ORIGINAL RESEARCH

Skipping Breakfast and Its Association with Health Risk Behaviour and Mental Health Among University Students in 28 Countries

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Introduction: The study aimed to investigate the associations between skipping breakfast and various health risk behaviours and mental health in university students in 28 countries.
Methods: Using a cross-sectional study design, 21,972 university students with a median age of 20 years from 28 countries in Africa, the Americas and Asia, replied to self-reported measures of breakfast consumption, health compromising behaviours, mental health measures and protective factors.
Results: In adjusted logistic regression analysis, infrequent and/or frequent breakfast skipping was associated with inadequate fruit and vegetable intake, frequent soft drink intake, not avoiding fat and cholesterol, current binge drinking, current tobacco use, gambling, not always wearing a seatbelt, inadequate physical activity, inadequate tooth brushing, not seeing a dentist in the past year and having been in a physical fight. In addition, infrequent and/or frequent breakfast skipping was associated with depression, lower happiness, posttraumatic stress disorder, loneliness, short sleep, long sleep, sleep problem, restless sleep, sleep problem due to traumatic event, and poor academic performance.
Discussion: We found evidence that skipping breakfast was associated with 10 of 15 health risk behaviours, all of nine poor mental health indicators and poor academic performance.
Keywords: skipping breakfast, health compromising behaviour, mental health, university students, multi-country

Introduction

In the adolescent period lifestyle patterns are developed, including breakfast consumption.[1] Skipping breakfast is a common practice among university students, which has been shown in various studies, eg, in Barbados, Grenada and Jamaica, 48.2% of females and 41.6% of males,[2] in Bahrain 50%,[3] 47.7% in Turkey,[4] and significantly increases the risk of overweight/obesity, cardio metabolic risk factors, type 2 diabetes and heart disease.[5–9] Most studies investigating the association between skipping breakfast and health compromising behaviours and mental health have been conducted with single health risk variables, among adolescents and in high-income countries. There is particularly a lack of studies investigating the effect of skipping breakfast on multiple health risk variables among university students from low- and middle-income countries and across a number of countries, which prompted this study.

Various studies among adolescents or emerging adults found associations between skipping breakfast and overweight/obesity,[6,10–15] more negative body perception[13] and

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unhealthy dietary behaviour,[16] including low fruit and vegetable intake,[1,13,16,17] higher sodium intake,[16] lower consumption milk/dairy,[1,11,16] higher consumption of sweets, sugary or soft drinks,[1,13] and skipping other meals.[11,13]

Mental health correlates of skipping breakfast include stress or mentally distressed,[18–20] depressive mood,[10,18,21-23] lower happiness scores,[24] suicidal behaviour,[10,18] shorter sleep duration,[1] nocturnal sleeping problems,[25] and poor sleep quality.[26] Skipping breakfast has among adolescents or emerging adults further been associated with substance use, such as smoking[1,12,27] and alcohol use,[1,10,12] physical inactivity[1,11,15,28] and sedentary behaviour.[1,11] Other effects included poor oral hygiene, such as less frequent tooth brushing[29] and no dental care visit in the past year,[30] and poor hand hygiene, such as no hand washing before meals,[29] no seatbelt use,[29] cardio metabolic risk factors, such as systolic blood pressure,[5] and poorer academic performance.[10,15,19] The study aimed to investigate the associations between skipping breakfast and various health compromising behaviours and mental health in university students in 28 countries.

Methods

The cross-sectional study comprised 21,858 college or university students with a median age of 20 years (interquartile range =3 years) with complete breakfast consumption data from 28 countries in Asia: Bangladesh, India, Indonesia, Kyrgyzstan, Laos, Malaysia, Myanmar, Pakistan, Philippines, Russia, Singapore, Thailand, Turkey, and Vietnam; in Africa: Cameroon, Egypt, Ivory Coast, Madagascar, Mauritius, Namibia, Nigeria, South Africa and Tunisia; and the Americas: Barbados, Columbia, Grenada, Jamaica and Venezuela. "In each study country one or two universities were purposefully selected."[31,31,31]

> In each university, research assistants administered a questionnaire and anthropometric measurements to all students in classrooms selected through a cluster random sample procedure in 2013.

> Written informed consent was attained from all participating students, and ethics approvals were obtained from all participating universities (see supplementary file). The study was conducted in accordance with the Declaration of Helsinki. Participation rates were in most countries over 90%.

Measures

Breakfast consumption was measured with the item, "How often do you eat breakfast?" ("Almost every day,

sometimes, rarely or never").[32] Skipping breakfast was defined as sometimes, rarely or never having breakfast.

Socio-demographic information comprised gender, age, residence status, subjective wealth status and country income.

Overweight or obesity was determined based on measured body mass index (BMI) and defined as ≥ 23.0 kg/m^2 in South and East Asian countries[33] (WHO, 2004) and ≥ 25.0 kg/m^2 in the other countries.[34] "Standing height was measured to the nearest 0.1 cm without shoes, using a stadiometer. Participants, wearing light clothes were weighed to the nearest 0.01 kg on a load-cell-operated digital scale, which was first calibrated using a standard weight and re-checked daily".[2]

Fruit and vegetable intake was measured with two questions, 1) "How many servings [80 grams] of fruit do you eat on a typical day?" and 2)"How many servings [80 grams] of vegetables do you eat on a typical day?"[35] Inadequate fruit and vegetable intake was defined as "less than 5 servings a day."[36]

Other dietary items comprised: 1) "avoiding foods containing fat and cholesterol", 2) "frequency of eating red meat" 3) adding salt to food ("usually, sometimes, occasionally, never").[36]

Binge drinking (past-month) was assessed with the item, "How often do you have (for men) five or more and (for women) four or more drinks on one occasion?"[37]

Tobacco use was defined as currently using "tobacco products (cigarettes, snuff, chewing tobacco, cigars, etc.)."[38]

Gambling behaviour was measured with 5 different gambling behaviours, eg, "Played cards for money," from the "South Oaks Gambling Screen (SOGS)."[39] Gambling in the past week was defined as any of the five assessed gambling behaviours once a week or more. (Cronbach alpha 0.78)

Seatbelt use was measured with the item, "When driving or riding in the front seat of a car do you wear a seat belt?" ("1 = all of the time, 2 = some of the time, 3 = never and 4 = I don't ride in cars").[36]

Physical activity was measured using the "International Physical Activity Questionnaire (IPAQ) short form,"[40] and physical activity levels were defined following IPAQ guidelines.[41]

Sedentary behaviour was assessed with one item from the IPAQ[40] and defined as eight or more hours per day.

Oral health risk behaviour was measured with two items, 1) "Do you brush your teeth? ... Twice or more

a day, about once a day, less than once a day, and seldom or never."[36] and 2) "How frequently do you go for dental check-ups? . . . Twice a year, once a year, rarely and never."[42]

Having been in a physical fight was defined as one or more times in the past 12 months.[43]

The "Centres for Epidemiologic Studies Depression Scale (CES-D: Ten items)" measured with 15 or more scores severe depressive symptoms.[44] (Cronbach's alpha = 0.76).

"Post-traumatic stress disorder (PTSD)" was measured with "Breslau's 7-item screener".[45]

Loneliness was defined as most (5–7 days) feeling lonely in the past week.[44]

Happiness was measured with a four-item "Subjective Happiness Scale (SHS),"[46] a score of 13 and above was used to describe high happiness. (Cronbach's alpha 0.94)

Sleep duration: "On average, how many hours of sleep do you get in a 24 h period?" "Responses were divided into three categories: short sleep (≤6 h), reference category (7–8 h), and long sleep (≥9 h)."[24]

Sleep quality was assessed with the question, overall in the last 30 days, how much of a problem did you have with sleeping, such as falling asleep, waking up frequently during the night, or waking up too early in the morning? Response options ranged from 1 (none) to 5 (extreme/cannot do),[47] Restless sleep. "Much of the time in the past week, your sleep was restless?" Response option ranged from "1=rarely (<1 day) to 4= most (5–7 days)". Restless sleep was defined as "much (3–4 days) or most (5–7 days)."[44]

Sleep problem due to traumatic event. "In your life, have you ever had any experience that was so frightening, horrible, or upsetting that, in the past 30 days you had more trouble than usual falling asleep or staying asleep? (Yes/No)[45]

Poor academic performance was self-reported as "not satisfactory academic performance."[48]

Social support was sourced from three questions of the "Social Support Questionnaire."[49] (Cronbach's alpha 0.94).

Religiosity was assessed with two dimensions (one item organized religious activity and three items intrinsic religiosity) from the "Duke University Religion Index."[50] (Cronbach's alpha = 0.80).

Data Analysis

Data analysis was conducted with "STATA software version 15.0 (Stata Corporation, College Station, TX, USA)". Unadjusted and adjusted logistic regression analyses were used to assess the associations between skipping breakfast categories (sometimes and never or rarely having breakfast), with almost daily having breakfast as reference category, relevant confounders (age, sex, subjective economic status, residence status, country, social support, and religiosity) and dependent variables (15 health risk behaviours, nine poor mental health indicators and academic performance). Due to the clustered nature of the data, country was entered in the survey command. Missing data were excluded from the analysis. P values <0.05 were considered significant.

Results

The sample consisted of 21,972 university students (median age 20 years, interquartile range 3 years), 58.4% were females and 41.6% males, 51.2% rated their economic status as high, 53.9% were living away from parents (on their own or in university residences), 53.9% were residing in low- or lower middle-income countries, 63.8% had high social support, 39.8% high organized religiosity and 33.0% high intrinsic religiosity. In all, 13.8% of university students had rarely or never, 34.2% sometimes and 51.9% had almost every day breakfast (see Table 1).

Associations Between Skipping Breakfast and Health Risk Behaviour and Mental Health

In adjusted logistic regression analysis, infrequent and/or frequent breakfast skipping was associated with inadequate fruit and vegetable intake, frequent soft drink intake, not avoiding fat and cholesterol, current binge drinking, current tobacco use, gambling, not always wearing a seatbelt, inadequate physical activity, inadequate tooth brushing, not seeing a dentist in the past year and having been in a physical fight. In addition, infrequent and/or frequent breakfast skipping was associated with depression, lower happiness, PTSD, loneliness, short sleep, long sleep, sleep problem, restless sleep, sleep problem due to traumatic event, and poor academic performance (see Tables 2 and 3).

Discussion

In agreement with a number of previous studies,[1,10,11,13,15-30] this study found that skipping breakfast increased the likelihood of 11 of 15 health risk behaviours, all of nine poor mental health indicators and poor academic performance. These findings replicate earlier results showing the wide range of possible effects of skipping breakfast on various health risk behaviours and poor mental indicators.[16,18,20,29]

Table 1 Sample and Breakfast Intake Characteristics

Variables	Sample	Breakfast Intake		
		Rarely or Never	Sometimes	Almost Always
	N (%)	N (%)	N (%)	N (%)
All	21,972	3026 (13.8)	7517 (34.2)	11,431 (52.0)
Sex				
Female	12,789 (58.4)	1737 (13.6)	4586 (35.9)	6463 (50.5)
Male	9120 (41.6)	1282 (14.1)	2904 (31.9)	4921 (54.0)
Age				
17–19	6952 (31.6)	869 (12.5)	2399 (34.5)	3678 (53.0)
20–21	8608 (39.2)	1220 (14.2)	2916 (33.9)	4466 (51.9)
22–30	6412 (29.2)	937 (14.6)	2202 (34.4)	3269 (51.0)
Subjective economic status				
Low	10,705 (48.8)	1737 (13.6)	4586 (35.9)	6463 (50.5)
High	11,211 (51.2)	1282 (14.1)	2904 (31.9)	4921 (54.0)
Country income				
Low/lower	11,843 (53.9)	1572 (13.3)	3669 (33.5)	6298 (53.2)
Upper/high	10,129 (46.1)	1454 (14.4)	3548 (35.1)	5115 (50.6)
Residence status				
Live with parents/guardians	10,073 (46.1)	1330 (13.2)	2790 (27.7)	5951 (59.1)
Live away from parents	11,782 (53.9)	1679 (14.3)	4686 (39.8)	5403 (45.9)
Social support				
Low	7715 (36.2)	1136 (14.7)	2875 (37.3)	3698 (48.0)
High	13,620 (63.8)	1791 (13.2)	4443 (32.6)	7376 (54.2)
Organized religiosity				
Low	5081 (23.8)	813 (16.0)	1530 (30.1)	2739 (53.9)
Medium	7784 (36.4)	1098 (14.1)	2857 (36.7)	3838 (49.3)
High	8518 (39.8)	1022 (12.0)	2964 (34.8)	4540 (53.3)
Intrinsic religiosity				
Low	7717 (36.2)	1132 (15.2)	2596 (34.8)	3723 (50.0)
Medium	6566 (30.8)	837 (13.2)	2097 (33.1)	3403 (53.7)
High	7035 (33.0)	920 (13.6)	2223 (32.8)	3644 (53.7)

Possible mechanisms to explain the effects of skipping breakfast on health risk behaviours and mental health, may be that having breakfast assists university students to "function better cognitively and psychosocially."[18,51] University students who had almost daily or daily breakfast tended to make healthier food choices throughout the day, as found in an earlier study among Chinese adolescents.[1] Some mechanisms through which breakfast contributes to reducing poor mental health have been proposed.[52] For example, after eating breakfast, carbohydrates are converted into glucose which is essential for the formation of tryptophan, a precursor protein for the synthesis of serotonin, which regulates depressive symptoms, irritable mood and cognitive functioning.[51–53]

This study suggests that skipping breakfast is part of an unhealthy behaviour pattern, including poor mental health, which clusters in the form of multiple risk behaviours.[16,29] However, various previous studies found an association between skipping breakfast and overweight or obesity,[6,10-15] while this study only found such an association in unadjusted analysis. This study did also not find an association between skipping breakfast and sedentary behaviour and high sodium intake, as this was found in previous investigations.[1,11,16]

Table 2 Breakfast Consumption and Its Associations with Body Weight and Health Risk Behaviours

Variables	Breakfast Intake	UOR (95% CI)	AOR (95% CI)[A]
Body weight and health risk behaviour			
Overweight or obese (29.3%)	Almost daily	1 (Reference)	(Reference)
	Sometimes	0.96 (0.90, 1.03)	0.99 (0.86, 1.13)
	Rarely/never	1.12 (1.01, 1.48)*	1.11 (0.92, 1.33)
Inadequate fruit and vegetables intake (80.5%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	1.16 (0.95, 1.43)	1.24 (1.05, 1.46)*
	Rarely/never	1.29 (1.09, 1.54)**	1.33 (1.10, 1.60)**
Soft drink intake (≥2/day) (9.6%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	1.49 (0.89, 2.47)	1.37 (0.80, 2.35)
	Rarely/never	2.16 (1.54, 3.04)**	1.96 (1.01, 3.84)*
Not avoid fat and cholesterol (60.8%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	1.21 (1.04, 1.40)*	1.24 (1.09, 1.40)***
	Rarely/never	1.37 (1.17, 1.59)***	1.40 (1.20, 1.63)***
Usually salt with every meal (39.6%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	0.91 (0.74, 1.13)	0.92 (0.79, 1.08)
	Rarely/never	0.90 (0.74, 1.10)	0.91 (0.78, 1.07)
Red meat daily (48.0%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	0.87 (0.73, 1.04)	0.87 (0.74, 1.03)
	Rarely/never	0.94 (0.80, 1.10)	0.93 (0.79, 1.10)
Binge drinking (past month) (10.5%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	1.37 (1.23, 1.52)***	1.37 (1.15, 1.62)***
	Rarely/never	1.73 (1.51, 1.99)***	1.65 (1.25, 2.18)***
Current tobacco use (11.8%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	0.97 (0.89, 1.06)	1.14 (0.97, 1.29)
	Rarely/never	1.55 (1.39, 1.73)***	1.73 (1.38, 2.17)***
Gambling (any 5/week) (7.2%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	1.06 (0.87, 1.28)	1.09 (0.92, 1.28)
	Rarely/never	1.27 (1.08, 1.48)**	1.25 (1.08, 1.45)**
Not always wearing a seatbelt (61.1%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	1.22 (1.02, 1.45)*	1.18 (1.02, 1.37)*
	Rarely/never	1.20 (1.01, 1.43)*	1.24 (1.04, 1.48)*
Inadequate physical activity (38.2%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	1.26 (1.10, 1.44)***	1.20 (1.06, 1.35)**
	Rarely/never	1.31 (1.12, 1.53)***	1.31 (1.12, 1.53)***
Sedentary behaviour (8 or more hours) (33.5%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	0.90 (0.75, 1.08)	0.93 (0.78, 1.10)
	Rarely/never	1.04 (0.83, 1.30)	1.08 (0.86, 1.37)
Tooth brushing <2 times/day (31.0%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	1.03 (0.82, 1.30)	1.08 (0.90, 1.29)
	Rarely/never	1.51 (1.25, 1.81)***	1.56 (1.35, 1.79)***
Saw dentist less than past 12 months (58.2%)	Almost daily	1 (Reference)	1 (Reference)
	Sometimes	1.20 (0.96, 1.50)	1.14 (0.98, 1.34)
	Rarely/never	1.39 (1.13, 1.70)**	1.37 (1.20, 1.56)***

(*Continued*)

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Table 2 (Continued).

Variables	Breakfast Intake	UOR (95% CI)	AOR (95% CI)[A]
Physical fight past 12 month (12.0%)	Almost daily	I (Reference)	I (Reference)
	Sometimes	1.06 (0.97, 1.16)	1.35 (0.30, 6.08)
	Rarely/never	1.39 (1.24, 1.56)***	3.25 (1.51, 6.98)**

Notes: ***P<0.001; **P<0.01; *P<0.05; [A]Adjusted for age, sex, subjective economic status, residence status, country, social support, and religiosity.
Abbreviations: UOR, unadjusted odds ratio; AOR, adjusted odds ratio; CI, confidence interval.

Table 3 Breakfast Consumption and Its Associations with Mental Health and Academic Performance

Variables	Breakfast Intake	UOR (95% CI)	AOR (95% CI)[A]
Mental health			
Depression (severe) (12.9%)	Almost daily	I (Reference)	I (Reference)
	Sometimes	1.25 (1.06, 1.49)*	1.10 (0.95, 1.26)
	Rarely/never	1.82 (1.65, 2.00)***	2.13 (1.84, 2.45)***
Posttraumatic Stress Disorder (PTSD) (21.8%)	Almost daily	I (Reference)	I (Reference)
	Sometimes	1.23 (1.05, 1.43)*	1.14 (0.96, 1.35)
	Rarely/never	1.57 (1.29, 1.91)***	1.61 (1.32, 1.97)***
Loneliness (9.9%)	Almost daily	I (Reference)	I (Reference)
	Sometimes	1.19 (1.03, 1.37)*	1.17 (1.01, 1.35)*
	Rarely/never	1.58 (1.34, 1.87)***	1.56 (1.33, 1.84)***
Happiness (61.3%)	Almost daily	I (Reference)	I (Reference)
	Sometimes	0.93 (0.87, 0.99)*	0.98 (0.90, 1.07)
	Rarely/never	0.82 (0.75, 0.89)***	0.84 (0.75, 0.93)***
Short sleep (46.8%)	Almost daily	I (Reference)	I (Reference)
	Sometimes	1.35 (1.20, 1.53)***	1.38 (1.23, 1.56)***
	Rarely/never	1.58 (1.36, 1.82)***	1.58 (1.32, 1.89)***
Long sleep (12.9%)	Almost daily	I (Reference)	I (Reference)
	Sometimes	0.98 (0.81, 1.17)	0.98 (0.82, 1.18)
	Rarely/never	1.39 (1.15, 1.69)***	1.39 (1.15, 1.68)***
Sleep problem (severe) (9.3%)	Almost daily	1.49 (1.16, 1.92)**	I (Reference)
	Sometimes	2.32 (1.87, 2.87)***	1.55 (1.25, 1.92)***
	Rarely/never	I (Reference)	2.41 (1.99, 2.92)***
Restless sleep (much or most of the time) (19.9%)	Almost daily	I (Reference)	I (Reference)
	Sometimes	1.18 (1.03, 1.35)*	1.14 (0.99, 1.32)
	Rarely/never	1.79 (1.64, 1.97)***	1.89 (1.59, 2.24)***
Sleep problem (traumatic event) (26.6%)	Almost daily	I (Reference)	I (Reference)
	Sometimes	1.19 (1.04, 1.37)*	1.20 (1.05, 1.36)**
	Rarely/never	1.56 (1.51, 2.13)***	1.66 (1.38, 2.00)***
Academic performance (poor) (7.7%)	Almost daily	I (Reference)	I (Reference)
	Sometimes	1.14 (0.97, 1.35)	0.98 (0.83, 1.16)
	Rarely/never	1.49 (1.19, 1.85)***	1.40 (1.11, 1.78)**

Notes: ***P<0.001; **P<0.01; *P<0.05; [A]Adjusted for age, sex, subjective economic status, residence status, country, social support, and religiosity.
Abbreviations: UOR, unadjusted odds ratio; AOR, adjusted odds ratio; CI, confidence interval.

Study Limitations

The study survey was limited to a cross-sectional design, participants attending university and most of the questionnaire administered was by self-report. In order to identify causal associations, further longitudinal research is indicated. It is possible, for example, that students with poor mental health adopt skipping breakfast because of their poor mental health. Skipping breakfast was only assessed with one question and did not include diet quality and information about other meals, and future studies should consider several questions, including diet quality, information about other meals, provide definitions of terminology, such as what constitutes breakfast, and reasons or explanations of skipping breakfast. Further, some health risk behaviours, such as fast food consumption, and poor mental health indicators, such as suicidal behaviour, were not assessed in this investigation and should be included in further research.

Conclusion

This investigation added evidence for a large university population from 28 countries that skipping breakfast was associated with 10 of 15 health risk behaviours, all of nine poor mental health indicators, and poor academic performance. Interventions programmes targeting breakfast consumption in this population should address health risk behaviours and poor mental health linked with skipping breakfast identified in this survey.

Disclosure

The authors report no conflicts of interest for this work.

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