Health behaviors among male and female university students in Cambodia: a cross-sectional survey

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31   Abstract

32

33   **Background**

34   Students go through a transition when they enter university, which involves major individual

35   and contextual changes in every domain of life that may lead to several behavioral and health

36   problems. This paper describes a wide range of health behaviors among male and female

37   university students in Cambodia.

38

39   **Methods**

40   A cross-sectional survey was conducted in 2015 among students randomly selected from the

41   Royal University of Phnom Penh and University of Battambang. Health-related behaviors in

42   different domains were collected using a structured questionnaire. Chi-square test, Fisher's

43   exact test, or independent Student's *t*-test was used as appropriate to describe and compare

44   the variables among male and female students.

45

46   **Results**

47   This study included 1359 students, of whom 50.8% were male, and the mean age was 21.3

48   years (SD= 2.3). Of the total, 79.5% reported not having any vigorous-intensity activities,

49   25.9% not having moderate-intensity activities, and 33.5% not having walked continuously

50   for 10 minutes during the past seven days. The prevalence of substance use was low with

51   38.3% currently drinking alcohol, 1.1% smoking tobacco, and 0.4% using an illicit drug during

52   the past 12 months. About one in ten (10.6%) reported having sexual intercourse, with a mean

53   number of partners of 2.1 (SD= 2.4) during the past 12 months, and 42.4% not using a condom

54   in the last intercourse. Only 7.1% reported having been diagnosed with a sexually transmitted

55   infection in the past 12 months; of whom, 60% sought for treatment. About one-third (33.6%)

56   reported eating fast food once or twice, and 5.3% having it three times or more over the last

57   week. More than half (55.6%) had one to two servings of fruits and vegetables daily, and 9.9%

58   did not eat any fruits and vegetables over the last week.

59

60   **Conclusions**

61   We found that the prevalence of sexual risk behaviors and substance use was plausibly low

62   among university students in this study. However, the rates of inactive lifestyle and unhealthy

63   food consumption were concerning. Public policy and universities should promote healthy

64   behaviors among the students. The interventions may take advantage of and expend upon

65   the good health behaviors and consider gender differences.

66

67   ## Keywords

68   Chronic disease, health behavior, health promotion, knowledge, lifestyle, risk behavior

69

70   ## Introduction

71   Globally, chronic diseases such as cancer, stroke, heart disease, and diabetes are the major

72   causes of death [1]. Behavioral risk factors including tobacco smoking, alcohol consumption,

73   physical inactivity, sedentary behaviors, and obesity are major determinants of adult chronic

74   diseases, morbidity, and mortality [1-4]. In addition to the disease burden attributed to single

75   chronic behavioral risk factors, a growing body of evidence suggests that many behavioral risk

76   factors co-occur among youths, including university students [5-7] and that their

77   combinations yield greater risks for chronic diseases than the sum of their individual

78   independent effects [7-9].

79   People living in developing countries are mostly affected by health risks and behaviors

80   associated with poverty such as under-nutrition and unsafe sex [10]. With economic growth

81   and increase in life expectancies, major risks to health shift from these risks to other more

82   contemporary risks, e.g. obesity and physical inactivity, other diet-related factors such as fast

83   food and sugary product consumption, and tobacco and alcohol-related risks [11]. Besides

84   coping with the heavy burden of diseases associated with underdevelopment, these countries

85   thus need to fight with the growing burden of non-communicable diseases as well [10].

86   Different health risk behaviors have been shown to be associated with several

87   important factors, including economic growth, mobility, and low self-esteem. Studies have

88   shown that economic growth can lead to a rise in obesity or over nutrition, which suggests

89   that university students aiming for higher economic mobility may be at risk for obesity [12].

90   This population needs to be aware of the myriads of health risks for diseases in order to

91   prevent further incidence [6,13]. There are also many predictors for suicidal behaviors,

92   alcohol and other drug problems which include psychiatric disorders, substance abuse, lack

93   of social support, negative family environment, major life stressors, peer pressure and

94   conformity, and demographic factors [14,15].

95   Health behaviors formed during childhood and adolescence, including during

96   university, can have a significant impact on the occurrence of future illnesses and may

97   continue into adulthood and beyond [16,17]. While the full etiology of any of these diseases

98   has yet to be understood, behavioral factors such as tobacco use, exercise, diet, alcohol

99   consumption, and preventive health checks are strongly implicated as risk factors [3,18,19].

100   Like the trend in general youths, health risk behaviors among students are more

101   inclined towards the negative too. Research into the health behaviors of young European

102   university students indicates a growing trend towards a less healthy lifestyle [6,7,16]. Heavy

103   drinking and other risky behaviors, for example, tend to increase during this academic

104   transition [20,21]. Many studies from around the world have identified different health

105   behaviors among university students such as transport safety, violence, smoking, the use of

106   alcohol and illegal drugs, sexual behaviors, unhealthy eating, weight control, and the lack of

107   practice of physical exercise [6,7,16,22-24]. Like anywhere else, students in Cambodia go

108   through the same transition when they enter university, which involves major individual and

109   contextual change in every domain of life. However, there is no known study that examines

110   health risk behaviors among Cambodian university students. A few studies on risky sexual

111   behaviors, alcohol consumption, and tobacco use among other Cambodian youth groups,

112   however, indicates that some health risk behaviors are rather a concern [25,26].

113   Studies of health behaviors, especially of university students, in low- and middle-

114   income countries are important since the mortality and morbidity from common causes such

115   as coronary heart disease and cancers and adoption of healthy lifestyles differ widely across

116   countries [6,7,10,27], and not much is known about the situation in Cambodia. The National

117   Institute for Health and Care Excellence, the United Kingdom, stressed that social and

118   economic conditions can prevent people from changing their behaviors to improve their

119   health and can also reinforce behaviors that damage it [28]. Besides the great disparity of

120   social and economic conditions within the country, being one of the fastest growing

121   economies would intensify the impact of social and economic conditions on lifestyle and

122   behaviors of young populations in Cambodia.

123   The rationale for studying university students is that this population is faced with a lot

124   of transitions in their academic and living environments [7], which might lead to either

125   positive or negative behaviors. They need to adapt to new changes, brought about by the

126   academic transition, and have more freedom over their health and lifestyles. This important

127   transition provides a good opportunity to adopt healthy behaviors or otherwise [29].

128   Research has shown that many university students throughout the world engage in health

129   risk behaviors, and such can have long-term implications for their health and lifestyle

130   [6,16,17,30]. Studies regarding health behaviors related to non-communicable diseases in

131   developing countries are still scarce [7]. Further, this population subgroup will occupy

132   important positions in the government and society, including ones that promote public

133   health. It is therefore important to understand their health behaviors and to promote

134   remedial actions [7].

135   The aim of this study is to assess a wide range of health behaviors among university

136   students in Cambodia. Broadly speaking, the article focuses on six areas of basic health

137   behaviors: physical activities, substance use, sexual behaviors, eating behaviors, sleeping

138   behaviors, and driving behaviors. Variables covered in this study are presented in the sub-

139   section on variables and measurements in more details below.

140

141   ## Materials and Methods

142   ### Ethics statement

143   The National Ethics Committee for Health Research of the Ministry of Health, Cambodia,

144   approved the study protocol and materials (No. 191NECHR). Participation in this study was

145   voluntary. In the process of obtaining their written informed consent, participants were made

146   clear that they could refuse or discontinue their participation at any time and for any reason.

147   The confidentiality and privacy of the respondents were protected by administering the

148   questionnaires in a private premise and by excluding personal identifiers in the survey.

149

150   ### Study design and settings

151   This cross-sectional study was conducted in June and July 2015 among a sample of

152   undergraduate students randomly selected from the Royal University of Phnom Penh and

153   University of Battambang. These universities were purposively selected to partake in this

154   research. The Royal University of Phnom Penh is the oldest and largest university in the

155   country, and the University of Battambang is one of the most established universities in

156   northwestern Cambodia.

157

158   **Participants and sample size**

159   Epi Info (Atlanta, GA, United States) was used to calculate the sample size. There were

160   approximately 168000 students registered in the higher education institutions [31]. Because

161   the prevalence of health risk behaviors among university students in Cambodia was not

162   known, a 50% rate was used for the calculation to prevent any underestimated prevalence.

163   Based on a 95% confidence level (CI) and a 5% margin of error, the minimum required sample

164   size was 767 university students. Adjusted for 10% of incomplete response, missing data and

165   rejection rate, the final minimum required sample size was 850.

166

167   **Sampling and data collection procedures**

168   Undergraduate students from first to fourth years from all departments in the two

169   universities were eligible and selected to participate in the study. A multi-stage cluster

170   sampling method was used to select the participants. First, two universities were

171   conveniently selected for administration and logistics purposes. All departments in the

172   selected universities were included in the study. In each department, a proportional to size

173   sampling method was used to select the students to meet the required sample size.

174   Participants were randomly selected from a name list of students in each department, and a

175   personal identification number was assigned to each selected student. On the designated

176   date of data collection, all selected students were approached by our trained data collectors,

177   and questionnaires with an information sheet were delivered to them. Students were asked

178   for a written informed consent. The self-administered questionnaire was developed in

179   English, then translated into Khmer, and back translated into English by local experts. The

180   questionnaire was pre-tested as part of data collection training with 10 male and 10 female

181   students at the Royal University of Phnom Penh, who were later excluded from the main

182   study.

183

184   **Variables and measurements**

185 The design of the core part of the self-reported questionnaire was informed by the Health

186 Behavior Survey [32], the National College Health Risk Behavior Survey (the United States)

187 [33], and the Global School-based Student Health Survey [34]. There were five sections in the

188 survey. The first section focused on socio-demographic characteristics of the participants

189 including age (continuous), gender (male, female), marital status (single, married, cohabiting),

190 year of study in the university, living situation (with parent, relative, friend, partner, or alone),

191 perceived family economic status (wealthy, quite well-off, not very well-off, quite poor),

192 academic performance (excellent, good, fair, poor), weight (in kilograms, continuous), and

193 height (in centimeters, continuous). The second section collected information on vigorous-

194 intensity and moderate physical activities during the last seven days using the International

195 Physical Activity Questionnaire short version (IPAQ-S7S) [35].

196 Substance use, including tobacco use, alcohol drinking, and drug use, was covered in

197 the third section. Variables included current use of tobacco (yes, no), experience of daily

198 tobacco use (yes, no), frequency of smoking (not smoking, once or twice per week, weekly),

199 current status of alcohol drinking (non-drinker, very occasional drinker, occasional drinker,

200 regular drinker), average number of alcohol drinks during the past two weeks (cans or bottles

201 for beer and glasses for wine, continuous), and the use of illicit drugs (yes, no) during past 12

202 months.

203 Sexual behaviors were the focus of the fourth section. The participants were asked

204 questions on whether they had sexual intercourse during the past 12 months (yes, no), age

205 at first sexual intercourse (continuous), number of sexual partners during the past 12 months

206 (continuous), alcohol and drug use during the last sex (yes, no), condom use during the last

207 sex (yes, no), sex in exchange for money or gifts during the past 12 months (yes, no), condom

208 use during last sex in exchange for money or gifts, diagnosis of sexually transmitted infections

209 (STIs) during the past 12 months (yes, no), treatment seeking behaviors for the most recent

210 STI, and history of unwanted pregnancy in lifetime.

211 Eating, sleeping, and driving behaviors were covered in the last section. Overall, the

212 variables in this section collected information on the frequency and amount of fast food, soft

213 drinks, soda or sweet tea, high-fat snacks, margarine, butter, meat fat, fruits or vegetables,

214 and lean protein consumed during the past week. We also asked about the average sleeping

215 hours in 24 hours during the past week (continuous).

216

7

Data analyses

Data were cleaned and entered into a Microsoft Excel (version 2010) database and analyzed using SPSS version 22.0 (IBM Corporation, New York, USA). Descriptive statistics were used to compute means and standard deviations for continuous variables as well as frequencies and percentages for categorical variables. Exploratory univariate and bivariate analyses were conducted to measure the distribution of frequencies of variables. Bivariate analyses were conducted using χ^2 test (or Fisher's exact test when a sample size was smaller than five in one cell) for categorical variables and independent Student's *t*-test for continuous variables to compare socio-demographic characteristics, health status, and health risk behaviors by student sex.

Results

Of 1462 students approached, 1359 completed the questionnaire (a response rate of 92.9%). The majority (98.6%) of those who declined the participation reported time constraint as the main reason. About half (50.8%) of the respondents were male, and the mean age was 21.3 years (SD= 2.3). The majority (97.9%) of the respondents were single. Of the total, 36.5% was in year one, and 70.8% reported fair academic performance. Almost half (43.8%) were living with parents, and 67.3% reported coming from a not very well-off or quite poor family. There were significant differences between male and female respondents in terms of age, living situation, family economic conditions, height, and weight (Table 1).

Table 1. Socio-demographic characteristics of male and female university students

Variables	Frequency			p-value*
	Total	Male	Female	
	n (%)	n (%)	n (%)	
Age (in years, mean ± SD)	21.3 ± 2.3	21.7 ± 2.5	21 ± 2.2	<0.001
Marital status				0.88
Single	1330 (97.9)	674 (97.7)	656 (98.1)	
Married	27 (2.0)	15 (2.2)	12 (1.8)	
Cohabiting	2 (0.1)	1 (0.1)	1 (0.1)	
Year of study in the university				0.15

8

Year 1	496 (36.5)	245 (35.5)	251 (37.5)	
Year 2	281 (20.7)	130 (18.8)	151 (22.6)	
Year 3	251 (18.5)	137 (19.86)	114 (17.0)	
Year 4	331 (24.3)	178 (25.8)	153 (22.9)	
Living arrangement				<0.001
Parent	595 (43.8)	271 (39.3)	324 (48.4)	
Relative	335 (24.6)	173 (25.1)	162 (24.2)	
Friends	346 (25.5)	188 (27.2)	158 (23.6)	
Couple	21 (1.5)	14 (2.0)	7 (1.0)	
Alone	18 (2.7)	44 (6.4)	18 (2.7)	
Perceived family economic status				<0.001
Wealthy	1 (0.1)	1 (0.2)	0 (0.0)	
Quite well-off	443 (32.6)	194 (28.2)	249 (37.2)	
Not very well off	846 (62.3)	449 (65.2)	397 (59.3)	
Quite poor	68 (5.0)	45 (6.5)	23 (3.4)	
Perceived academic performance				0.92
Excellent	57 (4.2)	29 (4.2)	28 (4.2)	
Good	303 (22.3)	157 (22.8)	146 (21.8)	
Faire	962 (70.8)	487 (70.6)	475 (71.0)	
Poor	37 (2.7)	17 (2.5)	20 (3.0)	
Weight (in kg, mean ± SD)	53.0 ± 9.1	57.7 ± 8.5	48.1 ± 6.9	<0.001
Height (in cm, mean ± SD)	163.1 ± 14.8	168.5 ± 18.5	157.5 ± 5.3	<0.001

239 *Abbreviations: n, number; SD, standard deviation.*
240 *[*]Chi-square test (or Fisher's exact test when a sample size was smaller than five in one cell) was used*
241 *for categorical variables and independent Student's t-test for continuous variables.*
242

243   As shown in Table 2, 79.5% of the respondents had no vigorous intensity activity;
244 25.9% had no moderate-intensity activities; and 33.5% did not walk continuously for 10
245 minutes during the past seven days. More than half of those who had vigorous-intensity
246 activities (51.1%) and those who had moderate-intensity activities (59.6%) did it in a period
247 of less than 30 minutes. Of those who had walked continuously for at least 10 minutes, 73.1%
248 did it in a period of less than 30 minutes. There is a statistical difference between male and
249 female in the frequency and time spent on vigorous-intensity activities.

250 **Table 2. Physical activities among male and university students in the study**

Variables	Frequency			
	Total	**Male**	**Female**	***p*-value**
	***n* (%)**	***n* (%)**	***n* (%)**	
Work involved vigorous-intensity activities for ≥10 min continuously				0.001
Never	973 (71.7)	444 (64.4)	529 (79.5)	
Had 1-3 days/week	261 (19.3)	159 (23.1)	102 (15.3)	
Had 4-7 days/week	120 (8.9)	86 (12.5)	34 (5.1)	
Time usually spent doing vigorous-intensity activities on one of those days				0.001
≤30 minutes	161 (51.1)	89 (42.8)	72 (67.3)	
31-60 minutes	65 (20.6)	53 (25.5)	12 (11.2)	
>60 minutes	89 (28.3)	66 (31.7)	23 (21.5)	
Work involved moderate-intensity activities for ≥10 min continuously				0.61
Never	352 (25.9)	185 (26.9)	167 (25.0)	
Had 1-3 days/week	564 (41.6)	278 (40.4)	286 (42.8)	
Had 4-7 days/week	441 (32.5)	226 (32.8)	215 (32.2)	
Time spent doing moderate-intensity activities on one of those days				0.94
≤30 minutes	514 (59.6)	264 (60.0)	250 (59.1)	
31-60 minutes	204 (23.6)	104 (23.6)	100 (23.6)	
>60 minutes	145 (16.8)	72 (16.4)	73 (17.3)	
Days walking for ≥10 min continuously to get to and from places				0.08
Never	470 (34.7)	247 (35.9)	223 (33.5)	
Had 1-3 days/week	338 (24.9)	154 (22.4)	184 (27.6)	
Had 4-7 days/week	547 (40.4)	288 (41.8)	259 (38.9)	
Time usually spent walking on one of those days				0.19
≤30 minutes	545 (73.1)	261 (70.2)	284 (75.9)	
31-60 minutes	111 (14.9)	60 (16.1)	51 (13.6)	
>60 minutes	90 (12.1)	51 (13.7)	39 (10.4)	

251 *Abbreviations: n, number.*
252 **Chi-square test (or Fisher's exact test when a sample size was smaller than five in one cell) was used.*
253

10

254   Table 3 shows that 38.3% of the respondents reported currently drinking alcohol, 1.1%

255   smoking tobacco, and 0.4% using illicit drugs during the past 12 months. Of those who

256   reported using illicit drugs during the past 12 months, 50% used methamphetamines, 25%

257   used heroine, and 25% used other types of drugs. Among those who reported alcohol

258   drinking, average number of days they drank during the past two weeks was 1.3 (SD= 2.0),

259   and average number of alcoholic drinks used during the past two weeks was 1.8 (SD= 2.9).

260   There were statistically significant gender differences in frequency of smoking, frequency in

261   alcohol drinking, and average number of alcoholic drinks used during the past two weeks.

262

263   **Table 3. Substance use among male and female university students in the study**

Variables	Frequency			
	Total	**Male**	**Female**	**_p_-Value**
	_n_ **(%)**	_n_ **(%)**	_n_ **(%)**	
Current tobacco smokers				0.47
Yes	15 (1.1)	9 (1.3)	6 (0.9)	
No	1344 (98.9)	681 (98.7)	663 (99.1)	
Experience of daily smoking for at least 30 days				0.16
Yes	8 (0.6)	6 (0.9)	2 (0.3)	
No	1351 (99.4)	684 (99.1)	667 (99.7)	
Frequency of smoking during the past 3 months				0.002
I don't smoke	1343 (98.8)	676 (98.0)	667 (99.8)	
Once or twice	13 (1.0)	12 (1.7)	1 (0.1)	
Weekly	3 (0.2)	2 (0.3)	1 (0.1)	
Would you describe yourself as:				<0.001
Non-drinker	838 (61.7)	274 (39.7)	564 (84.3)	
Very occasional drinker	367 (27.0)	292 (42.3)	75 (11.2)	
Occasional drinker	151 (11.1)	121 (17.5)	30 (4.5)	
Regular drinker	3 (0.2)	3 (0.4)	0 (0.0)	
Average number of days drinking alcohol during the past 2 weeks (mean ± SD)	1.2 ± 2.0	1.4 ± 2.2	0.7 ± 2.0	0.001

Average number of alcohol drinks† during the past 2 weeks (mean ±SD)	1.8 ± 3.0	2.1 ± 3.1	1.1 ± 2.2	0.002
Used illicit drugs during the past 12 months				0.33
Yes	4 (0.3)	3 (0.4)	1 (0.1)	
No	1355 (99.7)	687 (99.6)	668 (99.9)	

264   *Abbreviations: n, number; SD, standard deviation.*
265   **Chi-square test (or Fisher's exact test when a sample size was smaller than five in one cell) was used*
266   *for categorical variables and independent Student's t-test for continuous variables.*
267   *†Can was a unit used for beer and glass for wine.*

268

269   Regarding sexual behaviors (Table 4), 10.6% of the respondents reported having

270   sexual intercourse during the past 12 months with an average number of sexual partners of

271   2.1 (SD= 2.4). Among those who responded, 42.4% reported not using condom, and 6.3%

272   reported using alcohol during their last sexual intercourse. Only 9.2% reported having sex in

273   exchange for money or gifts. Less than one in 10 (7.1%) reported having been diagnosed with

274   an STI in the past 12 months; of whom, 60% sought for treatment for the most recent STI.

275   Among students who reported having sexual intercourse in the past 12 months, 12.7%

276   reported having been or made someone pregnant in lifetime. There were significant gender

277   differences in sexual encounter, mean number of sexual partners, condom use, and

278   experience in having sex with commercial partners.

279

280   **Table 4. Sexual behaviors among male and female university students in the study**

Variables	Frequency			
	Total	**Male**	**Female**	**p-Value**
	n (%)	**n (%)**	**n (%)**	
Had sexual intercourse in the past 12 months				<0.001
Yes	144 (10.6)	119 (17.3)	25 (3.7)	
No	1215 (89.4)	571 (82.7)	644 (96.3)	
Alcohol use during last sex				0.60
Yes	9 (6.3)	8 (6.8)	1 (4.0)	
No	134 (93.7)	110 (93.2)	24 (96.0)	

12

Condom use during last sex				0.004
Yes	83 (57.6)	75 (63.0)	8 (32.0)	
No	61 (42.4)	44 (37.0)	17 (68.0)	
Sex in exchange for money or gifts				0.08
Yes	13 (9.2)	13 (11.2)	0 (0)	
No	128 (90.8)	103 (88.8)	25 (100)	
Condom use during last sex in exchange for money or gifts				N/A
Yes	8 (61.5)	8 (61.5)	N/A	
No	5 (38.5)	5 (38.5)	N/A	
Diagnosed with a sexually transmitted infection in the past 12 months				0.51
Yes	10 (7.1)	9 (7.8)	1 (4.0)	
No	131 (92.9)	107 (92.2)	24 (96.0)	
Sought for treatment for the most recent sexually transmitted infection				0.39
Yes	6 (60.0)	5 (55.6)	1 (100)	
No	4 (40.0)	4 (44.4)	0 (0)	
Ever made someone pregnant/been pregnant				0.58
Yes	18 (12.7)	14 (12.0)	4 (16.0)	
No	124 (87.3)	103 (88.0)	21 (84.0)	
Age at first sexual intercourse (in years, mean± SD)	20.6 ± 3.2	20.7 ± 2.9	20.2 ± 4.4	0.47
Number of partner during the past 12 months (mean± SD)	2.1 ± 2.4	2.3 ± 2.6	1.0 ± 0.2	0.02
Age first made someone pregnant/became pregnant (in years, mean± SD)	23.1 ± 3.2	23.3 ± 3.4	22.3 ± 2.3	0.65

281 *Abbreviations: n, number; SD, standard deviation.*
282 **Chi-square test (or Fisher's exact test when a sample size was smaller than five in one cell) was used*
283 *for categorical variables and independent Student's t-test for continuous variables.*
284

285   Table 5 presents eating behaviors among the participants. Of the total, 33.6% reported

286 having fast food once or twice per week, and 5.3% having it three times or more per week.

287 More than half (57.3%) reported drinking soft or sweet drinks once or twice per week, and

288 26.0% drinking three times or more per week. About two-thirds (63.9%) reported consuming

289   high-fat snacks once or twice per week, and 13.5% consuming three times or more per week.

290   Similarly, 51.2% reported consuming fat and its associated products daily, and 7.2%

291   consuming a lot of them. About one in ten (9.9%) reported not consuming any fruits and

292   vegetables, and 12.1% not consuming any lean meat in the past week.

293

294   **Table 5. Eating, sleeping, and driving behaviors among male and female university**

295   **students**

Variables	Frequency			p-Value
	Total	Male	Female	
	n (%)	n (%)	n (%)	
Times do eating fast food per week				<0.001
0 times	881 (61.1)	457 (66.2)	374 (55.9)	
1-2 times	456 (33.6)	201 (29.1)	255 (38.1)	
3 or more times	72 (5.3)	32 (4.6)	40 (6.0)	
Number of soft drinks, glasses of soda or sweet tea consumed per day				0.01
None	226 (16.6)	100 (14.5)	126 (18.8)	
1-2	779 (57.3)	389 (56.4)	390 (58.3)	
3 or more	354 (26.0)	201 (29.1)	153 (22.9)	
Times consuming high-fat snacks per week				0.001
0 times	307 (22.6)	174 (25.2)	133 (19.9)	
1-2 times	869 (63.9)	445 (64.5)	424 (63.4)	
3 or more times	183 (13.5)	71 (10.3)	112 (16.7)	
Amount of margarine, butter, meat fat consumed				0.67
None or very little	565 (41.6)	285 (41.3)	280 (41.9)	
Some	696 (51.2)	351 (50.9)	345 (51.6)	
A lot	98 (7.2)	54 (7.8)	44 (6.6)	
Number of servings of fruits or vegetables consumed per day				0.006
0 servings	134 (9.9)	84 (12.2)	50 (7.5)	
1-2 servings	755 (55.6)	385 (55.8)	370 (55.3)	
3 or more servings	470 (34.6)	221 (32.0)	249 (37.2)	
Times consuming lean protein per week				0.81

14

0 times	164 (12.1)	83 (12.0)	81 (12.1)	
1-2 times	874 (64.3)	439 (63.6)	435 (65.0)	
3 or more times	321 (21.6)	168 (24.3)	153 (22.9)	
Self-perception on body weight				<0.001
Overweight	408 (30.0)	157 (22.8)	251 (37.5)	
About right	496 (36.5)	251 (36.4)	245 (36.6)	
Underweight	455 (33.5)	282 (40.8)	173 (25.8)	
Problem with sleeping in the last 30 days				0.98
None	215 (15.8)	110 (15.9)	105 (15.7)	
Mild	454 (33.4)	231 (33.5)	223 (33.3)	
Moderate	587 (43.2)	295 (42.8)	292 (43.6)	
Severe	103 (7.6)	54 (7.8)	49 (7.3)	
Used seatbelt when driving a car or other motor vehicle in the past 30 days				0.04
I did not drive	756 (55.6)	397 (57.5)	359 (53.7)	
Never	211 (15.5)	88 (12.8)	123 (18.4)	
Rarely	93 (6.8)	44 (6.4)	49 (7.3)	
Sometimes	108 (7.9)	60 (8.7)	48 (7.2)	
Most of the time	68 (5.0)	41 (5.9)	27 (4.0)	
Always	123 (9.1)	60 (8.7)	63 (9.4)	
Used a helmet when riding a bicycle in the past 30 days				0.04
I did not ride	156 (11.5)	64 (9.3)	92 (13.8)	
Never	49 (3.6)	22 (3.2)	27 (4.0)	
Rarely	33 (2.4)	19 (2.8)	14 (2.1)	
Sometimes	51 (3.8)	29 (4.2)	22 (3.3)	
Most of the time	319 (23.5)	179 (25.9)	140 (25.9)	
Always	751 (55.3)	377 (54.6)	374 (55.9)	
Drove a car or other motor vehicle after drinking alcohol in the past 30 days				<0.001
I did not drive	371 (27.3)	151 (21.9)	220 (32.9)	
0 times	797 (58.6)	370 (53.6)	427 (63.8)	
1 time	120 (8.8)	105 (15.2)	15 (2.2)	
2-3 times	52 (3.8)	48 (7.0)	4 (0.6)	

≥4 times	19 (1.4)	16 (2.3)	3 (0.4)	
Average sleeping hours/24h during the past week (± SD)	7.2 ± 1.5	7.2 ± 1.5	7.3 ± 1.5	0.15

296 *Abbreviations: n, number; SD, standard deviation.*
297 **Chi-square test (or Fisher's exact test when a sample size was smaller than five in one cell) was used*
298 *for categorical variables and independent Student's t-test for continuous variables.*
299

300   As also shown in Table 5, on average, participants reported sleeping 7.2 hours per day
301   (SD= 1.5), while 33.4% reported having mild sleeping problems, and 50.8% having moderate
302   or severe sleeping problems. Of those who used a car in the past 12 months, 22.3% never or
303   rarely used a seatbelt. Of those who used a motorbike, 6.0% never or rarely used a helmet.
304   Regarding drunk driving, 14.0% reported driving or riding a vehicle after drinking at least once
305   during the past 30 days. There were significant sex differences in the frequency of
306   consumption of fast food and high-fat snacks, amount of soft or sweet drinks, fat and fat-
307   associated products, and fruits or vegetables. Perception on body weight, seatbelt and helmet
308   use, and drunk driving practice also differed significantly among the two sexes.
309

310   **Discussion**

311   This study is among the few investigations into health behaviors of Cambodian university
312   students. There were a comparable number of male and female respondents, and they came
313   from all years of the undergraduate programs. While many major findings above are perhaps
314   more or less in line with findings elsewhere or in other studies of Cambodian youths, there
315   are some exceptions too.

316   A positive point about the students' health behaviors is that the majority of the
317   respondents were not involved in any of the major health-risk behaviors, including tobacco
318   use, drug use, alcohol consumption, and sexual activities, and hence they could veer from
319   negative outcomes from such behaviors. Some of these findings seem to contradict with or
320   different from those of previous studies conducted on university students or youths, more
321   broadly, in Cambodia [36] or elsewhere [37]. Reproductive health issues and casual sex, for
322   instance, were reportedly higher among other Cambodian youth groups [25,38]. The self-
323   reported consumption of alcohol seemed to be relatively lower than that of adolescents in
324   Cambodia and in some other countries in the region as reported in other studies [6,39,40].

16

325 This may also be applied to the use of tobacco [41].

326 Such positive results are good for individual development and public health, given the
327 grave consequences from their consumption or involvement on the individuals' health and
328 finance and on the government and society at large [11,37]. Alcohol and drug abuse, for
329 instance, are known to be negatively associated with individuals' and family wellbeing and
330 can incur high societal and economic cost to the government [42], while drug use and
331 trafficking is a barrier to achieving international development, including the Sustainable
332 Development Goals [42]. A systematic review of alcohol consumption and disease burden
333 found that alcohol impacts many disease outcomes (both chronic and acute) and injuries,
334 including death [43]. Another systematic review indicated that heavy alcohol consumption in
335 the late adolescence continues into adulthood and is associated with alcohol problems [44].

336 Besides, there were some positive eating behaviors among the students too according
337 to their self-report, i.e. low consumption of fast food, soft and sweet drinks, high-fat snacks,
338 and fat and fat-associated products, as well as quite adequate sleep. The findings on healthy
339 dietary behaviors from other studies are inconclusive, with some indicating that students
340 elsewhere have 'satisfactory' eating habits, while others reported concerning behaviors
341 [17,45]. Public health policies in Cambodia should take advantage of and sustain these
342 positive behaviors and try to promote such behaviors beyond their university life.

343 While students' limited involvement in major health-risk behaviors and some positive
344 health behaviors are plausible, many other negative health behaviors were concerning. These
345 issues include relatively high consumption of soft and sweet drinks; low consumption of fruits,
346 vegetables, and lean protein; sleep disorders; low frequency in usage of a seatbelt and
347 helmet; and drunk driving practices. Many of these behaviors can have negative implications
348 for individual health, as many of them are more susceptible to the modern health risks
349 [8,9,11,16,45], which may result in big financial burden and social costs on the individuals and
350 government in the future.

351 Another noticeable negative instance was the inactive lifestyles of many participants.
352 The majority of them never had any vigorous- or moderate-intensity activities, and never
353 walked continuously for 10 minutes or more. For those who had vigorous-intensity activities,
354 moderate-intensity activities, and walked continuously for 10 minutes or so, the majority
355 reported to have done so for less than 30 minutes, the level of daily moderate-intensity
356 activity recommended by the World Health Organization for a healthy lifestyle [46]. Other

17

357 studies also found that university students had inactive lifestyles [7,45]. Apart from the
358 proactive response from the national policy, therefore, Cambodian universities may need to
359 promote healthy lifestyles and habits; for example, through extracurricular activities and
360 social engagement.

361   Differences between the two sexes can be observed in some areas. First, female
362 students were observed to have better dietary behaviors and nutritional knowledge, perhaps
363 due to the need to watch over one's weight and stronger beliefs in healthy eating [17,45].
364 Second, there was a significant difference between male and female students in smoking
365 frequency, frequency and amount of alcohol consumption [6], sexual activities including
366 number of partners and condom use, frequency of fast food and high-fat snack consumption,
367 and amount of soft and sweet drinks. Third, there is a statistically significant difference
368 between the two sexes in the involvement of vigorous-intensity activities and time spent on
369 the activities. Gender differences can also be seen in the amount of fruits and vegetables
370 consumed, perception of body weight, frequency in usage of seatbelts and helmets, and
371 frequency of drunk driving practices. Other studies also found gender differences in physical
372 activities (male being more active) and body weight [7,45]. Given the sex differences in many
373 outcome variables (including negative health risk behaviors), a gender lens may be considered
374 in any potential interventions and policy considerations.

375   Overall, the negative health behaviors and lifestyles could present multiple health
376 risks, especially the threat from chronic diseases and/or severe health conditions, to the
377 participants in the future [2,3,47], depending on the intensity of their current health
378 behaviors, risks and lifestyles, and the changes in behaviors and lifestyles in the future.
379 Coupled with the health risks associated with economic underdevelopment, they may be
380 facing, that is, according to the family status of a majority of the respondents, e.g., 67.3% of
381 them reported as not very well off or quite poor, which had a negative repercussion on or
382 implications for their diet and quality of the food consumed, among others, that they may
383 face these other health risks in the future is certainly high [6,11]. This prediction could be
384 more accurate and precise through regression analyses of the response, which is not the case
385 in this article. However, given the response and the multiple unhealthy and risky health
386 behaviors and lifestyles reported by many of the respondents, chances are very high that
387 many of the health risk factors could co-occur among many of them. It is commonly
388 understood that negative health behaviors, attitudes, and lifestyles formed during childhood

18

389   and adolescence have a profound impact on future health behaviors and lifestyles of the

390   individuals. They will have significant negative impact on the individual health as well as

391   familial economy and will be a big burden for the public policy to address in the future

392   [3,16,18,33].

393   This study has some limitations. Firstly, the cross-sectional design could capture only

394   a snapshot view of the study population and could not document changes in the variables

395   over time. Given that conduct of student or youth health surveys are a rare phenomenon in

396   Cambodia, findings from this study can provide some pioneering thoughts on the issue.

397   Nevertheless, it must be underlined that many respondents reportedly adopted positive

398   health behaviors and lifestyles, which may co-occur [17], although whether they co-occur was

399   not examined in this study and warrant further analyses and research. Many of the health

400   issues need to be examined into more details – examples include quality and adequacy of the

401   food consumed, quality of sleep, and rigorousness of the physical activities. Other health and

402   associated issues that may be addressed in the future research include mental health, family

403   environment, and peer pressure. Secondly, the self-reported measures may have led to social

404   desirability bias, particularly for sensitive information such as sexual behaviors and substance

405   abuse. Future studies may want to triangulate the data through, for example, adoption of a

406   mixed-method study. Third, the study may benefit from multiple regression analyses and

407   multi-factorial association tests, which may shed better light on the results that would provide

408   more nuanced and comprehensive findings. However, given that this paper attempts only to

409   present broad basic description of the students' health behaviors, this is beyond the scope of

410   our study. Finally, this study included a sample of students selected from only two major

411   universities located in the capital city and a province; therefore, findings from this study may

412   not be generalized to a wider university student population in the country. However, because

413   this is one of the few studies on Cambodian students' health, it can provide policy implications

414   for national health and education policy makers as well as the university community.

415

Conclusions

417   Despite the above-mentioned limitations, our study provides preliminary insights into health-

418   related behaviors among university students in Cambodia. We found that the prevalence of

419   some health risks (such as risky sexual behaviors, tobacco use, alcohol consumption, and illicit

420   drug use) among university students in this study was plausibly low. However, the rates of

421   many other negative health behaviors (inactive lifestyle, high consumption of unhealthy food,

422   and low consumption of healthy) were concerning. These health risks may predict later poor

423   health including increased risks of non-communicable chronic diseases such as diabetes,

424   hypertension, and other cardiovascular disease among this potential population. Further

425   studies are needed to explore factors associated with specific health risk behaviors and

426   effective intervention programs for promoting university student health in Cambodia. Effort

427   may be needed to conduct such surveys on a more regular basis and on a larger scale to better

428   inform public health programs and policies.

429

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434

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Supporting information

S1 File. STROBE checklist for cross-sectional studies

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