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Short Communication

Association between Neck Circumference and Thyroid Disease: Findings of a Nationwide Cross-Sectional Study in Korea

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Abstract

Background: There were contradictory reports about the relationship between neck circumference (NC) and thyroid status. This study aimed to compare the NCs of Korean adults with or without thyroid disease.

Methods: The data of 8,198 subjects (aged 40–80 yr) that participated in the 2019-2020 Korean National Health and Nutrition Examination Survey were subjected to analysis. NCs were measured by trained staff to an accuracy of ±0.1 cm with a tape measure. Multiple logistic models were used to assess the prevalence of thyroid disease by NC level among men and pre- and postmenopausal women.

Results: Approximately 5% of subjects had a history of thyroid disease. In contrast to men and postmenopausal women, premenopausal women with a larger NC had a significantly higher prevalence of thyroid disease (*P*-value=0.025).

Conclusion: A large NC is significantly associated with thyroid disease among premenopausal Korean women.

Keywords: Korean; Neck circumference; Premenopausal women; Thyroid diseases

Introduction

Neck circumference (NC) is a simple anthropometric index that reflects body fat accumulation in upper body. NC measurements are straightforward, little affected by breathing or diet, and highly reproducible. Accumulating studies have confirmed that NC, like waist circumference, provides a means of assessing cardio-metabolic risks and predicting the risks of cardiovascular diseases (1, 2).

Based on the impact of regional body fat on thyroid function (3), several studies have been conducted on the relation between NC and thyroid status. However, the results of related studies were inconsistent and additionally limited by small sample sizes or by the recruitment of specific groups (i.e., one-sex or postmenopausal women) (4-9). Therefore, this study examined relations between NCs and history of thyroid disease using nationwide Korean data.

Methods

Design and participants

The data used in this study were extracted from the 2019–2020 Korean National Health and Nutrition Examination Survey (KNHANES), a nationwide population-based survey conducted annually by the Korean Ministry of Health and Welfare on subjects randomly selected using a stratified, multistage, probability sampling design. Detailed information on KNHANES has already been published (10). In this study, we analyzed the data of 8,198 subjects (aged 40–80 yr) with available data on NC and history of thyroid disease. NC was measured in subjects aged 40 yr or older, and the age was not specified for subjects more than 80 yr old (only coded as "80").

The database used in this study is publicly available. Microdata and analytical guidelines can be downloaded from the KNHANES website (https://knhanes.kdca.go.kr/knhanes/eng/index.do). In accordance with the requirements of the National Health Enhancement Act, selected candidates were informed that they could refuse to participate in KNHANES without prejudice.

All participants provided written informed consent, and researchers followed the guidelines set forth in the Declaration of Helsinki. The Institutional Review Board of Gachon University Gil Medical Center approved the study protocol (IRB no. GFIRB2022-099).

Data collection

The main variables of interest were physician-diagnosed thyroid disease and NC. Trained staff measured NC to an accuracy of ±0.1 cm using a tape measure (Lufkin W606pm; Lufkin Industries, Inc., Missouri, TX, USA) perpendicularly to the long axis of the neck from under the Adam's apple with neck upright, head parallel to the Frankfort plane, and arms naturally lowered. NC was measured twice, and average values are presented. Information on demographic characteristics, health-related habits, and comorbidities was subjected to analysis.

Statistical analysis

Means and standard deviations or numbers (percentages) are used to describe subject characteristics. The significances of intergroup differences were determined by t test or Chi-square test, as appropriate. We divided participants into four groups according to quartile of NC to test the dose-dependent effects: i) in men, <36.5 cm, 36.5–37.8 cm, 37.9–39.4 cm, and ≥ 39.5 cm; ii) in premenopausal women, <31.3 cm, 31.3–32.4 cm, 32.5–33.9 cm, and ≥34.0 cm; and iii) in postmenopausal women, <31.6 cm, 31.6–32.7 cm, 32.8–34.0 cm, and ≥34.1 cm. Multiple logistic models adjusted for potential confounders (being significant in univariate analyses in each group) were used to assess the estimated prevalence of thyroid disease by NC quartile. The analysis was performed using STATA MP 17.0 (Stata Corp., College Station, TX, USA). All statistical tests were two-sided, and *P*-values less than 0.05 were considered statistically significant.

Results

Table 1 presents the differences in characteristics of subjects according to thyroid disease. Approximately 5% of subjects had a history of thyroid disease (1.86% for men, 6.82% for premenopausal women, and 7.76% for postmenopausal women). Significant differences by thyroid disease were noted in some variables: i) in men, subjects with history of thyroid disease were more likely to be older (*P*=0.005), currently less smoke (*P*=0.034), and have more cardiovascular diseases (*P*=0.004); ii) in premenopausal women, subjects with history of thyroid disease were more likely to exercise more (*P*=0.030) and have more type 2 diabetes (*P*=0.028) and cardiovascular diseases (*P*=0.031); and iii) in postmenopausal women, subjects with history of thyroid disease were more likely to be younger (*P*=0.004), low economic status (*P*=0.045), attain low level of education (*P*=0.001), and exercise more (*P*=0.002). Premenopausal women with thyroid disease had a significantly larger mean NC than those without thyroid disease (33.4 cm *vs.* 32.7 cm, *P*=0.002).

Table 1: Subject characteristics by history of thyroid disease

Variable	*Men*			*Premenopausal women*			*Postmenopausal women*		
	No history	History	*P*-value	No history	History	*P*-value	No history	History	*P*-value
No.	3,478	66		1,434	105		2,852	240	
Demographics									
Age (years)	59.7±11.7	63.8±11.1	0.005	48.5±7.9	49.5±8.2	0.198	65.3±9.0	63.6±8.6	0.004
≤median household income	1,554 (44.8)	26 (39.4)	0.381	485 (33.9)	33 (31.4)	0.603	1,641 (57.8)	121 (51.1)	0.045
≤middle school graduate	1,036 (29.9)	22 (33.3)	0.544	166 (11.6)	15 (14.3)	0.405	1,673 (58.7)	115 (47.9)	0.001
Health-related habits									
Current smoking	1,052 (30.3)	12 (18.2)	0.034	76 (5.3)	3 (2.9)	0.281	93 (3.3)	6 (2.5)	0.525
Drinking ≥2 per week	1,250 (38.0)	18 (29.0)	0.150	216 (16.5)	9 (9.7)	0.082	178 (8.6)	13 (7.0)	0.452
Regular aerobic exercise[a]	1,447 (41.8)	30 (45.5)	0.545	569 (39.7)	53 (50.5)	0.030	966 (34.0)	106 (44.2)	0.002
Comorbidities									
BMI ≥ 25 kg/m²	1,483 (42.6)	28 (42.4)	0.972	412 (28.7)	38 (36.2)	0.105	1,047 (36.7)	77 (32.1)	0.152
BMI (kg/m²)	24.6±3.2	24.3±3.2	0.535	23.5±3.7	24.0±4.1	0.239	24.1±3.3	23.7±3.1	0.072
Hypertension	1,265 (36.4)	26 (39.4)	0.613	189 (13.2)	13 (12.4)	0.815	1,173 (41.1)	95 (39.6)	0.640
Type 2 diabetes	547 (15.7)	15 (22.7)	0.123	58 (4.0)	9 (8.6)	0.028	463 (16.2)	40 (16.7)	0.862
MI and stroke	320 (9.2)	13 (19.7)	0.004	25 (1.7)	5 (4.8)	0.031	209 (7.3)	21 (8.8)	0.420
Neck circumference	38.0±2.4	37.8±2.5	0.439	32.7±2.1	33.4±2.5	0.002	32.9±1.9	32.9±1.9	0.847

BMI, body mass index; MI, myocardial infarction. Data are presented as the means±standard deviations or numbers (percentages). *P*-values are from t test or Chi-square test.

[a] Defined as ≥ 2.5 h/week of moderate intensity activities, ≥ 1.25 h/week of high-intensity activities, or a considered combination of activities

Figure 1 shows the estimated prevalence of thyroid disease by NC quartile, as determined by multiple logistic regression analyses adjusted for potential confounders identified from the univariate analyses (age, smoking, and cardiovascular diseases in model for men; exercise, type 2 diabetes, and cardiovascular disease in model of premenopausal women; age, economic status, educational level, and exercise in model of postmenopausal women). In contrast to men and postmenopausal women, premenopausal women with a larger NC had a significantly higher prevalence of thyroid disease (*P*=0.025).

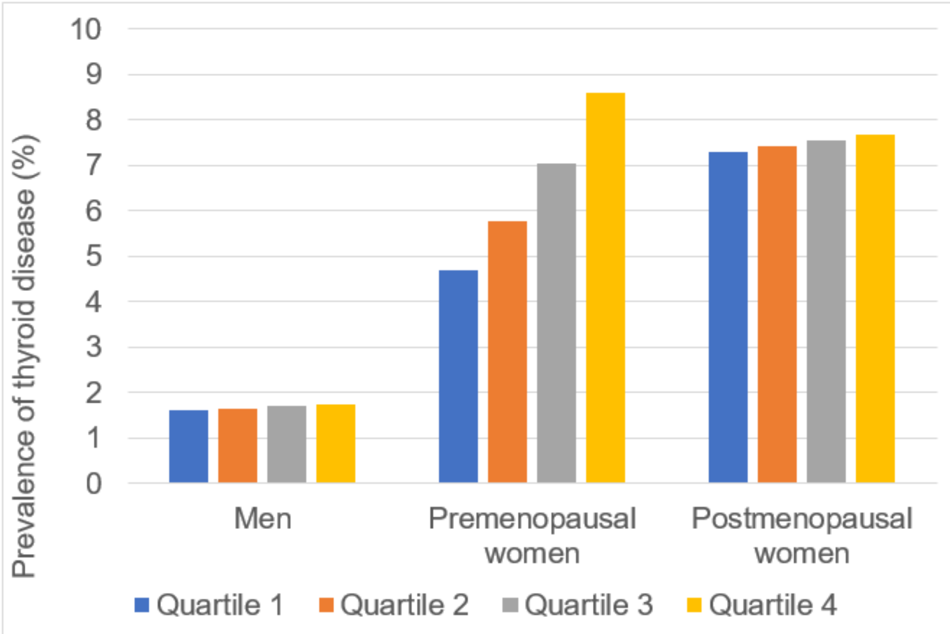

Fig. 1: Estimated prevalences of thyroid disease by neck circumference quartile
P-values were calculated using the multiple logistic models adjusted for significant variables in univariate models

Discussion

Few studies have compared NC values by thyroid status. NCs were significantly greater in a subclinical hypothyroidism group (n=51) than in healthy controls (6). Another study on overweight/obesity patients (n=78) found no significant difference between the NCs of euthyroid subjects and patients with subclinical hypothyroidism (7). NCs of Hashimoto's thyroiditis patients (n=99) with euthyroid functions were not significantly different from those of healthy controls (8). However, the present large-scale, nationally representative study shows NC is significantly associated with a history of thyroid disease in premenopausal women but not in postmenopausal women or men.

In this study, the different relationships between NC and a history of thyroid disease could be explained as follows. First, fat in women tends to distribute around the hips and thighs, but in the abdomen and neck in men (11), and thus, the impact of NC changes may be more significant in women. Additionally, sample size in thyroid diseases might be too small to detect any associations in men. Next, a possible explanation for the differences between the pre- and postmenopausal women may be the contributors by which thyroid diseases develops before and after menopause. Indeed, our analysis revealed that metabolic conditions (e.g., type 2 diabetes, cardiovascular diseases, or NC) were associated with thyroid diseases in premenopausal women while demographic features (e.g., age, economic status, or educational level) were related to those in postmenopausal women. Before menopause, the ovary produces a homeostatically controlled amount of estrogen, which regulates fat distribution via visceral lipolysis and subcutaneous adipogenesis (12). Thus, increased NC against this regulation would be more harmful to premenopausal women than to postmenopausal women.

The main limitation of this study derives from the cross-sectional nature of KNHANES, which prevented our drawing inferences regarding temporal relationships. Our results may have been influenced by the development of goiter as a sequela of thyroid disease. In addition, residual confounding is possible because clinical information on sex hormones and aspects of thyroid disease, such as thyroid function and ultrasound-determined morphologic findings, were not considered. We suggest a longitudinal study that includes detailed clinical information and different ethnicities be undertaken to confirm or refute our findings.

Conclusion

A large NC might be significantly associated with thyroid disease among premenopausal Korean women.

Journalism Ethics considerations

Ethical issues (Including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, redundancy, etc.) have been completely observed by the authors.

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Conflict of interest

The authors declare that there is no conflict of interests.

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