

THE ASSOCIATION BETWEEN BREAKFAST SKIPPING COMBINED WITH ALCOHOL CONSUMPTION AND THE RISK OF METABOLIC SYNDROME

Mayura Kanchananuruk¹, Suyanee Pongthananikorn^{2,*}

¹Department of Pharmacy, Phaholpolpayuhasaena Hospital, Kanchanaburi 71000, Thailand

²Department of Food and Pharmaceutical Chemistry, Faculty of Pharmaceutical Sciences, Chulalongkorn University, Bangkok 10330, Thailand

ABSTRACT: Skipping breakfast has been considered a representative of health compromising behavior, but there is little information about the combined effects of breakfast skipping and other unhealthy habits, especially drinking alcohol. This cross-sectional study investigated health compromising behaviors and the association with metabolic syndrome. The participants were 385 adults living in urban areas. The mean age was 45.71 (± 6.93 years). The data were collected from blood biochemical tests, blood pressure measurements, waist circumference measurements, and questionnaires. The results showed that the alcohol drinking rate in men (28.3%) was higher than that in women (4.0%), and the percentage of skipping breakfast in men (46.0%) was also higher than that in women (38.4%). The breakfast skipping was more prevalent in participants under the age of 40 years ($p=0.007$), and was related to other health compromising behaviors. Multiple logistic regressions identified current alcohol drinking as the most significant factor related to breakfast skipping (1.806, 95% CI=1.08-3.03). The other significant factors included an age younger than ages under 40 years (1.994, 95%CI=1.21-3.29) and a body mass index of more than 25 kg/m² (1.920, 95%CI=1.20-3.08). For the combination of skipping breakfast with drinking alcohol, the highest odds ratio for metabolic syndrome was found (5.720, 95%CI=1.71-19.10). In conclusion, the combined skipping breakfast with drinking alcohol may pose a greater risk for metabolic syndrome.

Keywords: skipping breakfast, alcohol consumption, metabolic syndrome

INTRODUCTION

Breakfast is an important meal that is associated with a better health status. Subsequently, skipping breakfast is considered unhealthy behavior that relates to cardiovascular risk and type 2 diabetes mellitus. Factors include lack of exercise, smoking, high blood pressure, and high serum total cholesterol [1-4]. In addition, it coincides with an increase in the prevalence of obesity contributing to a positive relationship with the change in body mass index (BMI) [5]. According to the report of the National Health Examination Survey Office IV (NHESO IV), 60-70% of Thais in the working-age group skipped their breakfast. The most common reason was a lack of time [6].

The related factors such as smoking, infrequent exercise, low education level, male gender, high BMI, and more frequent alcohol use were associated with breakfast skipping in adults [7]. In particular, alcohol consumption linked to skipping breakfast has been studied more frequently than other unhealthy behaviors [2, 7]. Alcohol drinking increases the risk of atherosclerotic disease, and excessive alcohol drinking increases the risk of a

hemorrhagic type of stroke [8]. It is mainly explained by alcohol-induced hypertension [9, 10]. Association between the amount of alcohol intake and the components of metabolic syndrome was stronger for men with high blood pressure and abdominal obesity, whereas it was stronger for women with high glucose levels [11]. It was reported that alcohol consumption is associated with decreased subcutaneous adipose tissue and increased visceral adipose tissue accumulation [12]. Metabolic syndrome is linked to abdominal obesity and a cluster of abnormalities including impaired glucose tolerance, dyslipidemia, and hypertension that together lead to a significantly increased risk of cardiovascular disease (CVD). Several studies indicated that numerous factors such as sedentary behavior, cigarette smoking, alcohol consumption, high fat and carbohydrate consumption, stress, etc. affects metabolic syndrome. This study aimed to determine the relationship between the combination of skipping breakfast with drinking alcohol and the risk of metabolic syndrome.

MATERIALS AND METHODS

This cross-sectional study was conducted in a local area in Thailand. The Nutrition and Health survey was conducted in an urban area of Kanchanaburi province. The study was approved by the Ethical

* Correspondence to: Suyanee Pongthananikorn
Email: Suyanee.P@chula.ac.th
Tel. + 66 (0) 2218 8295

Committee of the Faculty of Pharmaceutical Sciences, Chulalongkorn University (Protocol review No.11-33-017). The participants provided informed consent before the data collection.

Participants

A total of 385 participants were recruited from people aged 35-65 years old who received an annual health checkup at Phaholpolpayuhasaena Hospital, Kanchanaburi province between December 2011 and February 2012. None of them were pregnant, lactating, disabled or had incomplete results of health examinations.

Methods

The instruments for collecting data included nutrition and health questionnaires which elicited gender, age, weight, and lifestyle habits including questions on eating breakfast, smoking, alcohol drinking, quantity of sleep, and physical exercise habits. About breakfast, the frequency of breakfasts per week was recorded. Smoking status was indicated as current smoker or non-smoker. In the case of previous smokers, they were included in the non-smoker group. The participants were asked about their average frequency and amount (in ml) of alcohol intake. Then the amount was converted to the amount of pure alcohol (in grams). The drinkers were classified by the quantity of alcohol consumption as follows: heavy (>30 g/d), moderate (15-30 g/d), light (<15 g/d), or non-drinker. The questionnaire was substantiated by experts for testing the content validity. Then the revised questionnaire tested the reliability with a group of 30 people who had similar characteristics to the initial questionnaire participants. The reliability in the part of food frequency questionnaire was presented by Cronbach's alpha that was 0.72. Anthropometric data, including weight, height and waist circumference (WC), were measured. Blood pressure was twice measured and blood specimens were collected for analyzing fasting plasma glucose (FPG), total cholesterol (TC), triglycerides (TG), and high-density lipoprotein cholesterol (HDL-C). The diagnosis of metabolic syndrome defined by the National Cholesterol Education Program Adult Treatment Panel III (NCEP ATP III) was used in this study with the modified waist circumference cut off points for the Asian population [13, 14].

Statistical Analysis

The variables considered categorical were analyzed by chi-square test. The significance of all differences was defined using chi-square test or student's t-test, and binary logistic regression. The variables showing significant differences on the chi-square test were further analyzed by binary logistic regression and multivariate odds ratios were calculated. Differences between groups were defined by analysis of variance (ANOVA), or chi-square test. Adjusted odds ratios were calculated by

Table 1 Characteristics of the participants

Characteristics	Number	(%)
Sex		
Male	175	(45.5)
Female	210	(54.5)
Age (years)		
35-39	87	(22.6)
40-49	176	(45.7)
50-59	117	(30.4)
≥ 60	5	(1.3)
Mean ± SD	45.74 ± 6.93	
Marital status		
Single	68	(17.7)
Couple	287	(74.5)
Divorce/separate/widow	30	(7.8)
Education level		
High school and below	128	(33.2)
College	191	(49.6)
Master degree or over	66	(17.1)
Income (baht/month)		
≤ 10,000	48	(12.5)
10,001-20,000	135	(35.1)
≥ 20,001	202	(52.5)
Mean ± SD	25,418.80 ± 17,566.50	
Breakfast skipping (days/week)		
No skipping	215	(55.8)
1-2 days	44	(11.4)
3-4 days	45	(11.7)
5-6 days	29	(7.5)
7 days	52	(13.5)

multiple logistic regression. Statistically significant level was two-tailed and the *p-value* was less than 0.05.

RESULTS

There were 385 people participating in this study, 175 males (45.5%) and 210 females (54.5%). Most of them aged between 40-59 years (76.1%), were married (74.5%), had completed their bachelor degree (49.6%), and had a monthly income of more than 20,000 baht (52.5%). There were 215 participants (55.8%) who ate breakfast daily and 170 participants (44.2%) reported skipping breakfast at least once per week (Table 1). The significant differences between the two groups were found in the variables age, gender, BMI, and the amount of alcohol consumed ($p=0.007$, $p=0.045$, $p=0.003$, and $p=0.003$, respectively) (Table 2). The breakfast skipping rate among alcohol drinkers was 55.8% and significantly higher than that among non-drinkers (39.3%) ($p=0.003$). The four variables showing significant differences were selected to be analyzed by multivariate odds ratios (Table3). It was found that three of them were associated with skipping breakfast, including current drinkers (2.096, 95%CI=1.168-3.762, $p=0.013$), under the age of 40 (1.769, 95% CI=1.018-3.074, $p=0.043$), and a BMI of more than 25 kg/m² (1.952, 95% CI=1.213-3.139, $p=0.006$).

Table 2 Characteristics of the daily breakfast eaters and breakfast skippers

Variables		Daily breakfast eaters* (n=215)	Breakfast skippers** (n=170)	p-value (χ^2 -test)
Gender	Male	88 (50.3)	87 (49.7)	0.045
Age	< 40 years	37 (42.5)	50 (57.5)	0.007
BMI	≥ 25 kg/m ²	65 (44.5)	81 (55.5)	0.003
Physical exercise	< 3 days/week	158 (53.0)	140 (47.0)	0.052
Smoking	Current smoking	20 (44.4)	25 (55.6)	0.139
Alcohol drinking	Current drinking	50 (43.9)	64 (56.1)	0.003

*the participants who eat breakfast everyday.

**the participants who skip breakfast at least 1 day per week.

Table 3 Multivariate odds ratios of factors associated with skipping breakfast calculated by binary logistic regression (n=385)

Variables		Odds ratio	95%CI	p-value
Age	≥ 40 years	1		
	< 40 years	1.994	1.209-3.288	0.007
Gender	Female	1		
	Male	1.114	0.683-1.817	0.666
Alcohol drinking	Non-drinker ¹	1		
	Current drinker ²	1.806	1.076-3.032	0.025
BMI (kg/m ²)	< 22.9	1		
	23-24.99	0.888	0.493-1.600	0.693
	≥ 25	1.920	1.196-3.082	0.007

¹the people who have never drunk alcohol beverage.²the people who drink alcohol beverage.**Table 4** Characteristics of the participants with regard to skipping breakfast and/or alcohol drinking (n=311)

	No breakfast skipping No alcohol drinking (n=165)	No breakfast skipping Alcohol drinking (n=18)	Breakfast skipping No alcohol drinking (n=106)	Breakfast skipping Alcohol drinking (n=22)	p-value
Male, n (%)	46 (27.9) ^a	15 (83.3) ^b	35 (33.0) ^a	17 (77.3) ^b	<0.001
Age (years)	46.14 $\pm$ 6.83 ^a	45.89 $\pm$ 7.78 ^a	45.65 $\pm$ 6.73 ^a	41.32 $\pm$ 6.18 ^b	0.022
WC (cm), males	83.89 $\pm$ 8.21	82.92 $\pm$ 6.47	85.69 $\pm$ 7.87	85.21 $\pm$ 7.41	0.603
WC (cm), females	77.10 $\pm$ 6.83 ^a	86.84 $\pm$ 4.10 ^{ab}	80.69 $\pm$ 10.36 ^b	78.44 $\pm$ 11.11 ^{ab}	0.019
TG (mg/dL)	119.16 $\pm$ 59.88 ^a	165.06 $\pm$ 92.04 ^b	151.94 $\pm$ 95.66 ^c	210.27 $\pm$ 135.5 ^d	<0.001
HDL-C (mg/dL)	56.54 $\pm$ 13.90	51.50 $\pm$ 10.57	53.16 $\pm$ 13.92	54.26 $\pm$ 16.63	0.176
SBP (mmHg)	123.7 $\pm$ 16.25 ^a	131.80 $\pm$ 21.72 ^a	126.12 $\pm$ 17.75 ^a	131.68 $\pm$ 15.91 ^b	0.065
DBP (mmHg)	79.20 $\pm$ 11.10 ^a	84.90 $\pm$ 11.98 ^b	80.64 $\pm$ 11.75 ^{ab}	85.18 $\pm$ 10.30 ^c	0.036
FPG (mg/dL)	92.63 $\pm$ 15.83 ^a	98.78 $\pm$ 13.47 ^a	93.72 $\pm$ 14.50 ^a	107.37 $\pm$ 41.59 ^b	0.006
BMI (kg/m ²)	23.55 $\pm$ 3.59 ^a	23.96 $\pm$ 2.72 ^a	25.27 $\pm$ 4.89 ^b	24.79 $\pm$ 4.39 ^a	0.009
Weight (kg)	60.47 $\pm$ 11.34 ^a	66.67 $\pm$ 7.87 ^b	65.48 $\pm$ 13.05 ^c	68.27 $\pm$ 13.89 ^d	<0.001
LDL-C (mg/dL)	132.51 $\pm$ 33.68	118.28 $\pm$ 41.76	129.20 $\pm$ 34.00	120.59 $\pm$ 37.98	0.224
TC (mg/dL)	213.01 $\pm$ 38.89	202.60 $\pm$ 40.53	214.12 $\pm$ 38.22	214.30 $\pm$ 34.90	0.697

Data expressed as mean $\pm$ SD; ^{abc} the different letters in the same rows indicate a significant difference; mg-milligram; dL, deciliter; kg, kilogram; cm, centimeter; mm, millimeter; Hg, mercury; WC, waist circumference; TG, triglyceride; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; TC, total cholesterol; SBP, systolic blood pressure; DBP, diastolic blood pressure; FPG, fasting plasma glucose; BMI, body mass index.

Table 4 shows a group attribute of 311 participants who had behaviors of skipping breakfast and/or drinking alcohol. The percentages of males in the group consuming alcohol without skipping breakfast (84.3%) and in the group consuming alcohol and skipping breakfast (77.3%) were higher than those of all of the female respondents. Skipping breakfast combined with drinking alcohol

was found most in the younger participants. The group drinking alcohol together with skipping breakfast had greater values of TG, DBP and FPG than the other groups. The group skipping breakfast with no alcohol drinking had a BMI higher than other groups. However, BMI in all four groups were most classified in the overweight (23.55-24.72 kg/m²) or obesity (≥ 25 kg/m²) categories.

Table 5 Age-, gender-, and BMI adjusted odds ratio and 95% confidence intervals for metabolic syndrome by multiple logistic regression

	No skipping breakfast with no alcohol drinking (n=165)	No skipping breakfast but Alcohol drinking (n=18)	Skipping breakfast but no alcohol drinking (n=106)	Skipping breakfast with alcohol drinking (n=22)
Prevalence (%)	17.0	33.3	40.6	45.5
by NCEP ATP III				
Adjusted OR [1]	1	2.683	3.019*	5.720*
(95% CI)		(0.764-9.423)	(1.546-5.895)	(1.713-19.096)
Adjusted OR [2]	0.373	1	1.125	2.132
(95% CI)	(0.106-1.309)		(0.322-3.933)	(0.467-9.732)
Adjusted OR [3]	0.331*	0.889	1	1.895
(95% CI)	(0.170-0.647)	(0.254-3.107)		(0.581-6.183)

**p*-value<0.001; NCEP ATP III - National Cholesterol Education Program Adult Treatment Panel III; definition [14]. The diagnosis of the metabolic syndrome is made when three or more of the following risk factors are present: (1) abdominal obesity (2) elevated triglyceride level ≥ 150 mg/dL (3) low HDL cholesterol level <40 mg/dL in men and <50 mg/dL in women (4) elevated blood pressure $\geq 130/85$ mm Hg (5) raised fasting plasma glucose ≥ 100 mg/dL.

After adjustments of age, gender and BMI, the prevalence of metabolic syndrome was analyzed by multiple logistic regression (Table 5). The group that skipped breakfast and drank alcohol showed a significantly higher OR for metabolic syndrome (5.720, 95% CI=1.71-19.10, $p<0.001$), whereas OR in the group with only skipping breakfast was lower (3.019, 95% CI=1.546-5.895, $p<0.001$). In addition, OR in the group without both factors was 0.331 (95%CI=0.170-0.647, $p<0.001$) that indicated a reduction in the risk for metabolic syndrome.

DISCUSSION

The results of the study found that males with health compromising behaviors, such as more frequent alcohol use, high BMI, smoking, and a lack of exercise were associated with skipping breakfast. The rates of skipping breakfast and drinking alcohol in men were higher than those of the women. These characteristics were similar to the previous studies [7, 15]. Furthermore, the highest odds ratio for skipping breakfast was found among alcohol drinkers. The combination of skipping breakfast with the drinking of alcohol was related to increased odds of developing metabolic syndrome after age, gender, and BMI were controlled. Valencia-martin et al. [16] found that excessive alcohol drinkers were more likely to skip breakfast because of getting up late in the morning or alcohol intoxication. Not eating breakfast will increase insulin response, resulting in increased fat storage and weight gain [17].

A number of previous studies have suggested an association between skipping breakfast and drinking alcohol in adults [2, 7, 15]. In this study, the association between breakfast consumption or drinking alcohol and obesity was found. It was consistent with other studies that found the relationships between skipping breakfast and risk

factors for obesity such as weight gain, high BMI, and large waist circumference [5]. Increasing prevalence of obesity was found in adults who skipped breakfast [18]. It may impair fasting lipid levels and postprandial insulin sensitivity. The peak postprandial insulin response tends to be lower in the period after eating breakfast and a prolonged fasting state may lead to increased fat storage and weight gain [17]. Moreover, this study showed that the participants who skipped breakfast without drinking alcohol had a large waist circumference and high plasma triglyceride, whereas the level of HDL cholesterol was low. These parameters are the risk factors of metabolic syndrome.

The present study showed that alcohol consumption was an increased risk of high fasting glucose, elevated blood pressure, raised triglycerides, and abdominal obesity. These risks are the components of metabolic syndrome. Similarly, one previous study revealed that the current drinkers had 1.34 times greater risk of metabolic syndrome than the non-drinkers [19]. Increased alcohol intake was associated with an increased risk of central obesity and metabolic syndrome and its components (except HDL-cholesterol) [20, 21]. In addition, other studies found that heavy alcohol drinking led to an increase in serum triglycerides as well as abdominal obesity [22, 23]. Mild to moderate alcohol consumption was inversely associated with the prevalence of the low HDL-cholesterol, raised serum triglycerides, large waist circumference, and hyperinsulinemia [24]. The two risk factors of breakfast skipping and alcohol drinking were investigated in this study. The results showed the association between metabolic syndrome with each factor alone or in combination. In particular, the combination of skipping breakfast with drinking alcohol can increase the risk of developing high fasting plasma glucose, blood pressure, and

triglycerides, as well as a large waist circumference.

CONCLUSION

The combination of skipping breakfast and drinking alcohol is associated with metabolic syndrome. Routinely eating breakfast and reduced alcohol intake may be beneficial for reducing the risk for the components of metabolic syndrome.

ACKNOWLEDGEMENT

This study was supported by research grants from the Chulalongkorn University.

REFERENCES

- Breslow L, Breslow N. Health practices and disability: some evidence from Alameda County. *Prev Med.* 1993; 22(1): 86-95.
- Sakata K, Matumura Y, Yoshimura N, Tamaki J, Hashimoto T, Oguri S, et al. Relationship between skipping breakfast and cardiovascular disease risk factors in the national nutrition survey data. *Nihon Koshu Eisei Zasshi.* 2001; 48(10): 837-41.
- Timlin MT, Pereira MA. Breakfast frequency and quality in the etiology of adult obesity and chronic diseases. *Nutr Rev.* 2007; 65(6): 268-81.
- Schmidt LE, Rost KM, McGill JB, Santiago JV. The relationship between eating patterns and metabolic control in patients with non-insulin-dependent diabetes mellitus (NIDDM). *Diabetes Educ.* 1994; 20: 317-21.
- Song WO, Chun OK, Obayashi S, Cho S, Chung CE. Is consumption of breakfast associated with body mass index in US adults? *J Am Diet Assoc.* 2005; 105: 1373-82.
- Ministry of Public Health, Health System Research Institute. The report of Thailand population, the National Health Examination survey office IV. Nonthaburi: Ministry of Public Health, Health System Research Institute; 2009.
- Keski-Rahkonen A, Kaprio J, Rissanen A, Virkkunen M, Rose RJ. Breakfast skipping and health-compromising behaviors in adolescents and adults. *Eur J Clin Nutr.* 2003; 57(7): 842-53.
- Reynolds K, Lewis LB, Nolen JDL, Kinney GL, Sathya B, He J. Alcohol consumption and risk of stroke: a meta-analysis. *JAMA* 2003; 289: 579-88.
- Xin X, He J, Frontini MG, Ogden LG, Motsamai OI, Whelton PK. Effects of alcohol reduction on blood pressure: a meta-analysis of randomized controlled trials. *Hypertension.* 2001; 38: 1112-7.
- Klatsky AL. Alcohol and cardiovascular disease more than one paradox to consider. Alcohol and hypertension: does it matter? Yes. *J Cardiovasc Risk.* 2003; 10: 21-4.
- Lee K. Gender-specific relationships between alcohol drinking patterns and metabolic syndrome: the Korea National Health and Nutrition Examination Survey 2008. *Public Health Nutr.* 2012; 10: 1-8.
- Kim KH, Oh SW, Kwon H, Park JH, Choi H, Cho B. Alcohol consumption and its relation to visceral and subcutaneous adipose tissues in healthy male Koreans. *Ann Nutr Metab.* 2012; 60(1): 52-61.
- Alberti KG, Zimmet P, Shaw J. The metabolic syndrome new worldwide definition. *Lancet* 2005; 366(9491): 1059-62.
- National Cholesterol Education Program. Executive Summary of the Third Report of the National Cholesterol Education Program (NCEP) Expert Panel on Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III). *JAMA.* 2001; 285: 2486-97.
- Smith AP. Breakfast cereal consumption and subjective report of health by young adult. *Nutr. Neurosci.* 2003; 6: 59-61.
- Valencia-Martín JL, Galán I, Rodríguez-Artalejo F. The association between alcohol consumption patterns and adherence to food consumption guidelines. *Alcohol Clin Exp Res.* 2011; 35(11): 2075-81.
- Farshchi HR, Taylor MA, Macdonald IA. Deleterious effects of omitting breakfast on insulin sensitivity and fasting lipid profiles in healthy lean women. *Am J Clin Nutr* 2005; 81: 388-96.
- Ma Y, Bertone ER, Stanek EJ, Reed GW, Hebert JR, Cohen NL, et al. Association between eating patterns and obesity in a free-living US adult population. *Am J Epidemiol.* 2003; 158: 85-92.
- Kloimklinsuk A. Factors associated with the metabolic syndrome in health workers at Bamrasnaradura Infectious Disease Institute. Master's thesis, Faculty of Graduate Studies, Mahidol University; 2007 [Cited 2012 Mar 12]. Available from: <http://www.li.mahidol.ac.th/thesis>
- Yoon YS, Oh SW, Baik HW, Park HS, Kim WY. Alcohol consumption and the metabolic syndrome in Korean adults: the 1998 Korean National Health and Nutrition Examination Survey. *Am J Clin Nutr.* 2004; 80:217-24.
- Chen CC, Lin WY, Li CI, Liu CS, Li TC, Chen YT, et al. The association of alcohol consumption with metabolic syndrome and its individual components: the Taichung community health study. *Nutr Res.* 2012; 32(1): 24-9.
- Panagiotakos DB, Pitsavos CH, Skoumas Y, Stefanadis C. The association between food patterns and the metabolic syndrome using principal components analysis: the ATTICA study. *J Am Diet Assoc.* 2007; 107(6): 979-87.
- Risérus U, Ingelsson E. Alcohol intake, insulin resistance, and abdominal obesity in elderly men. *Obesity (Silver Spring).* 2007; 15(7):1766-73.
- Freiberg MS, Cabral HJ, Heeren TC, Vasan RS, Curtis Ellison R. Alcohol consumption and the prevalence of the metabolic syndrome in the US: a cross-sectional analysis of data from the Third National Health and Nutrition Examination Survey. *Diabetes Care.* 2004; 27(12): 2954-9.