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Association between temporomandibular disorders and obesity

Eunmi Rhim [a], Kyungdo Han [b], Kyoung-In Yun [c, *]

[a] Department of Conservative Dentistry and Endodontics, The Catholic University of Korea, Yeouido St. Mary's Hospital, Seoul, Republic of Korea
[b] Department of Biostatistics, The Catholic University of Korea, College of Medicine, Seoul, Republic of Korea
[c] Department of Oral and Maxillofacial Surgery, The Catholic University of Korea, Yeouido St. Mary's Hospital, Seoul, Republic of Korea

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ABSTRACT

Psychological stress can induce altered eating patterns, and studies have indicated that there is a correlation between temporomandibular disorder (TMD) and psychological stress. This study investigated the relationship between TMD and body mass index (BMI) in a large representative sample of the South Korean population using data from the Korea National Health and Nutrition Examination Survey (KNHANES). Men and women with TMD showed decreased prevalence of abdominal obesity. Women with TMD had lower age, lower BMI, lower metabolic syndromic waist circumference, lower prevalence of metabolic syndrome, and lower prevalence of diabetes compared with the group without TMD. However, males with TMD didn't show any statistically significant difference between BMI, and metabolic syndromic waist circumference compared with the group without TMD, although there were similar tendencies in the female subject groups. Overall, TMD was associated with decreased BMI and abdominal obesity in women.

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1. Introduction

Temporomandibular disorder (TMD) is defined as a set of clinical conditions characterized by pain and dysfunction of the masticatory muscles, temporomandibular joint (TMJ), and associated hard and soft tissues (Yun et al., 2008). Common symptoms include pain, limitation in jaw function, and clicking jaw sounds. Possible risk factors that contribute to TMJ are parafunction and psychological stress (Koray et al., 2009). On the contrary, TMD is also considered as a causative or intensifying factor in the development of anxiety and depression (Koray et al., 2009).

Psychological stress induces altered eating patterns (Macht, 2008). During stressful periods, some study subject ate high-calorie comfort foods and gained weight, whereas others ate less and lost weight (Epel et al., 2004; Roberts et al., 2007). Body mass index (BMI) is used to identify possible weight problems, and previous studies have evaluated the effects of stress on eating behavior and BMI (Roberts et al., 2007; Nguyen-Rodriguez et al., 2008). However, there is little evidence on the relationship between TMD and BMI.

The aim of this study was to investigate the relationship between TMD and BMI in a large representative sample of the South Korean population using data from the Korea National Health and Nutrition Examination Survey (KNHANES).

2. Materials and methods

2.1. Survey overview

The present study was performed with data from the Fifth Korean National Health and Nutrition Examination Survey (KNHANES V), which was carried out from 2010 to 2012. The KNHANES was first performed as a nationwide survey in 1998 by the Division of Chronic Disease Surveillance at the Korean Center of Disease Control and Prevention. It is a nationwide study of non-institutionalized civilians and uses a stratified and multistage probability sampling design with a rolling survey-sampling model. The sampling units were based on the population and housing consensus from the 2005 National Census Registry in Korea, which includes age, sex, and geographic area.

A total of 25,533 KNHANES V participants had sufficient data available for inclusion in the present study. The KNHANES V was approved by the Institutional Review Board for Human Subjects of the Korea Center for Disease Control and Prevention. Each

* Corresponding author.
E-mail address: yun_ki@catholic.ac.kr (K.-I. Yun).

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participant in the survey signed an informed consent form. Overall response rate was 81.9% in 2010, 80.4% in 2011, and 80.0% in 2012. There were 19,851 subjects who participated in the pain and/or discomfort questionnaire and 17,313 respondents for the TMD symptom questionnaire. Exclusion criteria were two-fold: (1) those aged <12 years and (2) those with missing values in the health assessment or questionnaires. The final sample size for this study was 11,922 (5120 males and 6802 females, 46.7% of all participants in KNHANES V).

The survey was composed of three parts: a health interview survey, a health examination survey, and a nutrition survey. Trained interviewers conducted face-to-face interviews with a structured questionnaire. Physical examinations, blood sampling, and urine sampling were performed at a mobile examination center. All data used in the present study are available in public-use files provided by the Korea Centers for Disease Control and Prevention and the Ministry of Health and Welfare of Korea.

2.2. Demographic variables

Demographic variables were sex, age, education level, alcohol intake, income, and smoking status according to author's previous papers.

Education level was categorized into four groups: less than primary school, middle school, high school, and college or higher. The education level was classified as low if the respondent did not finish education beyond middle school.

Monthly household income was adjusted for the number of household members and was categorized into four groups: <25%, 25%–49%, 50%–75%, and >75% of the total equivalized income in the survey. Individuals with household incomes in the lowest quartile were classified as the low-income group.

The amount of pure alcohol consumed (in grams per day) was calculated using the average number of alcoholic beverages consumed and the frequency of alcohol consumption. Alcohol consumption status was classified into three groups: nondrinker, mild-to-moderate drinker (<30.0 g alcohol/day), and heavy drinker (≥30.0 g alcohol/day). High-risk drinker was designated as drinking >60.0 g alcohol/day for male and >40.0 g/day for female subjects.

Smoking status was categorized into three groups: non-smokers (i.e., those who had never smoked or who had smoked fewer than 100 cigarettes in their lifetime), current smokers (i.e., those who were currently smoking and who had smoked 100 or more cigarettes in their lifetime), and ex-smokers (i.e., those who had smoked in the past but had ceased smoking).

Regular exercise was defined as strenuous physical activity performed for at least 20 min at a time at least three times a week (Choi et al., 2013).

2.3. Descriptions of metabolic syndrome, diabetes, and hypertension

Metabolic syndrome was defined according to the American Heart Association/National Heart, Lung, and Blood Institute Scientific Statement criteria for Asians (Chun et al., 2013). To be diagnosed with metabolic syndrome, ≥3 of the following criteria must be fulfilled: 1) waist circumference ≥90 cm in men or ≥80 cm in women; 2) fasting TG ≥150 mg/dL or use of lipid-lowering medication; 3) HDL-C <40 mg/dL in men or <50 mg/dL in women or use of cholesterol-lowering medication; 4) blood pressure ≥130/85 mm Hg or use of antihypertensive medication; and 5) FBG ≥100 mg/dL or current use of anti-diabetic medication (Kim et al., 2013).

Diabetes was diagnosed when fasting blood sugar was >126 mg/dL or when the individual was currently using anti-diabetic medication (Jeon et al., 2013).

Hypertension was defined as systolic blood pressure >160 mm Hg, diastolic blood pressure >90 mm Hg, or current use of systemic antihypertensive drugs (Weber et al., 2004).

2.4. Anthropometric measurements

Measurements were obtained by trained staff members in the Division of Chronic Disease Surveillance under the Korea Centers for Disease Control and Prevention and the Korean Ministry of Health and Welfare. Body weight and height were measured to the nearest 0.1 kg and 0.1 cm, respectively, with the participants in light indoor clothing without shoes (Nam et al., 2012).

Waist circumference was measured at the narrowest point between the lower border of the rib cage and the iliac crest. The waist circumference cut-off point was defined as ≥90 cm in men and ≥80 cm in women.

BMI was calculated as weight in kg divided by height in m^2. The BMI cut-off point was 23 kg/m^2 for overweight and 25 kg/m^2 for obesity (Kim et al., 2014).

A standard mercury sphygmomanometer was used to measure systolic blood pressure and diastolic blood pressure on the right arm. Systolic blood pressure and diastolic blood pressure measurements were performed twice at 5-min intervals; the average values were used for the analysis.

2.5. TMD assessment

All TMD examinations were performed by dentists. To assess TMD, the following criteria of the World Health Organization (WHO) were used (WHO, 1987):

(1) Clicking of one or both temporomandibular joints (TMJ),
(2) tenderness (on palpation) of the anterior temporalis and/or masseter muscles on one or both sides,
(3) reduced jaw mobility-opening of <30 mm. Clicking was evaluated directly by an audible sharp sound or by palpation of the TMJ.

Tenderness was evaluated by unilateral palpation with firm pressure of two fingers, exerted twice on the most voluminous part of the muscle. Tenderness was recorded only if the palpation spontaneously provoked an avoidance reflex.

Reduced jaw mobility was determined by measuring the distance between the incisal tips of the central maxillary and mandibular incisors. As a general guide, mobility was considered to be reduced if the subject was unable to open his or her jaw to the width of two fingers.

TMD was determined to be present if the subject reported having at least one of the following signs: clicking, tenderness (on palpation), or reduced jaw mobility (opening < 30 mm) once or more per week.

2.6. Statistical analyses

All data are presented as mean ± SE or percentage (SE). If necessary, logarithmic transformation was performed to achieve a normal distribution. Statistical analyses were performed using the survey procedure of the statistical software package to account for the complex sampling design. p values <0.05 were considered statistically significant. Student's t-test or one-way analysis of variance was used to investigate the differences in presence of TMD, according to the variables. Univariate and multivariate logistic regression analyses were used to assess the associations of TMD with BMI and its individual components. Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated after adjustment

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