Snoring as an independent risk factor for incident type 2 diabetes in obese versus non-obese subjects:

A 5- year longitudinal study from the EGAT study

Visasiri Tantrakul, MD
Sleep Disorder Center Ramathibodi
Hospital. Medicine Department.
Mahidol University

Snoring, OSA, Incident DM, EGAT cohort

Introduction

* **Cross-sectional studies had documented co-occurrence of obstructive sleep apnea(OSA) with glucose tolerance, insulin resistance, T2DM.**

* **Obstructive sleep apnea(OSA) is associated with alteration in glucose metabolism.**

  - 6,981 nonobese Korean study found frequent snoring is independent associated with elevated HbA1c level.
  (Joo et al 2006.)

  - Cross-sectional 595 men study found high prevalence of T2DM and OSA; association of severity of OSA and glucose tolerance independent of degree & distribution of obesity.
  (Meslier et al 2003)

  - Case controlled study (40 OSA, 40 matched non-apneic obese, and 40 normal weight;No significant difference in insulin resistance (HOMA) in OSA compared to obese control.
  (Sharma et al 2007)

Snoring, OSA, Incident DM, EGAT cohort

Introduction. Cont'd

* However evidence for causal role of OSA (or snoring)for incident diabetes from various clinic -and population-based studies showed inconsistent results.

  - Wisconsin Sleep Cohort: 4 yr f/u study found more prevalent DM in OSA(OR 2.3), but no independent relationship between incident DM and and OSA. Reichmuth et al. 2005

  - US Nurses Health study: 10 yr f/u found regular snoring is associated with 2-fold increased risk of DM. Al-Delaimy et al. 2002.

  - Clinic-based cohort of 1233 veteran affair men with OSA found severity of OSA as independent risk factor for incident T2DM (HR1.43) and regular CPAP may reduced the risk. Botros et al. 2009.

* **This is a large Asian cohort that aimed to demonstrate this relationship.**

Snoring, OSA, Incident DM, EGAT cohort

Methods

* A 5- year longitudinal observational study of 3227 non-diabetic Thai employees from EGAT was performed during 2002-2008.

* "Snoring" is defined as reports of frequent snoring

  (≥3-4 times/week), or loud and disturbing snoring from questionnaire.

* " Type 2 diabetes" is diagnosed by either

  - subjects reported of physician-diagnosed DM and currently on hypoglycemic/insulin treatment or

  - fasting plasma glucose is ≥ 126 mg/dl.

At baseline: EGAT 1/3(2002) & EGAT2/2(2003)
N= 6718

Questionnaire, FPG

Exclude: old diabetes 620 (9.2%)
Missing Data: 1950

4148 Non-Diabetes subjects

Loss F/U: 921 (22%)

At 5 year follow-up: EGAT 1/4 (2007) & EGAT2/3(2008)
N= 3227 (72.1% male)

Questionnaire, FPG

Incident Diabetes : N= 222 (6.9%)

Snoring, OSA, Incident DM, EGAT cohort

Statistical Analysis

* **Student's t test** was used to compare means values between groups.

* Categorical data were compared using the **chi-squared test**.

* **Univariated logistic regression analysis** were generated for the unadjusted association between snoring and incident diabetes.

* **Multivariated logistic regression analysis** were then calculated for the confounding effects of other baseline characteristics, including, age, gender BMI, waist circumference, change in BMI (over the follow-up period).

* **Subgroup analyses of obese and non-obese subjects** were further calculated.

Results

Baseline Characteristics 1

N= 3227	Snorers N= 1233 (38.2%)	Non-snorers N =1994 (61.8%)	Total	*p* value
Age	52.9 ± 7.2	52.8± 6.9	52.9 ± 7.2	0.77
Gender % male	84.3%	64.5%	72.1%	<0.001
BMI (kg/m2)	25.3± 3.5	23.8 ±3.2	24.3± 3.4	<0.001
Waist circumference (cm)	89.7± 9.3	84.6± 9.2	86.3 ±9.6	<0.001
Obesity %(BMI ≥27.5kg/m2)*	61.9%	43.2%	50.3%	<0.001
Current smoking (%)	26.1%	21.9%	23.7%	0.02
Current alcohol consumption (%)	36.6%	25.1%	29.5%	<0.001
Hypertension (%)	44.9%	35.1%	38.8%	<0.001
Parental history of DM %	25.9%	25.5%	25.7%	0.83

* WHO Expert Consultation 2004

Baseline characteristics 2

N= 3227	Snorers N= 1233 (38.2%)	Non-snorers N =1994 (61.8%)	Total	p value
Fasting Plasma Glucose (mg/dL)	96.5 ± 14.1	94.3± 10.2	94.9 ±11.7	<0.001
Total cholesterol (mg/dL)	241.0± 41.7	236.7± 43.0	237.9 ±42.3	0.006
LDL-cholesterol (mg/dL)	158.1± 37.8	154.4± 39.8	155.5 ±38.9	0.01
HDL-cholesterol (mg/dL)	52.3 ±13.5	55.9± 15.5	54.6 ±14.8	<0.001
Triglyceride (mg/dL)	157.7± 98.1	136.8 ±87.3	145.5 ±97.9	<0.001
GGT	62.3 ± 70.7	49.7± 65.1	56.0 ±69.2	<0.001
Hs-CRP	4.8 ±35.1	2.7 ±14.8	3.7± 27.0	0.08

Snoring, OSA, Incident DM, EGAT cohort

Incident T2DM at 5 years

17.3%

16.1%

6.4%

4.3%

Percentage

20
18
16
14
12
10
8
6
4
2
0

Non Obese without Snoring   Non Obese with Snoring   Obese without Snoring   Obese with Snoring
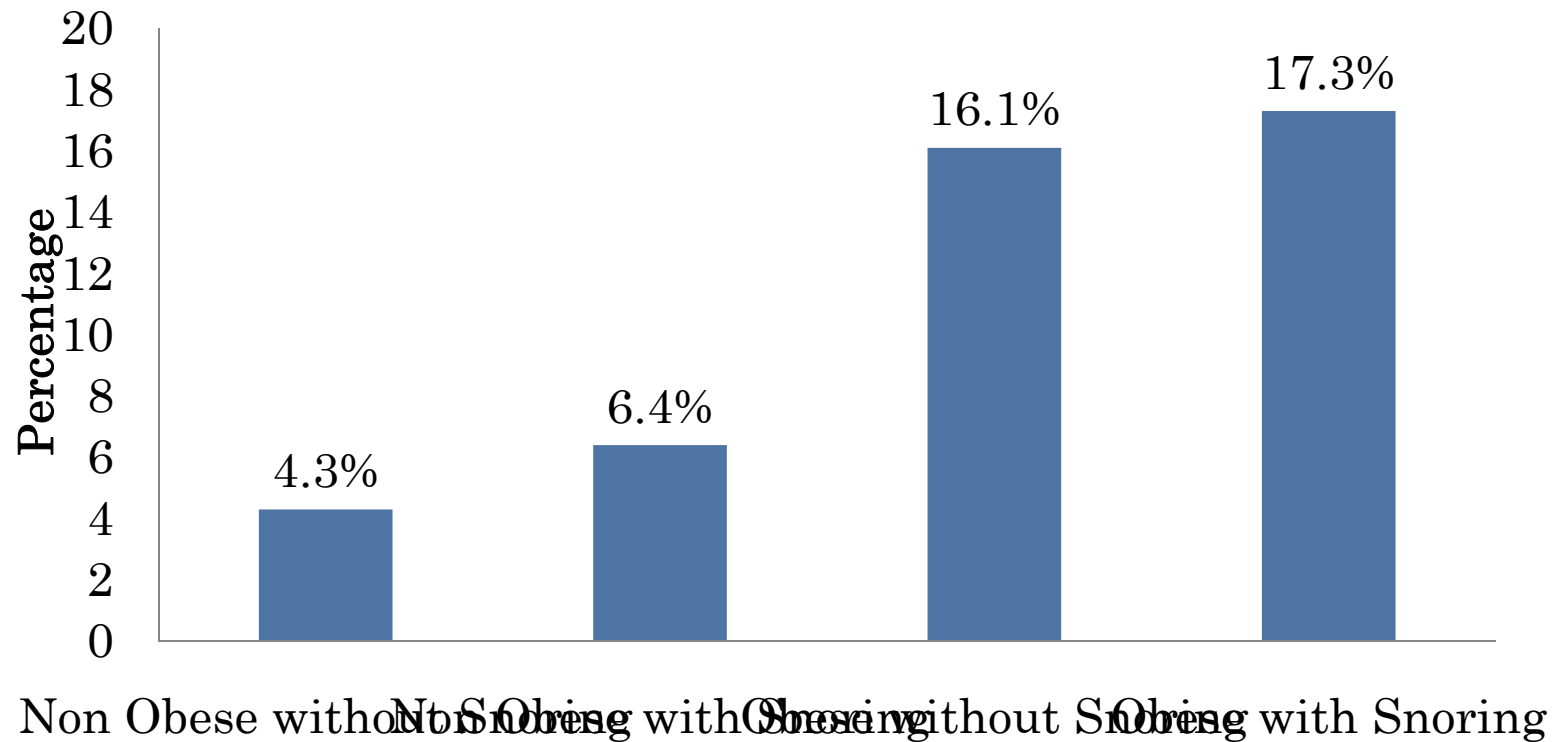
p value < 0.001

Snoring, OSA, Incident DM, EGAT cohort

	Non-adjusted				Adjusted §		
	OR	95%CI	p value		OR	95%CI	p value
Snorers	1.61	1.23-2.12	0.001	Snorers	1.35	0.96-1.91	0.08
Obesity*	3.98	3.01-5.25	< 0.001	Obesity	3.11	2.51-4.48	< 0.001
Central Obesity**	3.32	2.4-4.6	< 0.001	Central Obesity	2.11	1.33-3.32	0.001
Parental Diabetes	1.74	1.32-2.29	< 0.001	Parental Diabetes	1.93	1.36-2.75	< 0.001

§ Adjusted for age, gender, BMI change at 5 years, current smoking and alcohol status and baseline fasting plasma glucose.

* Obesity is defined as BMI ≥ 27.5 kg/m2. (WHO Expert Consultation 2004)

** Central obesity are defined as waist-hip ratio > 0.9 in men and > 0.85 in women. (WHO report 2008)

Snoring, OSA, Incident DM, EGAT cohort

Subgroup analysis of Non-obese subjects; BMI < 27.5 kg/m2
(N= 1604)

	OR	95%CI	*p* value
Snorers	2.03	1.20-3.44	0.008
BMI	1.10	0.914-1.32	0.32
Central Obesity*	1.97	1.14-3.4	0.015
Parental diabetes	2.59	1.53-4.39	<0.001

•Central obesity are defined as waist-hip ratio > 0.9 in men and > 0.85 in women.
(WHO report 2008)

Snoring, OSA, Incident DM, EGAT cohort

Subgroup analysis of Obese subjects; BMI ≥ 27.5 kg/m2
(N= 1623)

	OR	95%CI	p value
Snorers	1.10	0.79-1.54	0.60
BMI	1.20	1.14-1.27	<0.001
Central Obesity*	2.21	1.32-3.70	0.003
Parental diabetes	1.57	1.10-2.23	0.013

•Central obesity are defined as waist-hip ratio > 0.9 in men and > 0.85 in women.
 (WHO report 2008)

Conclusion1

* This is the first prospective study in a large Asian population determining the causal relationship between " snoring" and " incident T2DM"

* Our finding emphasized the high incidence (6.9%) of T2DM in Thai EGAT population despite the short period of 5 year- follow up.

* Obesity, central obesity and parental history of diabetes had stronger impact than snoring in developing T2DM.

Conclusion2

* However in subgroup analysis of Non-obese subjects " snoring" independently increased the risk of developing T2DM (OR2.03) regardless of BMI and central obesity.

* This evidence supported that in low risk subjects without major confounding factors of obesity/central obesity,

  " snoring" is a risk factor for incident T2DM.

* But in Obese-subgroup, obesity, central obesity had stronger influences than snoring as a risk factor for incident T2DM.