

Supplementary Materials: Frequency of Loud Snoring and Metabolic Syndrome among Korean Adults: Results from the Health Examinees (HEXA) Study

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Table S1. Odds ratio (ORs) ^a of metabolic syndrome (MetS) ^b by snoring frequency stratified by BMI, the Health Examinees Gem (HEXA-G) 2009–2013.

	Snoring Frequency					<i>p</i> -Trend ^c	<i>p</i> -Interaction ^d
	Never	1–3 times/mth	1–3 times/wk	4–5 times/wk	6+ times/wk		
<i>Men</i>							
<i>BMI < 25 kg/m² n = 14918</i>	6694	2926	2843	828	1627		
MetS	Ref.	1.20 (1.07–1.36)	1.38 (1.23–1.55)	1.46 (1.21–1.75)	1.26 (1.09–1.45)	<0.0001	0.0059
WC ≥ 90 cm	Ref.	1.25 (1.06–1.47)	1.17 (0.99–1.38)	1.03 (0.78–1.36)	1.56 (1.29–1.88)	<0.0001	0.2056
Serum TG ≥ 150 mg/dL	Ref.	1.08 (0.98–1.18)	1.23 (1.12–1.35)	1.27 (1.09–1.48)	1.26 (1.13–1.42)	<0.0001	0.9157
Serum HDL-C ≤ 40 mg/dL	Ref.	1.14 (1.02–1.28)	1.12 (1.00–1.26)	1.30 (1.09–1.56)	1.35 (1.18–1.55)	<0.0001	0.3967
BP ≥ 130/85 mmHg	Ref.	1.18 (1.08–1.29)	1.27 (1.16–1.39)	1.33 (1.15–1.54)	1.20 (1.08–1.34)	<0.0001	0.1045
Fasting glucose ≥ 100 mg/dL	Ref.	1.05 (0.95–1.16)	1.17 (1.06–1.29)	1.12 (0.96–1.32)	0.97 (0.86–1.10)	0.2596	0.0067
<i>BMI ≥ 25kg/m² n = 9938</i>	2861	1931	2347	806	1993		
MetS	Ref.	1.05 (0.93–1.18)	1.28 (1.14–1.43)	1.39 (1.19–1.63)	1.59 (1.41–1.78)	<0.0001	
WC ≥ 90 cm	Ref.	1.05 (0.94–1.19)	1.23 (1.10–1.38)	1.25 (1.06–1.46)	1.60 (1.42–1.80)	<0.0001	
Serum TG ≥ 150 mg/dL	Ref.	1.12 (1.00–1.26)	1.27 (1.13–1.41)	1.22 (1.04–1.43)	1.33 (1.19–1.50)	<0.0001	
Serum HDL-C ≤ 40 mg/dL	Ref.	0.98 (0.86–1.11)	1.05 (0.93–1.19)	1.12 (0.94–1.33)	1.31 (1.16–1.49)	<0.0001	
BP ≥130/85 mmHg	Ref.	1.06 (0.94–1.20)	1.32 (1.18–1.49)	1.40 (1.18–1.67)	1.40 (1.24–1.58)	<0.0001	
Fasting glucose ≥100 mg/dL	Ref.	1.10 (0.98–1.24)	1.12 (1.00–1.26)	1.30 (1.11–1.52)	1.29 (1.15–1.46)	<0.0001	
<i>Women</i>							
<i>BMI < 25 kg/m² n = 34441</i>	20,135	7205	4277	1026	1798		
MetS	Ref.	1.33 (1.23–1.43)	1.52 (1.39–1.66)	1.42 (1.21–1.67)	1.79 (1.58–2.01)	<0.0001	0.0449
WC ≥ 80 cm	Ref.	1.39 (1.30–1.48)	1.41 (1.31–1.53)	1.29 (1.12–1.50)	1.71 (1.54–1.90)	<0.0001	0.0003
Serum TG ≥ 150 mg/dL	Ref.	1.14 (1.06–1.22)	1.30 (1.20–1.41)	1.20 (1.03–1.40)	1.38 (1.24–1.55)	<0.0001	0.5473
Serum HDL-C ≤ 50 mg/dL	Ref.	1.12 (1.06–1.19)	1.14 (1.06–1.23)	1.03 (0.90–1.19)	1.36 (1.23–1.50)	<0.0001	0.0477

BP $\geq$ 130/85 mmHg	Ref.	1.25 (1.18–1.33)	1.42 (1.32–1.53)	1.41 (1.24–1.62)	1.42 (1.28–1.57)	<0.0001	0.6113
Fasting glucose $\geq$ 100 mg/dL	Ref.	1.15 (1.06–1.24)	1.29 (1.18–1.41)	1.31 (1.11–1.54)	1.44 (1.27–1.62)	<0.0001	0.7439
BMI $\geq$ 25 kg/m ² n = 13588	5455	3215	2459	753	1706		
MetS	Ref.	1.20 (1.10–1.32)	1.41 (1.28–1.55)	1.73 (1.48–2.03)	1.67 (1.49–1.87)	<0.0001	
WC $\geq$ 80 cm	Ref.	1.22 (1.09–1.37)	1.49 (1.30–1.70)	1.54 (1.23–1.94)	2.54 (2.10–3.06)	<0.0001	
Serum TG $\geq$ 150 mg/dL	Ref.	1.16 (1.05–1.27)	1.33 (1.20–1.47)	1.50 (1.28–1.76)	1.44 (1.28–1.61)	<0.0001	
Serum HDL-C $\leq$ 50 mg/dL	Ref.	1.14 (1.04–1.24)	1.14 (1.03–1.25)	1.40 (1.20–1.64)	1.30 (1.17–1.45)	<0.0001	
BP $\geq$ 130/85 mmHg	Ref.	1.22 (1.11–1.34)	1.33 (1.20–1.47)	1.46 (1.24–1.71)	1.50 (1.34–1.69)	<0.0001	
Fasting glucose $\geq$ 100 mg/dL	Ref.	1.18 (1.07–1.30)	1.28 (1.15–1.42)	1.53 (1.30–1.80)	1.50 (1.33–1.68)	<0.0001	

^a ORs adjusted for: age (continuous), BMI (continuous), education ($\leq$ middle school, high school, $\geq$ college, unknown), occupation (manual, non-manual, unemployed, unknown), marital status (married, single, unknown), smoking (never, past, current, unknown; only for men), alcohol drinking (current, non, unknown), regular exercise (yes, no, unknown), menopausal status (pre-, post-, unknown; only for women), and sleep duration (continuous). ^b MetS: the presence of 3 or more of the following components: 1) elevated waist circumference (WC); 2) high triglyceride (TG) levels; 3) low high density lipoprotein-cholesterol (HDL-C) or taking anticholesterol medication; 4) high blood pressure (BP) or taking antihypertensive medicine; 5) high fasting glucose levels or taking medication to treat diabetes mellitus. ^c Linear trends across snoring frequency categories were calculated by general linear regression. ^d BMI interaction term was assessed by likelihood ratio tests with the use of a cross-product term.

Table S2. Odds ratio (ORs) ^a of metabolic syndrome (MetS) ^b by number of obstructive sleep apnea (OSA) markers, the Health Examinees-Gem (HEXA-G) 2009–2013.

	Number of OSA Markers ^c				<i>p</i> -Trend ^d
	None	1	2	3	
<i>Men n = 24,856</i> ^e	9447	9916	3904	1589	
MetS	Ref.	1.51 (1.41–1.61)	1.86 (1.71–2.01)	2.03 (1.81–2.27)	<0.0001
WC ≥ 80 cm	Ref.	1.64 (1.53–1.75)	2.01 (1.85–2.18)	2.45 (2.19–2.74)	<0.0001
Serum TG ≥ 150 mg/dL	Ref.	1.31 (1.23–1.39)	1.45 (1.34–1.56)	1.53 (1.37–1.70)	<0.0001
Serum HDL-C ≤ 50 mg/dL	Ref.	1.10 (1.02–1.18)	1.02 (0.93–1.12)	1.17 (1.03–1.32)	<0.0001
BP ≥ 130/85 mm Hg	Ref.	1.32 (1.25–1.40)	1.59 (1.47–1.72)	1.62 (1.45–1.81)	<0.0001
Fasting glucose ≥ 100 mg/dL	Ref.	1.17 (1.10–1.24)	1.32 (1.22–1.43)	1.31 (1.18–1.47)	<0.0001
<i>Women n = 48,029</i> ^e	25,332	15,841	5858	998	
MetS	Ref.	1.28 (1.21–1.35)	1.37 (1.27–1.47)	1.48 (1.28–1.72)	<0.0001
WC ≥ 80 cm	Ref.	1.26 (1.19–1.33)	1.12 (1.03–1.21)	1.09 (0.91–1.30)	<0.0001
Serum TG ≥ 150 mg/dL	Ref.	1.16 (1.10–1.21)	1.25 (1.17–1.33)	1.39 (1.21–1.60)	<0.0001
Serum HDL-C ≤ 50 mg/dL	Ref.	1.10 (1.05–1.15)	1.14 (1.07–1.21)	1.20 (1.05–1.37)	<0.0001
BP ≥ 130/85 mm Hg	Ref.	1.24 (1.19–1.30)	1.33 (1.25–1.41)	1.42 (1.24–1.63)	<0.0001
Fasting glucose ≥ 100 mg/dL	Ref.	1.17 (1.11–1.24)	1.27 (1.18–1.37)	1.38 (1.19–1.60)	<0.0001

^a ORs adjusted for: age (continuous), BMI (continuous), education (≤middle school, high school, ≥college, unknown), occupation (manual, non-manual, unemployed, unknown), marital status (married, single, unknown), smoking (never, past, current, unknown; only for men), alcohol drinking (current, non, unknown), regular exercise (yes, no, unknown), menopausal status (pre-, post-, unknown; only for women), and sleep duration (continuous). ^b MetS: the presence of 3 or more of the following components: (1) elevated waist circumference (WC); (2) high triglyceride (TG) levels; (3) low high density lipoprotein-cholesterol (HDL-C) or taking anticholesterol medication; (4) high blood pressure (BP) or taking antihypertensive medicine; (5) high fasting glucose levels or taking medication to treat diabetes mellitus. ^c OSA markers include loud snoring, breathing interruptions and awakenings. ^d Linear trends across snoring frequency categories were calculated by general linear regression. ^e Gender *p*-interaction value < 0.0001; interaction term was assessed by likelihood ratio tests with the use of a cross-product term.



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