***
Grenada [§]	411	52.2	51.6	48.1	63.3	30.9	58.1	3.0 (1.5)	0.22**
Jamaica [§]	738	35.3	32.7	60.6	68.6	21.7	48.5	2.7 (1.5)	-0.17***
Colombia [§]	818	47.1	35.9	50.6	89.7	25.4	41.7	2.9 (1.3)	0.08
Venezuela [§]	563	46.0	31.6	52.5	60.3	30.5	82.8	3.0 (1.3)	0.21***
Sub-Saharan Africa	4759	40.3	42.2	58.3	50.3	39.3	49.9	2.8 (1.4)	-0.04
Cameroon [‡]	627	26.8	19.6	38.8	21.4	36.5	50.6	1.9 (1.1)	-0.92***
Ivory Coast [‡]	810	36.7	73.2	53.4	55.3	35.6	31.8	2.9 (1.3)	0.03
Madagascar [†]	790	34.3	20.7	63.4	59.8	36.9	79.1	2.9 (1.2)	0.11*
Mauritius [§]	485	60.4	51.2	72.9	91.6	47.6	60.1	3.9 (1.4)	1.06***
Namibia [§]	457	39.2	47.5	43.2	44.4	35.9	43.7	2.6 (1.4)	-0.28***
Nigeria [‡]	786	43.0	38.5	60.6	34.8	31.8	44.2	2.5 (1.2)	-0.28***
South Africa [§]	759	46.8	44.9	71.0	51.5	51.3	41.9	3.1 (1.3)	0.25***
North Africa, Near East and central Asia	4126	32.4	32.1	54.3	48.1	42.4	54.7	2.6 (1.4)	-0.25***
Egypt [‡]	796	38.2	40.3	44.5	41.1	47.0	44.1	2.6 (1.4)	-0.26***
Tunisia [§]	902	39.1	53.4	54.3	70.4	53.5	62.8	3.3 (1.3)	0.55***
Turkey [§]	796	33.8	23.3	78.0	60.0	35.3	57.2	2.8 (1.4)	0.06
Russia [§]	789	26.4	24.5	57.1	45.6	39.8	59.0	2.5 (1.4)	-0.33***
Kyrgyzstan [†]	837	24.1	16.8	38.1	21.7	35.7	49.5	1.9 (1.1)	-1.01***
South Asia and China	3485	39.4	40.4	59.6	62.7	34.9	62.6	3.0 (1.3)	0.20***
Bangladesh [†]	785	39.6	43.3	62.8	64.4	37.4	61.8	3.1 (1.2)	0.32***
India [‡]	783	32.2	32.0	88.1	42.9	41.9	64.6	3.0 (1.2)	0.16**
Pakistan [‡]	813	40.8	41.3	74.9	47.2	41.7	58.5	3.0 (1.3)	0.21***
China [§]	1104	43.2	43.2	25.4	87.1	22.9	64.7	2.8 (1.3)	0.04
Southeast Asia	4077	40.3	46.2	43.3	73.1	32.8	48.2	2.8 (1.3)	0.01
Indonesia [‡]	739	45.1	73.1	80.0	33.6	35.7	40.1	3.1 (1.2)	0.27***
Laos [‡]	806	29.5	27.8	57.3	78.2	19.1	45.2	2.6 (1.3)	-0.27***
Philippines [‡]	781	28.6	31.9	35.3	74.6	26.7	53.6	2.5 (1.2)	-0.33***
Singapore [¶]	885	43.7	38.3	20.5	85.0	28.9	62.5	2.8 (1.4)	-0.02
Thailand [§]	854	53.4	61.3	29.2	89.0	55.5	38.4	3.3 (1.9)	0.46***

[†]Low income country; [‡]Lower middle income country; [§]Upper middle income country; [¶]High income country (Source: World Bank, New Country Classifications, 2013); ^{††}Beta for country difference; * $p<0.05$; ** $p<0.01$; *** $p<0.001$.

Table 2. Ratings of belief in the importance of healthy dietary behaviours and dietary risk awareness by country among university students from 26 countries, 2013

	Not to eat too much animal fat	To eat enough fiber	Not to add too much salt	To eat enough fruit	To eat breakfast every day	Health benefits	Healthy dietary risk awareness	
	M (SD)	M (SD)	M (SD)	M (SD)	M (SD)	OR (95% CI)	M (SD)	OR (95% CI)
All	6.4 (3.1)	7.0 (2.9)	7.0 (3.0)	7.7 (2.7)	7.5 (3.0)		1.4 (0.8)	
Caribbean and South America	6.3 (2.8)	7.1 (2.6)	7.1 (2.8)	7.7 (2.5)	7.8 (2.7)	0.89 (0.82-0.96)**	1.5 (0.7)	1.47 (1.34-1.60)***
Barbados [¶]	6.3 (2.7)	7.0 (2.5)	7.3 (2.6)	7.7 (2.3)	7.6 (2.6)	0.97 (0.81-1.16)	1.5 (0.8)	1.19 (1.01-1.41)*
Grenada [§]	7.0 (2.8)	7.5 (2.6)	7.4 (2.8)	8.0 (2.4)	7.8 (2.7)	1.43 (1.15-1.79)**	1.6 (0.8)	1.54 (1.26-1.89)***
Jamaica [§]	6.4 (2.9)	6.7 (2.8)	7.3 (2.8)	7.7 (2.6)	7.3 (3.0)	0.81 (0.69-0.94)**	Not available	
Colombia [§]	6.0 (2.8)	7.3 (2.5)	6.9 (3.1)	7.7 (2.6)	7.9 (2.8)	0.79 (0.68-0.91)***	1.5 (0.7)	1.47 (1.27-1.69)***
Venezuela [§]	6.4 (2.6)	6.9 (2.5)	6.8 (2.7)	7.4 (2.4)	8.8 (2.2)	0.87 (0.73-1.02)	1.5 (0.7)	1.48 (1.25-1.75)***
Sub-Saharan Africa	5.9 (3.5)	6.3 (3.3)	6.7 (3.4)	7.5 (3.2)	6.9 (3.6)	0.63 (0.59-0.68)***	1.2 (0.8)	0.51 (0.48-0.55)***
Cameroon [†]	5.9 (2.9)	6.9 (2.8)	6.9 (3.0)	8.4 (2.3)	8.1 (2.7)	0.82 (0.70-0.97)*	1.5 (0.7)	1.29 (1.10-1.52)**
Ivory Coast [†]	6.6 (4.4)	7.0 (4.2)	7.5 (4.0)	8.1 (3.7)	5.5 (4.5)	0.71 (0.61-0.83)***	1.1 (0.7)	0.48 (0.41-0.57)***
Madagascar [†]	5.5 (3.1)	5.5 (2.9)	6.6 (3.0)	7.5 (2.9)	8.4 (2.7)	0.45 (0.39-0.53)***	1.0 (0.7)	0.38 (0.33-0.45)***
Mauritius [§]	7.3 (2.5)	7.6 (2.2)	7.9 (2.4)	8.3 (2.1)	8.0 (2.5)	2.01 (1.61-2.52)***	1.5 (0.7)	1.02 (0.85-1.23)
Namibia [§]	6.3 (3.2)	7.1 (2.9)	6.9 (3.0)	7.6 (2.8)	7.3 (3.0)	0.75 (0.62-0.90)**	1.2 (0.7)	0.56 (0.46-0.68)***
Nigeria [†]	4.8 (3.7)	4.7 (3.6)	5.3 (3.8)	5.9 (3.8)	5.1 (3.8)	0.63 (0.52-0.76)***	0.9 (0.8)	0.32 (0.27-0.38)***
South Africa [§]	5.4 (3.1)	6.4 (2.9)	6.3 (3.3)	7.0 (3.0)	7.0 (3.1)	0.50 (0.43-0.59)***	Not available	
North Africa, Near East and central Asia	5.9 (3.0)	6.4 (3.0)	6.6 (3.2)	7.3 (3.0)	7.1 (3.1)	0.58 (0.54-0.63)***	1.4 (0.8)	0.93 (0.86-1.00)
Egypt [†]	6.1 (3.1)	6.5 (3.0)	6.0 (3.1)	7.0 (3.0)	6.1 (3.2)	0.58 (0.49-0.67)***	1.6 (0.8)	1.61 (1.39-1.86)***
Tunisia [§]	6.4 (3.0)	6.4 (3.3)	7.1 (3.3)	6.9 (3.9)	7.3 (2.9)	0.73 (0.63-0.86)***	1.1 (0.9)	0.57 (0.50-0.65)***
Turkey [§]	5.5 (3.0)	5.8 (2.9)	6.7 (3.3)	7.0 (2.7)	6.9 (3.3)	0.47 (0.40-0.54)***	1.4 (0.8)	0.98 (0.85-1.14)
Russia [§]	5.8 (3.2)	6.3 (3.1)	6.3 (3.1)	7.4 (2.8)	7.4 (3.0)	0.67 (0.57-0.78)***	1.1 (0.7)	0.36 (0.27-0.48)***
Kyrgyzstan [†]	5.8 (2.9)	6.9 (2.8)	6.8 (3.1)	8.3 (2.4)	7.9 (2.8)	0.81 (0.70-0.94)**	1.4 (0.7)	1.21 (1.02-1.38)*
South Asia and China	7.5 (2.8)	7.9 (2.4)	7.7 (2.6)	8.3 (2.3)	8.1 (2.6)	2.41 (2.21-2.64)***	1.5 (0.8)	0.99 (0.92-1.07)
Bangladesh [†]	6.5 (2.9)	7.0 (2.5)	6.6 (3.1)	7.2 (2.7)	7.1 (3.1)	1.04 (0.88-1.21)	1.5 (0.8)	1.12 (0.97-1.30)***
India [†]	6.4 (3.4)	7.1 (3.1)	7.1 (3.2)	7.8 (2.8)	7.8 (3.0)	0.88 (0.76-1.02)***	1.1 (0.7)	0.33 (0.28-0.39)***
Pakistan [†]	9.6 (0.8)	9.6 (0.7)	9.5 (0.9)	9.6 (0.8)	9.6 (0.8)	8.08 (5.58-9.88)***	1.6 (0.9)	1.18 (0.98-1.35)
China [§]	7.4 (2.1)	8.0 (1.8)	7.6 (1.9)	8.3 (1.7)	7.8 (2.0)	3.23 (2.73-3.82)***	1.8 (0.7)	2.53 (2.21-2.88)***
Southeast Asia	6.7 (2.8)	7.5 (2.5)	7.2 (2.7)	8.0 (2.3)	7.7 (2.7)	1.50 (1.38-1.62)***	1.6 (0.8)	1.57 (1.47-1.68)***
Indonesia [†]	8.1 (2.9)	8.9 (2.3)	8.1 (2.9)	9.2 (1.9)	8.3 (2.8)	5.58 (4.35-7.14)***	1.5 (0.9)	1.01 (0.88-1.18)
Laos [†]	5.7 (3.0)	6.8 (3.0)	6.6 (3.4)	7.9 (2.7)	8.1 (3.0)	0.63 (0.54-0.72)***	1.2 (0.9)	0.77 (0.67-0.89)***
Philippines [†]	6.6 (2.4)	7.1 (2.2)	7.2 (2.2)	8.0 (2.0)	8.0 (2.4)	1.25 (1.07-1.46)**	1.8 (0.6)	4.14 (3.47-4.93)***
Singapore [¶]	6.8 (2.4)	7.2 (2.1)	7.1 (2.2)	7.7 (1.9)	6.9 (2.5)	1.70 (1.45-1.99)***	1.8 (0.7)	2.62 (2.26-3.04)***
Thailand [§]	6.4 (2.6)	7.5 (2.3)	7.3 (2.5)	7.4 (2.3)	7.3 (2.7)	1.19 (1.02-1.38)*	1.4 (0.7)	0.89 (0.77-1.02)

†Low income country; ‡Lower middle income country; §Upper middle income country; ¶High income country (Source: World Bank, New Country Classifications, 2013); * $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

Table 3. Linear regression with healthy dietary behaviour among university students from 26 countries, 2013

Variables (%)	%	Men		Women	
		Unadjusted odds ratio Beta (95% CI)	Adjusted odds ratio Beta (95% CI)	Unadjusted odds ratio Beta (95% CI)	Adjusted odds ratio Beta (95% CI)
Socio-demographics					
Age in years					
16-19	34.1	Reference			
20-21	35.5	-0.13 (-0.20 to -0.05)***	-0.07 (-0.05 to 0.01)	-0.01 (-0.07 to -0.05)	---
22 or more	30.4	-0.03 (-0.03 to 0.05)	0.01 (-0.7 to 0.09)	-0.03 (-0.10 to 0.03)	
Wealth					
Not well off/poor	46.4	Reference			
Wealthy/quite well off	53.6	-0.09 (-0.15 to -0.03)**	0.01 (-0.07 to 0.09)	-0.07 (-0.12 to -0.013)*	-0.05 (-0.11 to -0.01)
Country income					
Upper middle income/high income	49.8	Reference			
Low income/lower middle income	50.2	-0.07 (-0.13 to -0.004)*	-0.16 (-0.23 to -0.09)***	-0.40 (-0.45 to -0.35)***	-0.17 (-0.24 to -0.10)***
Dietary factors					
Dietary knowledge					
Low (0)	14.4	Reference	---		
Medium (1)	36.1	-0.07 (-0.17 to 0.03)		0.06 (-0.03 to 0.15)	0.04 (-0.06 to 0.14)
High (2-3)	49.5	0.01 (-0.08 to 0.11)		0.11 (0.02 to 0.19)*	0.03 (-0.07 to 0.13)
Dieting to lose weight	15.6	0.72 (0.62 to 0.82)***	0.67 (0.57 to 0.77)***	0.51 (0.44 to 0.57)***	0.47 (0.39 to 0.54)***
Importance of dietary benefits					
Low	25.8	Reference			
Medium	34.0	0.46 (0.39 to 0.54)***	0.40 (0.32 to 0.48)***	0.43 (0.35 to 0.50)***	0.38 (0.30 to 0.46)***
High	40.2	0.68 (0.61 to 0.76)***	0.64 (0.56 to 0.72)***	0.79 (0.73 to 0.86)***	0.73 (0.65 to 0.81)***
Religious and personality factors					
Non-organized religious activity					
Low	30.2	Reference			
Medium	38.7	0.20 (0.12 to 0.27)***	0.18 (0.10 to 0.25)***	0.30 (0.24 to 0.35)***	0.33 (0.26 to 0.40)***
High	31.1	0.35 (0.27 to 0.43)***	0.31 (0.22 to 0.39)***	0.36 (0.30 to 0.43)***	0.39 (0.32 to 0.47)***
Personal control					
Low	33.6	Reference			---
Medium	40.3	-0.01 (-0.08 to -0.07)	-0.03 (-0.10 to 0.05)	-0.01 (-0.07 to 0.05)	-0.02 (-0.08 to 0.05)
High	26.1	0.08 (0.002 to -0.16)*	0.02 (-0.07 to 0.10)	0.10 (0.04 to 0.18)*	0.12 (0.05 to 0.20)***
Other health behaviours					
Physical activity					
Low	46.5	Reference			
Moderate	21.9	0.13 (0.04 to 0.21)**	0.13 (0.04 to 0.22)**	0.18 (0.11 to 0.24)***	0.20 (0.13 to 0.27)*
High	31.5	0.15 (0.08 to 0.33)***	0.21 (0.14 to 0.29)***	0.08 (0.02 to 0.15)**	0.13 (0.06 to 0.20)***
Current tobacco user	12.8	-0.35 (-0.43 to -0.28)***	-0.30 (-0.38 to -0.22)***	-0.41 (-0.52 to -0.30)***	-0.33 (-0.45 to -0.21)***

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$.

UOR: unadjusted odds ratio; AOR: adjusted odds ratio; CI: confidence interval.

associated with healthy dietary behaviour. However, in agreement with several studies^{4,6,9} this study found that beliefs about dietary health benefits and dieting behaviour were highly associated with healthy dietary behaviour. The cognitive model of dietary health behaviour can be utilized in dietary health interventions. In addition, dietary health behaviour was assessed in relation to religious and personality constructs such as personal control or mastery and non-organized religious activity. Non-organized religious activity and among women personal control or mastery were associated with dietary healthy behaviour, as found in some previous studies.^{7,10} This finding seems to emphasise the importance of “internality”¹⁰ on dietary healthy behaviour, which can also be utilized in dietary interventions. Further, in agreement with previous studies, physical activity and no current tobacco use were associated with dietary healthy behaviour.^{4,8} This seems to support that positive, healthy behaviours may cluster and can be combined in health promotion programmes.

Study limitations

This study had several limitations. The study was cross-sectional, so causal conclusions cannot be drawn. The investigation was carried out with students from one university in each country, and inclusion of other centres could have resulted in different results. University students are not representative of young adults in general, and the prevalence of the different dietary healthy practices and its risk factors may be different in other sectors of the population. Another limitation of the study was that all the other information collected in the study was based on self-reporting.

Conclusion

The study found a high prevalence of relative poor dietary healthy behaviours in a large sample of university students from Africa, Asia and the Americas. Several factors associated with healthy dietary behaviours university students were identified.

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AUTHOR DISCLOSURES

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REFERENCES

1. WHO. Global strategy on diet, physical activity and health. [cited 2014/9/10]; Available from: <http://www.who.int/dietphysicalactivity/diet/en/>.
2. Abdel-Megeid FY, Abdelkarem HM, El-Fetouh AM. Unhealthy nutritional habits in university students are a risk factor for cardiovascular diseases. *Saudi Med J*. 2011;32:621-7.
3. Takomana G, Kalimbira AA. Weight gain, physical activity and dietary changes during the seven months of first-year university life in Malawi. *South Afr J Clin Nutr*. 2012;25:132-9.
4. Osaka R, Nanakorn S, Sanseeha L, Nagahiro C, Kodama N. Healthy dietary habits, body mass index, and predictors among nursing students, northeast Thailand. *Southeast Asian J Trop Med Public Health*. 1999;30:115-21.
5. Wardle J, Steptoe A, Bellisle F, Davou B, Reschke K, Lappalainen R, Fredrikson M. Healthy dietary practices among European students. *Health Psychol*. 1997;16:443-50. doi: 10.1037/0278-6133.16.5.443.
6. Wardle J, Haase AM, Steptoe A, Nillapun M, Jonwutiwes K, Bellisle F. Gender differences in food choice: the contribution of health beliefs and dieting. *Ann Behav Med*. 2004;27:107-16. doi: 10.1207/s15324796abm2702_5.
7. Peltzer K. Healthy dietary practices among black and white South Africans. *Ethn Dis*. 2002;12:336-41.
8. Shelton NJ. What not to eat: inequalities in healthy eating behaviour, evidence from the 1998 Scottish Health Survey. *J Public Health*. 2005;27:36-44. doi: 10.1093/pubmed/fdh191.
9. Westenhoefer J. Age and gender dependent profile of food choice. *Forum Nutr*. 2005;57:44-51. doi: 10.1159/000083753.
10. Bennett P, Moore L, Smith A, Murphy S, Smith C. Health locus of control and value for health as predictors of dietary behaviour. *Psychol Health*. 1994;10:41-54. doi: 10.1080/08870449408401935.
11. Hall JN, Moore S, Harper SB, Lynch JW. Global variability in fruit and vegetable consumption. *Am J Prev Med*. 2009;36:402-9.e5. doi: 10.1016/j.amepre.2009.01.029.
12. Wardle J, Steptoe A. The European Health and Behaviour-Survey: rationale, methods and initial results from the United Kingdom. *Soc Sci Med*. 1991;33:925-36.
13. Koenig HG, Parkerson GR Jr, Meador KG. Religion index for psychiatric research. *Am J Psychiatry*. 1997;154:885-6.
14. Lachman ME, Weaver SL. The sense of control as a moderator of social class differences in health and well-being. *J Pers Soc Psychol*. 1998;74:763-73.
15. Craig CL, Marshall AL, Sjöström M, Bauman AE, Booth ML, Ainsworth BE et al. International physical activity questionnaire: 12-Country reliability and validity. *Med Sci Sports Exerc*. 2003;35:1381-95. doi: 10.1249/01.MSS.0000078924.61453.FB.
16. International Physical Activity Questionnaire (IPAQ) (2006). IPAQ scoring protocol. [cited 2014/4/5]; Available from: <https://sites.google.com/site/theipaq/>.
17. World Health Organization (WHO). Guidelines for controlling and monitoring the tobacco epidemic. Geneva, Switzerland: WHO; 1998.
18. Boylan S, Welch A, Pikhart H, Malyutina S, Pajak A, Kubinova R et al. Dietary habits in three Central and Eastern Eu-

- ropean countries: the HAPIEE study. *BMC Public Health*. 2009;9:439. doi: 10.1186/1471-2458-9-439.
19. Abe SK, Stickley A, Roberts B, Richardson E, Abbott P, Rotman D, McKee M. Changing patterns of fruit and vegetable intake in countries of the former Soviet Union. *Public Health Nutr*. 2013;16:1924-32. doi: 10.1017/S1368980013001316.
 20. Otemuyiwa IO, Adewusi SR. Food choice and meal consumption pattern among undergraduate students in two universities in South western Nigeria. *Nutr Health*. 2012;21:233-45. doi: 10.1177/0260106013510994.
 21. Steptoe A, Wardle J. Motivational factors as mediators of socioeconomic variations in dietary intake patterns. *Psychol Health*. 1999;14:391-402. doi:10.1080/08870449908407336.
 22. Peltzer K. Healthy dietary practices among Black South African university students. *Health SA Gesondheid*. 2001;6:59-64.

Original Article

Dietary health behaviour and beliefs among university students from 26 low, middle and high income countries

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26 個低、中、高收入國家大學生的飲食健康行為與信念

本研究目的為評估來自 26 個低、中、高收入國家大學生，他們的六個健康飲食行為及相關因子的盛行率。本研究室一個橫斷性調查，我們使用一份自填式問卷（大部分參照歐洲健康與行為調查）收集來自 26 個國家的 27 所大學，共 19503 名大學學生（平均年齡為 20.8 歲，標準差=2.8 歲，年齡範圍為 16-30 歲）的資訊。結果顯示，總共六項的健康飲食行為，整體學生自評健康飲食行為平均為 2.8 項。更多的女學生較男學生表示有健康飲食行為。男女生的多元線性迴歸，居住在中上或是高收入國家者、為了減重而節食、認為飲食健康益處的重要性高、常參與非組織宗教活動、高體能活動及目前為非吸菸者與健康飲食行為指數有關。本研究發現高盛行不良飲食健康行為。

關鍵字：飲食行為、健康信念、知識、大學生、多國