The relationship of breakfast skipping and type of breakfast consumed with overweight/obesity, abdominal obesity, other cardiometabolic risk factors and the metabolic syndrome in young adults. The National Health and Nutrition Examination Survey (NHANES): 1999–2006

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Abstract

Objective: To examine the association between breakfast skipping and type of breakfast consumed with overweight/obesity, abdominal obesity, other cardiometabolic risk factors and the metabolic syndrome (MetS).

Design: Cross-sectional. Three breakfast groups were identified, breakfast skippers (BS), ready-to-eat-cereal (RTEC) consumers and other breakfast (OB) consumers, using a 24 h dietary recall. Risk factors were compared between the breakfast groups using covariate-adjusted statistical procedures.

Setting: The 1999–2006 National Health and Nutrition Examination Survey, USA.

Subjects: Young adults (20–39 years of age).

Results: Among these young adults (*n* 5316), 23·8 % were BS, 16·5 % were RTEC consumers and 59·7 % were OB consumers. Relative to the BS, the RTEC consumers were 31 %, 39 %, 37 %, 28 %, 23 %, 40 % and 42 % less likely to be overweight/obese or have abdominal obesity, elevated blood pressure, elevated serum total cholesterol, elevated serum LDL-cholesterol, reduced serum HDL-cholesterol or elevated serum insulin, respectively. Relative to the OB consumers, the BS were 1·24, 1·26 and 1·44 times more likely to have elevated serum total cholesterol, elevated serum LDL-cholesterol or reduced serum HDL-cholesterol, respectively. Relative to the OB consumers, the RTEC consumers were 22 %, 31 % and 24 % less likely to be overweight/obese or have abdominal obesity or elevated blood pressure, respectively. No difference was seen in the prevalence of the MetS by breakfast skipping or type of breakfast consumed.

Conclusions: Results suggest that consumption of breakfast, especially that included an RTEC, was associated with an improved cardiometabolic risk profile in US young adults. Additional studies are needed to determine the nature of these relationships.

Table 1 Demographic characteristics by breakfast skipping or breakfast consumption from a reported 24 h dietary recall in young adults (20–39 years of age): NHANES 1999–2006

| | Breakfast consumption group | | | | | | |
| | BS (*n* 1277) | | RTEC (*n* 826) | | OB (*n* 3213) | | |
Demographic characteristic	%*	SE	%*	SE	%*	SE	*P* value†
Sample size	23·8	0·7	16·5	0·7	59·7	0·9	
Age (years)							
Mean*	28·1[a]	0·2	29·6[b]	0·2	30·4[c]	0·2	<0·0001
Energy intake							
Mean*							
kJ	8982·2[a]	188·7	11078·8[b]	226·8	10547·5[b,c]	172·4	<0·0001
kcal‡,§	2146·8[a]	45·1	2647·9[b]	54·2	2520·9[b,c]	41·2	<0·0001
Gender							<0·0001
Male	26·1	0·9	16·2	1·0	57·7	1·0	
Female	21·2	0·9	16·9	1·0	61·9	1·2	
Ethnicity							<0·0001
Non-Hispanic white	23·0	1·1	18·8	1·0	58·1	1·1	
Non-Hispanic black	31·8	1·4	12·5	1·1	55·7	1·7	
Mexican-American/Hispanic	19·5	1·4	12·7	0·8	67·9	1·7	
Other, including multiracial	29·0	3·3	10·9	2·3	60·1	3·8	
PIR							0·017
<1	27·4	1·8	14·4	1·5	58·2	2·1	
≥1 and <2	26·5	1·9	15·9	1·4	57·6	1·8	
≥2 and <3	25·0	1·8	16·3	1·9	58·8	2·5	
≥3 and <5	22·3	1·5	16·1	1·2	61·6	1·7	
≥5	16·7	1·8	21·0	1·9	62·3	1·9	
Smoking status							<0·0001
Never smoker	21·1	0·8	18·8	1·1	60·1	1·2	
Past smoker	19·3	1·9	13·2	1·2	67·5	2·0	
Current smoker	30·4	1·4	13·8	1·0	55·8	1·4	
Alcohol consumption (g/d)							<0·0001
Mean*	18·5[a]	2·1	8·9[b]	1·0	14·2[a]	0·8	
Physical activity							0·18
Sedentary	24·9	1·5	17·4	1·2	57·7	1·5	
Light	24·0	0·9	17·2	1·1	58·8	1·2	
Moderate	23·1	1·7	16·0	1·2	60·9	2·1	
Heavy	22·3	2·1	13·0	1·5	64·7	2·3	
Marital status							<0·0001
Never married	28·8	1·2	16·0	1·0	55·3	1·3	
Married/cohabiting	20·7	1·0	16·7	0·8	62·6	1·1	
Divorced/widowed/separated	25·1	2·4	14·4	2·3	60·5	2·4	

NHANES, National Health and Nutrition Examination Survey; BS, breakfast skippers; RTEC, ready-to-eat cereal; OB, other breakfast; PIR, poverty income ratio.
[a,b,c]Mean values (unadjusted) within a row with unlike superscript letters were significantly different (*P* < 0·0167 using Bonferroni's correction).
*All values are sample-weighted.
†Indicates overall *P* value from the χ^2 test for categorical variables or from Wald's *F* test for continuous variables.
‡1 kcal = 4·184 kJ.
§Covariates: age, gender, ethnicity, ethnicity × gender, PIR, smoking status, alcohol consumption, physical activity and marital status.

Table 2 Anthropometric/other cardiometabolic risk factors by breakfast skipping or breakfast consumption from a reported 24 h dietary recall in young adults (20–39 years of age): NHANES 1999–2006

| | | Breakfast consumption group | | | | | | |
| | | BS | | RTEC | | OB | | |
Risk factor (dependent variable)	*n*	Least-square mean*	SE	Least-square mean*	SE	Least-square mean*	SE	*P* value†
Weight (kg)‡	4752§	81·6[a]	0·7	77·3[b]	0·7	80·1[a]	0·5	0·0002
BMI (kg/m²)‡	4746§	28·0[a]	0·2	26·6[b]	0·3	27·4[a]	0·2	0·0002
WC (cm)‡	4690§	94·1[a]	0·5	90·7[b]	0·6	92·7[c]	0·4	0·0001
Triceps skinfold (mm)‡	4309§	18·5[a]	0·3	17·4[b]	0·3	18·3[a]	0·2	0·029
Subscapular skinfold (mm)‡	3832§	19·1[a]	0·3	17·5[b]	0·3	18·7[a]	0·2	0·002
SBP (mmHg)‡	4623§	115·4[a]	0·4	113·9[b]	0·4	115·0[a,b]	0·3	0·038
DBP (mmHg)‡	4623§	70·6	0·4	69·3	0·5	69·9	0·3	0·11
Serum TAG (mg/dl)‡	2058§,‖	132·3	5·5	128·2	6·7	124·6	3·7	0·45
Serum total cholesterol (mg/dl)‡	4537§	192·7[a]	1·6	187·0[b]	1·8	188·8[a,b]	0·9	0·017
Serum LDL-cholesterol (mg/dl)‡	2019§,‖	117·7[a]	1·9	111·0[b]	2·6	110·7[b]	1·0	0·002
Serum HDL-cholesterol (mg/dl)‡	4537§	50·0[a]	0·4	50·8[a,b]	0·4	51·1[b]	0·3	0·003
Plasma glucose (mg/dl)‡	2078§,‖	95·6	0·9	93·7	0·8	94·8	0·6	0·14
Serum insulin (μU/ml)‡	2053§,‖	12·1[a]	0·7	10·3[b]	0·4	11·0[a,b]	0·4	0·032
HOMA-IR‡	2053§,‖	3·0[a]	0·2	2·5[b]	0·1	2·6[a,b]	0·10	0·026
QUICKI‡	2053§,‖	0·1490[a]	0·0009	0·1529[b]	0·0011	0·1517[b]	0·0005	0·004
Glycosylated Hb (%)‡	4573§	5·3[a]	0·04	5·1[b]	0·02	5·2[a]	0·02	0·002
Plasma homocysteine (μmol/l)‡	4573§	8·0[a]	0·1	7·3[b]	0·1	7·8[a]	0·1	0·003
Serum hs-CRP (mg/dl)‡	4554§	0·4	0·02	0·4	0·03	0·3	0·01	0·09

NHANES, National Health and Nutrition Examination Survey; BS, breakfast skippers; RTEC, ready-to-eat cereal; OB, other breakfast; WC, waist circumference; SBP, systolic blood pressure; DBP, diastolic blood pressure; HOMA-IR, homeostatic model assessment insulin resistance; QUICKI, quantitative insulin sensitivity check index; hs-CRP, high-sensitivity C-reactive protein.
[a,b,c]Mean values within a row with unlike superscript letters were significantly different (*P* < 0·0167 using Bonferroni's correction).
*All values are sample-weighted.
†Indicates composite *P* value from Wald's *F* test.
‡Covariates: energy intake, age, gender, ethnicity, ethnicity × gender, poverty income ratio, smoking status, alcohol consumption, physical activity and marital status.
§Sample size varied from the original during analysis due to missing data.
‖Only data for those who were fasting for at least 8·5 h before the blood draw were used.