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Research Article

Comparison of health risk behavior, awareness, and health benefit beliefs of health science and non-health science students: An international study

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Abstract This study determines the differences in health risk behavior, knowledge, and health benefit beliefs between health science and non-health science university students in 17 low and middle income countries. Anonymous questionnaire data were collected in a cross-sectional survey of 13,042 undergraduate university students (4,981 health science and 8,061 non-health science students) from 17 universities in 17 countries across Asia, Africa, and the Americas. Results indicate that overall, health science students had the same mean number of health risk behaviors as non-health science university students. Regarding addictive risk behavior, fewer health science students used tobacco, were binge drinkers, or gambled once a week or more. Health science students also had a greater awareness of health behavior risks (5.5) than non-health science students (4.6). Linear regression analysis found a strong association with poor or weak health benefit beliefs and the health risk behavior index. There was no association between risk awareness and health risk behavior among health science students and an inverse association among non-health science students.

Key words health benefits, health risk behavior, health sciences, multi-country, non-health science university students, risk awareness.

INTRODUCTION

"Health risk" is defined as "a factor that raises the probability of adverse health outcomes" (World Health Organization, 2009). There are two broad classes of health-related behaviors: risk behavior and positive health behavior (Steptoe, 2007). "A health risk behaviour can be defined as an activity carried out by people with a frequency or intensity that increases the risk of disease or injury" (Steptoe, 2007, p. 263). Health risk behaviors include physical inactivity, unhealthy diet, tobacco use, drug abuse, unprotected sexual practices, and harmful use of alcohol (Lim *et al*., 2012; World Health Organization, 2013). These behaviors are attributes of health-related lifestyle factors that may lead to chronic diseases, including heart disease, stroke, cancer, and diabetes (von Bothmer & Fridlund, 2005; World Health Organization, 2005). Youth and young adults are increasingly exposed to many health risk behaviors related to epidemiologic and socioeconomic transitions, in particular, in low and middle income countries (Jackson *et al*., 2012). These countries are undergoing rapid changes associated with the development of high rates of non-communicable diseases and injuries, while at the same time experiencing high levels of specific communicable diseases, such as the human immunodeficiency virus (Oni & Unwin, 2015). Health risk behaviors in young adulthood influence the development of lifestyle-related disorders later in life (von Bothmer & Fridlund, 2005). For healthcare staff, in particular, it is important to identify with a healthy lifestyle and to serve as a role model for clients (Frank *et al*., 2000). Health science students are expected to be aware of and practice healthy behaviors (Can *et al*., 2008). There is a lack of research investigating health risk behaviors in developing countries, in particular, comparing health and non-health science students (Can *et al*., 2008; Pengpid *et al*., 2014).

Several studies comparing health risk behaviors between medical or health science and non-medical or non-health sciences students found a higher prevalence rate of health risk behaviors among non-medical or non-health science students. In Turkey, nursing students had more "positive

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health-promoting lifestyles" than non-nursing students (Can *et al*., 2008). In Greece, fewer medical students admitted to smoking and drinking alcohol than non-medical students, but there was no difference regarding their eating habits (Tirodimos *et al*., 2009). In Myanmar, Htay *et al*. (2010) compared medical students with community youth and found that smoking prevalence in men was significantly higher in community youth than in medical students. In Pakistan, the frequency of regular substance abuse in non-medical undergraduates was 29.4%, higher than medical graduates (13.4%) (Mahmud *et al*., 2014). While a number of studies found a higher prevalence of tobacco use in non-medical than medical students, for example, in China, Pakistan, and Turkey, other studies did not report this difference (Zhu *et al*., 2004; Poyrazoğlu *et al*., 2010; Chatterjee *et al*., 2011; Han *et al*., 2012). For example, in Tbilisi, Georgia, 49.5% of medical students and 48.0% of non-medical students were smokers. Of the medical students, 59.5% expressed a willingness to quit smoking, as did 54.2% of the non-medical students (Chkhaidze *et al*., 2013). Regarding oral health risk behavior in India, Sharda and Shetty (2010) found significantly lower behavior scores for the non-medical students than for the para-medical and medical categories. In terms of sexual risk behavior, no difference in at least one sexual risk behavior between medical and non-medical university students was found in Xinjiang, China (Maimaiti *et al*., 2010).

Generally, health science or medical students seem to have greater knowledge of health behavior risk awareness. For example, in Pakistan, the knowledge score (healthy lifestyle and dietary habits) of medical students was better (with 94.7% of medical students scoring good > 17 *vs* 52%) than non-medical students (Sajwani *et al*., 2009); in China, medical students had higher smoking-related knowledge than non-medical students (Han *et al*., 2011; 2012); and in India, health professional students reported significantly higher oral health scores than their comparison group (Kumar Tadakamadla *et al*., 2010; Sharda & Shetty, 2010). Health risk behaviors may be influenced by a lack of awareness and low perceived health benefits (Steptoe & Wardle, 1992).

This study determines the differences and associations of health risk behaviors, knowledge, and health benefit beliefs between health and non-health science university students in 17 low and middle income countries.

METHODS

Sample and procedure

This cross-sectional study was conducted with various collaborators in participating countries. The questionnaire used for data collection was in English, and then translated by two independent bilingual translators into Arabic, Chinese, French, Lao, Russian, Spanish, Thai, and Turkish. Another bilingual translator, who had no knowledge of the original instrument, back-translated the re-conciliated target language version. In cases where a translated version of specific sections of the questionnaire, for example, the International Physical Activity Questionnaire (IPAQ), was available, this was not re-translated (Pengpid *et al*., 2015). In each study country, the questionnaire was pre-tested on a sample of 20–30 university students for validity; these results did not form part of the final sample. Some of the instruments used in this study have previously been validated, such as the IPAQ (Craig *et al*., 2003). Principal investigators arranged for data collection from an intended 400 male and 400 female undergraduate university students aged 16–30 in one university in their respective countries. The sample size was calculated using Epi-Info Version 7.1 (Centers for Disease Control and Prevention, Atlanta, GA; USA). For the population survey, the expected frequency of 50% (maximum possible percentage of students with positive and negative health behaviors), design effect 1 (in calculation used given the ratio of the actual variance, under the sampling method, to the variance computed under the assumption of simple random sampling), confidence limited 5%, cluster 1, form this confidence limited 5% key in to calculating formula, will get outcome of sample size calculated for seven confidence levels, the researchers chose sample size for confidence of 99%, the minimum sample size is 663. To prevent incomplete data, the sample size was increased to 800 (400 male, 400 female).

Participating universities were located in cities in the various countries. Research assistants asked undergraduate students to complete the questionnaire at the end of a teaching class. In each participating country, undergraduate students were surveyed in classrooms selected through a stratified random sample procedure. A university department formed a cluster and was used as a primary sampling unit. One department was randomly selected from each faculty. For each selected department, undergraduate courses offered by the department were randomly ordered. Written informed consent was obtained from participating students, and the study was conducted in 2013. Ethics approvals were obtained from all institutions participating in the study: Bahria University Medical and Dental College, Cairo University, Chinese University of Hong Kong, Istanbul University, Kyrgyz State Medical Academy, Mae Fah Laung University, Peoples' Friendship University of Russia, Obafemi Awolowo University, St. George's University, Université Félix Houphouët Boigny de Cocody, University of Health Sciences, Universidad de Pamplona, Universidad Central de Venezuela, University of Limpopo, University of Antananarivo, and University of the West Indies.

MEASURES

Fields of education

University students were asked about their field of study. Responses were grouped according to the International Standard Classification of Education (United Nations Educational, Scientific and Cultural Organization, 2011) into two groups: health science (medicine, medical services, nursing, dental services) and non-health science subjects (agriculture, business and law, education, engineering, humanities and arts, manufacturing and construction, science, services, social care, and social work social sciences).

Health risk behavior

Addictive risk behavior (3 items): current tobacco use (yes/no); binge drinking over the past month (men = five or more, women = four or more drinks, on one occasion; 1 = never to 5 = daily or almost daily); and gambling once a week or more (from nine different gambling behaviors; 1 = not at all to 3 = once a week or more; Cronbach's α 0.90) (Babor *et al.*, 2001; Lesieur & Blume, 1987; World Health Organization, 1998).

Nutrition risk behavior (6 items): skipping breakfast (1 = almost every day to 3 = rarely or never); no avoidance of dietary fat and cholesterol (yes/no); no effort to eat fibre (yes/no); daily intake of less than five servings of fruit and vegetables (one standard serving = 80 g); usually adding salt to food (1 = usually to 4 = never); and eating red meat at least once a day (1 = at least once a day to 5 = never) (Wardle & Steptoe, 1991; Hall *et al.*, 2009).

Sexual risk behavior (3 items): two or more sexual partners in the past 12 months (number of sexual partners); inconsistent condom use in the past three months (1 = never to 5 = every time); no contraceptive use in the past 12 months (1 = never to 5 = always).

Injury risk behavior (4 items): not always wearing a seat belt when sitting in the front seat of a car (1 = all of the time to 4 = I don't ride in cars); drinking and driving (a car or motorcycle) in the past 12 months (number of times); physical fighting in the past 12 months (0–12 or more times); and carrying a weapon to university in the past 30 days (0 = days to 5 = 6 or more days) (Centers for Disease Control and Prevention, 2013; Wardle & Steptoe, 1991).

Oral health risk behavior (2 items): brushing teeth less than twice daily (1 = twice or more a day to 4 = seldom or never); and dental care visit less than once a year (1 = twice a year to 4 = never) (Wardle & Steptoe, 1991; Åstrøm & Masalu, 2001).

Other health risk behavior

Physical activity was examined with the short version IPAQ for the last seven days (IPAQ-S7S). The instructions given in the IPAQ manual for reliability and validity were used, which have been described previously (Craig *et al.*, 2003). Physical activity was categorized according to the official IPAQ scoring protocol as low, moderate, and high (International Physical Activity Questionnaire, 2014).

Sleep duration

Students were asked: On average, how many hours of sleep do you get in a 24 h period (number of hours) (Steptoe *et al.*, 2006)? Responses were grouped into three categories: short sleep (≤ 6 h), normal sleep (7–8 h), and long sleep (≥ 9 h) (Steptoe *et al.*, 2006; Hublin *et al.*, 2007).

Socio-demographic questions included age, gender, and year of study (Wardle & Steptoe, 1991).

Health behavior risk awareness

Risk knowledge included asking participants to indicate whether or not each health risk behavior (dietary fat, lack of exercise, smoking, alcohol consumption, and being overweight) contributed to four different health problems (high blood pressure, heart disease, breast cancer, and lung cancer). For example, for avoidance of dietary fat and cholesterol, associations with heart disease and breast cancer were accepted (Steptoe & Wardle, 1992). Cronbach's alpha for this 10-item health risk awareness index was 0.71 in this sample.

Health benefit beliefs

Students were asked to rate the importance of 14 positive health behaviors, such as consumption of adequate quantities of fruit and non-smoking to health, on a 10-point scale ranging from 1 (low importance) to 10 (very great importance) (Steptoe & Wardle, 1992). Cronbach's alpha for this 14-item health benefit index was 0.91 in this sample.

Data analysis

Data analysis was performed using STATA software version 13.0 (Stata Corporation, College Station, TX, USA). The proportion of health risk behaviors were calculated as a percentage. Logistic regression analysis was performed to calculate the crude odds ratio (OR) with 95% confidence interval (CI) to determine the association between each health risk behavior and health or non-health science student, adjusted for age, gender, academic year, and country of residence. 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.

A 21-item health behavior risk index, a 10-item health risk awareness index, and a 14-item health behavior benefit index, were created. The health behavior risk index included: current tobacco use; binge drinking over the past month; gambling once a week or more; skipping breakfast; no avoidance of dietary fat and cholesterol; no effort to eat fibre; daily intake of less than five servings of fruit and vegetables; usually adding salt to food; eating red meat at least once a day; having two or more sexual partners in the past 12 months; inconsistent condom use in the past three months; no contraceptive use in the past 12 months; not always wearing a seatbelt when sitting in the front seat of a car; drinking and driving (a car or motorcycle) in the past 12 months; physical fighting in the past 12 months; carrying a weapon to university in the past 30 days; brushing teeth less than twice daily; dental care visit less than once a year; low physical activity; and short and long sleep duration. A higher score indicated a greater number of health risk behaviors. The health risk awareness index included: high blood pressure and exercise; high blood pressure and alcohol consumption; high blood pressure and smoking; high blood pressure and overweight; heart disease and alcohol; heart disease and smoking; heart disease and exercise; heart disease and fat consumption; breast cancer and fat consumption; and lung cancer and smoking. The health behavior benefit index included: perform regular exercise; do not eat too much animal fat; eat enough fibre; keep body weight within the normal range; eat enough fruit; do not smoke; do not add too much salt; eat breakfast almost every day; get seven or eight h sleep on most

Table 1. Characteristics of university students from 17 countries

Study country	*n*	Age mean (SD)	Gender (Male) %	Proportion of health science students %	Response rate %
Barbados	580	21.6 (2.8)	42.7	8.2	41.4
China	809	19.7 (2.2)	71.3	47.1	97.5
Colombia	816	21.1 (3.2)	55.9	18.1	98.0
Egypt	831	20.5 (1.3)	54.3	94.9	82.5
Grenada	435	24.1 (4.1)	67.5	19.1	53.0
Ivory Coast	824	23.8 (2.7)	50.0	8.3	96.0
Kyrgyzstan	837	21.3 (1.5)	57.2	100	97.8
Laos	806	22.3 (1.9)	66.1	87.3	90.8
Madagascar	800	20.0 (1.7)	50.0	34.3	78.8
Nigeria	820	21.5 (2.7)	45.7	10.1	95.3
Pakistan	813	19.9 (1.8)	58.2	73.7	95.6
Russia	799	19.9 (1.8)	50.8	13.7	96.2
South Africa	888	22.3 (3.6)	56.8	5.9	95.3
Thailand	860	21.1 (1.8)	72.8	52.2	97.3
Tunisia	960	21.1 (1.8)	67.2	10.9	97.0
Turkey	800	20.6 (2.2)	50.0	15.3	96.5
Venezuela	564	20.5 (2.8)	59.8	27.0	96.6

SD, standard deviation.

nights; brush teeth regularly; wear a seatbelt when travelling in a car; never drive after drinking alcohol; do not drink too much alcohol; and use a condom (see Table 3).

The Cronbach's α estimates for the health behavior practice index were positive but low ($\alpha = 0.38$), indicating considerable independence among health risk practices. In linear regression analysis, associations between the health risk behavior, health risk awareness, and health behavior benefits indexes were assessed.

RESULTS

Sample characteristics

The sample included 13,042 university students (42.5% men and 57.5% women), with a mean age of 21.1 years (standard deviation = 2.8). The sample size by university ranged from 435 in Grenada to 960 in Tunisia, with most participating study countries having had a sample of 800 of more students; the mean age ranged from 19.7 years in China to 24.1% in Grenada; and the proportion of male participants ranged from 42.7% in Barbados to 72.8% in Thailand. In all, 38.2% were health science and 61.2% were non-health science university students, ranging from 5.9% health science students in South Africa to 100% in Kyrgyzstan. The student response rate was above 90% in most study countries (see Table 1).

Health risk behavior

In all, health science students had the same mean number of health risk behaviors as non-health science students. Regarding addictive risk behaviors, fewer health science students used tobacco, were binge drinkers, or gambled once a week or more than non-health science students. In terms of nutrition risk behavior, more health science students had poor dietary behaviors (inadequate fruit and vegetable consumption, salt intake, and eating red meat), than non-health science students. There were no significant differences between the faculties regarding the avoidance of dietary fat and cholesterol, effort to eat fibre, and skipping breakfast. Three sexual risk behaviors were examined; health science students had more sexual partners, had more often inconsistent condom use, and had not used contraception compared with non-health science students. Regarding the four different injury risk behaviors, health science students used a seatbelt as often as non-health science students, while non-health science students more frequently carried a weapon to university. Further, health science students had poorer oral health behavior in terms of tooth brushing and more non-health science students had visited the dentist in the past 12 months. Physical inactivity was higher among health than non-health science students. Short and long sleep duration did not differ between health and non-health science students (see Table 2).

Health behavior risk awareness

Overall, from a total of 10 health behavior risk awareness items, health science students had a greater awareness of health behavior risks (5.5) than non-health science students (4.6). In particular, in nine of the 10 health risk behavior factors, health science students had higher scores (see Table 3).

Health behavior benefits

Health science students endorsed the benefits of positive health behaviors significantly more often than non-health science students in 13 of the 14 health behaviors, with the exception of the importance of wearing a seat belt (see Table 4).

Association between health risk behaviors, risk awareness, and health benefits

Linear regression analysis demonstrated a strong association with poor or weak health benefit beliefs and the health risk behavior index. There was no association between the risk awareness and health risk behavior indexes among health science students and an inverse association among non-health science students (see Table 5).

DISCUSSION

The results of our large study of university students from 17 low and middle income countries were consistent with a number of previous studies in that overall there was no significant difference in the health risk behaviors of health versus non-health science students (Maimaiti *et al.*, 2010;

Table 2. Health risk behavior index

Variable	Health science (n = 4981) n (%)	Non-health science (n = 8061) n (%)	OR (95% CI)†	P value
Addictive risk behavior				
Current tobacco use	567 (11.8)	1074 (15.2)	0.70 (0.59–0.84)	< 0.001
Binge drinking (past month)	453 (9.1)	1364 (16.9)	0.73 (0.62–0.85)	< 0.001
Gambling once a week or more	209 (4.2)	956 (11.9)	0.35 (0.30–0.41)	< 0.001
Nutrition risk behavior				
Skipping breakfast	2347 (47.3)	3695 (46.6)	1.01 (0.94–1.09)	0.753
No avoidance of dietary fat and cholesterol	3028 (61.3)	4664 (59.9)	1.05 (0.97–1.13)	0.266
No effort to eat fibre	3057 (62.1)	4531 (59.2)	1.04 (0.96–1.13)	0.380
Daily intake of less than five servings of fruit and vegetables	3862 (82.3)	5468 (77.8)	1.22 (1.10–1.35)	< 0.001
Usually adding salt to food	2166 (43.7)	2954 (37.5)	1.20 (1.11–1.30)	< 0.001
Eating red meat at least once a day	2531 (51.4)	3280 (41.7)	1.36 (1.26–1.47)	< 0.001
Sexual risk behavior (of sexually active)				
Two or more sexual partners in the past 12 months	1173 (25.3)	1560 (22.9)	1.14 (1.03–1.25)	0.009
Inconsistent condom use	2264 (84.4)	3894 (73.2)	1.85 (1.62–2.10)	< 0.001
No contraceptive use	550 (41.5)	1477 (40.0)	1.18 (1.03–1.35)	0.023
Injury risk behavior				
Not always wearing a seatbelt	2489 (62.5)	3949 (55.5)	1.50 (1.38–1.64)	< 0.001
Drinking and driving (car or motorcycle)	754 (19.8)	1038 (20.2)	1.02 (0.91–1.14)	0.667
Physical fighting	675 (14.0)	1010 (14.6)	1.07 (0.95–1.20)	0.270
Carrying a weapon	252 (5.1)	615 (8.2)	0.74 (0.63–0.88)	< 0.001
Oral health risk behavior				
Brushing teeth less than twice daily	1754 (35.5)	2566 (32.8)	1.13 (1.04–1.25)	0.003
Dental care visit, less than once a year or never	2789 (56.8)	4447 (57.4)	0.97 (0.91–1.05)	0.477
Other health risk behavior				
Physical inactivity	2609 (52.4)	3796 (47.1)	1.35 (1.25–1.46)	< 0.001
Short sleep (≤ 6 h)	1644 (38.6)	2864 (37.2)	1.03 (0.95–1.12)	0.401
Long sleep (≥ 9 h)	639 (15.0)	1217 (15.8)	0.95 (0.85–1.06)	0.281
	M (SD)	M (SD)	β (SE)	
All 21 health risk behaviors	7.3 (2.3)	7.2 (2.5)	0.02 (0.06)†	0.105

***P < 0.001; **P < 0.01; *P < 0.05. †Adjusted by age, gender, academic year, country of residence. β, beta; CI, confidence interval; OR, odds ratio; SE, standard error.

Table 3. Health behavior risk awareness index

Risk awareness	Health science (n = 4981) n (%)	Non-health science (n = 8061) n (%)	OR (95% CI)†
High blood pressure and exercise	2029 (46.2)	2253 (39.9)	1.39 (1.27–1.51)***
High blood pressure and alcohol consumption	2464 (59.4)	2643 (50.6)	1.39 (1.27–1.52)***
High blood pressure and smoking	1999 (49.8)	1322 (30.6)	2.29 (2.08–2.52)***
High blood pressure and overweight	3147 (64.3)	4091 (58.7)	1.20 (1.11–1.30)***
Heart disease and alcohol	2424 (58.2)	3223 (55.2)	1.04 (0.96.1.14)
Heart disease and smoking	2513 (51.2)	2701 (37.8)	1.50 (1.38–1.62)***
Heart disease and exercise	2116 (48.2)	2489 (45.9)	1.19 (1.09–1.30)***
Heart disease and fat consumption	3292 (66.9)	4536 (61.5)	1.07 (0.97–1.16)
Breast cancer and fat consumption	999 (20.7)	646 (9.9)	2.56 (2.28–2.87)***
Lung cancer and smoking	4145 (83.8)	5514 (71.8)	1.54 (1.40–1.70)***
All 10 items awareness	5.5 (2.4)	4.6 (2.3)	1.17 (1.14–1.20)***

***P < 0.001; **P < 0.01; *P < 0.05. †Adjusted by age, gender, academic year, country of residence. CI, confidence interval; OR, odds ratio.

Table 4. Health behavior benefit index

Importance	Health science students mean (SD)	Non-health science students mean (SD)	OR (95% CI)†
Undertake regular exercise	7.5 (3.0)	6.8 (3.2)	1.57 (1.45–1.71)***
Do not eat too much animal fat	6.7 (3.0)	6.0 (3.2)	1.38 (1.28–1.50)***
Eat enough fibre	7.3 (2.9)	6.5 (3.1)	1.55 (1.43–1.69)***
Keep body weight within the normal range	8.1 (2.6)	7.4 (2.9)	1.47 (1.34–1.62)***
Eat enough fruit	8.0 (2.6)	7.3 (3.0)	1.56 (1.42–1.71)***
Do not smoke	8.4 (3.0)	7.5 (3.5)	1.82 (1.65–2.01)***
Do not add too much salt	7.2 (3.0)	6.8 (3.2)	1.31 (1.21–1.43)***
Eat breakfast almost every day	7.7 (3.0)	7.2 (3.2)	1.45 (1.33–1.59)***
Get 7 or 8 h sleep on most nights	8.0 (7.7)	7.7 (2.9)	1.26 (1.15–1.39)***
Brush your teeth regularly	8.6 (2.4)	8.4 (2.6)	1.27 (1.13–1.43)***
Wear a seatbelt when travelling in a car	7.8 (3.0)	7.9 (2.9)	0.91 (0.83–0.99)*
Never drive after drinking alcohol	8.7 (2.6)	8.4 (2.8)	1.27 (1.14–1.43)***
Do not drink too much alcohol	8.4 (2.7)	7.7 (3.1)	1.64 (1.47–1.81)***
Use a condom	8.0 (3.1)	7.7 (3.2)	1.22 (1.11–1.35)***
Total health behavior benefits	112.0 (27.3)	105.0 (28.1)	1.55 (1.43–1.69)***

***$P < 0.001$; **$P < 0.01$; *$P < 0.05$. †Adjusted by age, gender, academic year, country of residence. CI, confidence interval; OR, odds ratio; SD, standard deviation.

Table 5. Linear regression analysis for association between independent variables and health risk behavior index

	Health science students		
	β†	SE	$P > (t)$
Risk awareness	0.002	0.02	0.937
Health benefits	–0.13	0.11	< 0.001
	Non-health science students		
	β†	SE	$P > (t)$
Risk awareness	-0.07	0.03	0.016
Health benefits	-0.29	0.12	< 0.001

†Adjusted by age, gender, academic year, country of residence. β, Beta; SE, Standard Error.

Chkhaidze *et al*., 2013). This finding is in contrast to some other studies which found fewer health risk behaviors of health versus non-health science students (e.g. Can *et al*., 2008). A closer look at the specific types of health risk behaviors reveals that health science students practised more nutrition risk behaviors, while non-health students practised more addictive risk behaviors. This finding has been confirmed in a number of previous studies (Zhu *et al*., 2004; Tirodimos *et al*., 2009; Htay *et al*., 2010; Poyrazoğlu *et al*., 2010; Chatterjee *et al*., 2011; Han *et al*., 2012; Mahmud *et al*., 2014).

Our study involved university students of low and middle income countries. Compared to nutritional imbalances, addictive behaviors (such as drinking alcohol and tobacco use), are more established problems in most of these countries; thus, students studying health sciences are expected to have more exposure to these issues. A stronger awareness of addictive behavior in health science students likely acts as a deterrence to taking up such habits. The main nutritional concerns in low income countries have been undernutrition or food insecurity (Popkin, 1994). The concept of healthy eating and a balanced diet may, therefore, be less of a public health topic. Health sciences students may therefore ignore the importance of dietary benefits resulting in some higher risk nutritional behaviors than in non-health sciences students.

Further, contrary to a previous study, our study found more frequent oral health risk behavior in health versus non-health science students (Sharda & Shetty, 2010). One possible explanation for the relatively high health risk behaviors and lack of knowledge translation into healthy behaviors among health science students may be related to the higher prevalence of perceived stress and increased workload compared to non-health science disciplines (Richman, 1992; Dutta *et al*., 2005; Neveu *et al*., 2012; Tavolacci *et al*., 2013).

Regarding the awareness of health behavior disease links, this study found an overall higher awareness in health than in non-health science students, which is consistent with the results of previous studies (Sajwani *et al*., 2009; Kumar Tadakamadla *et al*., 2010; Sharda & Shetty, 2010; Han *et al*., 2011). Nevertheless, only about one fifth of the health science students were aware of the link between fat consumption and breast cancer. According to the World Cancer Research Fund (2007), dietary fat consumption has been shown to be associated with an increased risk of postmenopausal breast cancer, a cancer which represents a growing epidemic worldwide.

Health science students are likely to be the leaders of health promotion in future. In our study, among all students, knowledge of various health risk behaviors, such as the harmful effects of smoking, poor diet, and injury risk behavior, was not put into practice and did not result in healthy behavior, facts also reported in previous studies (e.g.

Malara *et al*., 2006). Further, poorer health behavior risk awareness was among non-health science students, but not health science students, associated with health risk behaviors. This result confirms for non-health science students with previous findings that health risk behaviors may be influenced by the lack of health risk awareness (Steptoe & Wardle, 1992). Health behavior risk awareness campaigns for non-health science students could be beneficial.

In agreement with previous studies, our study found that health science students endorsed the benefits of positive health behavior significantly more often than non-health science students (Kumar Tadakamadla *et al*., 2010; Sharda & Shetty, 2010). Moreover, this study found that poor or weak health behavior benefits were highly associated with health risk behaviors in both health and non-health science students. This finding concurs with previous studies and can be utilized in positive health behavior intervention programs (Steptoe & Wardle, 1992).

STUDY LIMITATIONS

This study had a number of limitations: as a cross-sectional survey, causal conclusions cannot be drawn; the participation of more than one institution in each country could have yielded different results; undergraduate university students may not be representative of the young adult population, and the health risk behaviors examined may be different in other segments of the population; the fact that data was self-reported could have resulted in desired participant responses; only a few of the instruments used in this study have been validated; and finally, the sample size between health and non-health science students was unequal at a country level in order to make meaningful country comparisons.

CONCLUSION

In this large study among university students from 17 low and middle income countries, results suggest no significant difference in the health risk behavior of health versus non-health science students. However, study faculty differences were observed for awareness of health risk behavior disease links and positive health behavior benefits. Our study findings imply that there is an urgent need to improve relevant knowledge in the curricula. Health promotion projects could be initiated at university campuses targeting different health risk behaviors, such as nutrition, substance use and gambling, sexual risks, injury, oral health risks, physical inactivity, and sleep hygiene. Further studies are required to better understand poor health behaviors, in particular, among health science university students.

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