

# Association Between Occupation Type and Obesity Prevalence: An Analysis of the 2018 Korea National Health and Nutrition Examination Survey

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## Research Article

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# Abstract

**Purpose :** Although occupational factors such as working hours, type of workers, and being a shift worker have been associated with the prevalence of obesity, the relationships between occupation type and obesity prevalence, especially in South Korea, have not been clarified. We therefore investigated the association between obesity markers such as body mass index (BMI) and waist circumference (WC) and types of occupation using data from the 2018 Korea National Health and Nutrition Examination Survey. **Methods:** We evaluated the height, weight, WC, -and demographic variables (age, sex, socioeconomic status, alcohol, and smoking) from data of 3,645 respondents. The occupational groups were classified into nine categories (managers, professionals and related workers, clerks, service workers, sales workers, skilled agriculture, forestry and fishery workers, craft and related trade workers, equipment, machine operating and assembling workers, and elementary workers) using the Korean version of the Standard Classification of Occupations. We performed an analysis of covariance test to assess the relationship between obesity markers (BMI; and WC) and types of occupation. **Results:** There was a significant difference in obesity markers among men according to occupation categories after controlling for socio-demographic covariates. The prevalence of obesity was significantly higher in managers (25.8 +/- 0.4 kg/m<sup>2</sup> , 89.7 +/- 1.1 cm), and lower in craft and related trade workers (24.3 +/- 0.2 kg/m<sup>2</sup> , 85.1 +/- 0.6 cm) , respectively . (p = 0.011) . **Conclusion:** The obesity markers were highest in the manager group and lowest in the craft and related trades workers group among men of all the occupation groups.

# Introduction

Overweight and obesity has been defined as the abnormal or excessive fat accumulation that presents a risk to health. [1] A prospective study has shown that a healthy BMI (Body Mass Index) and WC (Waist Circumference) are important indicators of obesity among patients with diabetes. [2] According to the Korean Society for the Study of Obesity (KSSO) guidelines, Class I obesity is defined as a BMI 25 kg/m<sup>2</sup> < 30 kg/m<sup>2</sup> in Korea. [3] In addition, the cut-off values for WC to predict metabolic risk factors in Koreans, were 85 cm in men and 80 cm in women. [4]

According to data from the Korea CDC, the prevalence of obesity increased from 34.7% in 2005 to 42.8% in 2018. [5] Obesity was considered to be a risk factor for the metabolic syndrome, type 2 diabetes mellitus (T2DM), hypertension, coronary artery disease, stroke, respiratory effects, types of cancers [6] and other associated factors including genetic [7], social [8], environmental factors [9]. Occupational factors that were related to obesity were identified as working hours [10, 11], type of work [12, 13], and being a shift worker. [14, 15] In particular, for the factor, type of work, the prevalence of obesity was higher in health care support, protective service, transportation, and material moving workers in the US [12], and the BMI was higher in male intermediate transport and production workers than in unemployed individuals in Australia. [13] In addition, from 1998 to 2015, the prevalence of obesity showed an increase for manual male workers (31.1 to 39.5%), service/sales workers (32.3% to 38.2%), and non-manual workers (25.3%-39.7%) in Korea. [16] Working conditions such as longer sedentary working and more

frequent eating out were shown to demonstrate higher health risks such as the metabolic syndrome. [17, 18]

However, the relationships between the types of occupation and the prevalence of obesity have not been clarified in Korea. Therefore, we aimed to investigate the association between obesity markers such as BMI and WC and types of occupation using the 2018 Korea National Health and Nutrition Examination Survey (KNHANES) data.

## Method

### Participant and database information

To periodically assess nutrition, health behavior, and food consumption status, the K-CDC (Korea Center for Disease Control) conducted the KNHANES (version 7, n=7,992) in 2018. We investigated 3,645 respondents excluding the non-applicants, those who were in military service, and the non-answers among them. The Institutional Review Board (IRB) of the Korean Centers for Disease Control and Prevention approved our study (IRB: 2013-12EXP-03-5C).

### Measures

#### Body Mass Index and Waist Circumference

BMI (kg/m<sup>2</sup>) was expressed as body weight (kg) divided by height (meter square) and the WC (Waist circumference, cm) was measured at the midpoint between the lower borders of rib cage and the anterior superior iliac spine along the mid-axillary line. [19]

#### Occupation

We classified the types of occupation into nine major categories based on the Korean standard classification of occupations: managers, professionals and related workers, clerks, service workers, sales workers, skilled agriculture, forestry and fishery workers, craft and related trade workers, equipment, machine operating and assembling workers, and elementary workers.

#### Statistical analysis

We assessed the association between types of work and the obesity markers, BMI and WC, after adjusting for age, sex, economic status, education, smoking, and alcohol consumption. A P-value less than 0.05 was considered significant. We performed an analysis of covariance test to assess the relationship between types of work and the BMI and WC using the post hoc Bonferroni method. SPSS 18.0 software (IBM Corp., NY, USA) was used for the statistical analyses.

## Results

We investigated 3,645 of the 7,992 participants, whose characteristics are described in Table 1.

The differences in the BMI and WC related to occupation are described in Table 2). For males, the mean BMI was  $24.8 \pm 3.3$  and the mean WC  $87.0 \pm 9.7$ . There were statistically significant differences in both the BMI and WC according to occupation category ( $p$ -value = .002, .001). The mean BMI and WC of the managers were  $25.7 \pm 2.6$  and  $90.0 \pm 7.2$ , respectively, with managers having the highest BMI and WC. Elementary workers had the lowest BMI ( $24.2 \pm 3.3$ ) with craft and related trade workers having the lowest WC ( $85.2 \pm 8.4$ ).

For females, the mean BMI was  $23.3 \pm 3.8$ , and the mean WC  $77.8 \pm 9.4$ . There were also statistically significant differences in both the BMI and WC according to occupation category ( $p$ -value = .002, .001). The mean BMI of managers ( $21.9 \pm 2.5$ ) and the mean WC of clerks ( $74.6 \pm 8.9$ ) were the lowest. Skilled agricultural, forestry, and fishery workers had the highest BMI ( $25.0 \pm 3.7$ ) and WC ( $82.4 \pm 10.1$ ).

From the correlation analysis between the obesity markers BMI and WC and occupation after controlling for the covariates (age, education, income, and alcohol, smoking), the obesity markers were significantly different according to occupation categories in male subjects ( $p = .042, .002$ , Table 3).

The BMI and WC (Mean  $\pm$  S.D.) estimates were based on the occupational categories using post hoc analysis. (Figure 1, Figure 2). We found that there was a significant difference between the managers whose WC was the highest and craft and related trade workers whose WC was the lowest ( $p = 0.011$ ). However, no difference was found among occupation categories for BMI according to the Bonferroni method.

## Discussion

The obesity markers such as BMI and WC of male managers were the highest among the occupation groups, while that of male craft and related trades workers were the lowest. The results for the male managers were consistent with the 2019 KSSO obesity fact sheet. However, while the WC in craft and related trades workers was the lowest in the present study, according to the 2019 KSSO fact sheet, it was the 2nd highest among occupation groups. We therefore inferred that smoking and alcohol consumption could have been the confounding factor, that led to the inconsistency between the present study and the KSSO results. We found that the ratio of "smoking everyday" was higher (46.1%) in craft and related traded workers than in other occupation groups and that of "alcohol consumption more than 3 times a week" was also higher (48.3%).

The findings of a study conducted in a Japanese metal-product producing factory, indicated that obesity markers such as the BMI and Waist to hip ratio (adjusted for age) of managers was the highest among the male occupation groups. [20] In a study using data from the China Health and Nutrition Survey, obesity rate (BMI > 25) was found to be the highest in the low-intensity workload group. [21] High socioeconomic status was also found to be one of the significant risk indicators for general and central

obesity in Bangladesh. [22] The results of the present study produced were similar to those of other Asian studies.

An Australian health survey found that while the intermediate production and transport occupation group had the highest risk of  $BMI \geq 25 \text{ kg/m}^2$  in men, professionals showed no increase in the likelihood of being overweight and managers had a decreased risk after adjustment for socioeconomic factors. [13] A 2014 US worker-based study found that while the BMI of managers was lower, those of health care support, protective service, and transportation and material moving occupation were higher. [12] The prevalence of obesity in health and social assistance and public administration industries, whose employment was more than 40 hours a week and where there was exposure to a hostile environment, was higher than found in other US studies [23] A Finnish study showed that the prevalence of obesity in managers was not different from that in other occupation groups in men, but was lower than that in other occupation groups in women, [24] while the BMI ( $24.9 \text{ kg/m}^2$ ) of managers, workers in trade industries, and transportation occupations were highest in the Netherlands. [25]

It should be noted that previous studies [20, 21, 22] have reported that the prevalence of obesity in the manager group was somewhat higher in Asian studies than in Western studies. These findings were most likely to be related to differences between Asian and Western cultural lifestyles because studies have also found that the prevalence of obesity was closely associated with social lifestyle. [17, 18, 26] Several East Asian countries have a common unique cultural background ("Confucianism"), which represents paternalistic and male domineering characteristics. Korea is one of the countries most influenced by this background and most Koreans follow the duties and responsibilities required in hierarchical society in Korea. [27]

Confucianism is based on human relationships, which focuses on a deference to authority based on hierarchical social relationships. [28] In addition, the family is considered as a prototype of social institutions. In Confucianism, the elderly and men have more respectable positions than the young and women among family members. [28] Taken together, the family context is applied to that of a company. Persons in the manager group are considered as the father, a high position in the family, while those of the rest of the occupational groups as young sibling or woman. [29] Therefore, it can be inferred that managers in high positions make policies, create orders, and workers in low positions follow orders unconditionally, which means that managers often have a tendency to have low occupational physical activity. 64 out of 66 answered "no" to the questionnaire "how hard do you do over moderate intensity physical activities with work?" in the present study.

Previous studies have reported that people with low occupational physical activity are more obese than others. [30,31] In addition, according to the British Registrar Classification this group consumed more fried foods, table sugar, potatoes, and less vegetables and fish than the high occupational group. [32] In the present study found that the higher the frequency of eating out, the higher the energy intake, especially the high fat intake. [33] The proportion of male managers with a high income was higher than that of others (60.6%), and the frequency of eating out (5 times per week) was also higher (77.6%).

## Strength And Limits

In the present study, specific occupation (male manager) of Korea which has higher risk of obesity is directly presented and it is unusual result compared to previous studies about association between obesity prevalence and occupation category in western countries. But the present study had several limitations. First, the present data was obtained from a cross-sectional cohort consisting of socioeconomic variables and 3,645 participants; hence, a longer and larger cohort study is needed in order to reflect the whole population. Second, we did not study important confounder covariates such as physical activity and energy intake in obesity. According to the Hispanic Community Health Study, the prevalence of obesity in managers is relatively lower because they have a higher level activities such as leisure, outside of the work environment. [34] Third, there was a sampling bias due to the low number in the female manager group (n=7) in the present data; therefore, we could not obtain a significant outcome between sex and occupation.

“What is already known on this subject?”

In previous studies, relationship between obesity prevalence and occupation type had been studied mostly in western countries and results showed that manager group had low obesity prevalence. We believe that our study makes a significant contribution to the literature because the relationships between the types of occupation and the prevalence of obesity have not been clarified in Korea.

“What this study adds?”

This study adds that in South Korea, one of the east Asian country, male manager group has higher prevalence of obesity than other occupation groups.

## Conclusion

In conclusion the prevalence of obesity markers such as BMI and WC in the male manager group was the highest among all categories of occupations, while in the male craft and related trades workers group it was the lowest. Although our results need to be confirmed by further studies, they suggest that people of the manager group should carefully look at their obesity markers (BMI and WC). Further, a longer and larger controlled cohort study should be considered in the future.

## Declarations

Due to technical limitations, Declarations section is not available for this version.

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## Tables

Table 1. Demographic characteristics of subjects

Variables	Total (n=3645)		P-value
	Male(n=1862)	Female(n=1783)	
Age			<0.001
20-29	177(9.5)	235(13.2)	
30-39	366(19.7)	285(16.0)	
40-49	418(22.4)	424(23.8)	
50-59	431(23.1)	445(25.0)	
60-64	202(10.8)	153(8.6)	
65 +	268(14.4)	241(13.5)	
Occupation category			<0.001
Managers	66(3.5)	7(0.4)	
Professionals and related workers	387(20.8)	430(24.1)	
Clerks	300(16.1)	307(17.2)	
Service workers	123(6.6)	341(19.1)	
Sales workers	155(8.3)	207(11.6)	
Skilled agricultural, forestry and fishery workers	145(7.8)	79(4.4)	
Craft and related trades workers	230(12.4)	49(2.7)	
Equipment, machine operating and assembling workers	275(14.8)	49(2.7)	
Elementary workers	181(9.7)	314(17.6)	
Education			<0.001
Elementary school or lower	187(10.0)	279(15.6)	
Middle school	158(8.5)	172(9.6)	
High school	637(34.2)	591(33.1)	
College or higher	880(47.3)	741(41.6)	
Income			0.342
Low	388(20.8)	384(21.5)	
Mid-low	497(26.7)	443(24.8)	
Mid-high	496(26.6)	457(25.6)	
High	481(25.8)	499(28.0)	
Alcohol(1 year)			<0.001
Never in a year	195(10.5)	295(16.5)	
Below once a month	234(12.6)	455(25.5)	
Once a month	145(7.8)	190(10.7)	
2-4 per month	515(27.7)	406(22.8)	
2-3 per week	477(25.6)	216(12.1)	
More than 4 per week	248(13.3)	52(2.9)	
Never	48(2.6)	169(9.5)	
Smoking			<0.001
Everyday	611(32.8)	83(4.7)	
Sometimes	87(4.7)	32(1.8)	
Ex-smoker	752(40.4)	113(6.3)	
Never	412(22.1)	1555(87.2)	

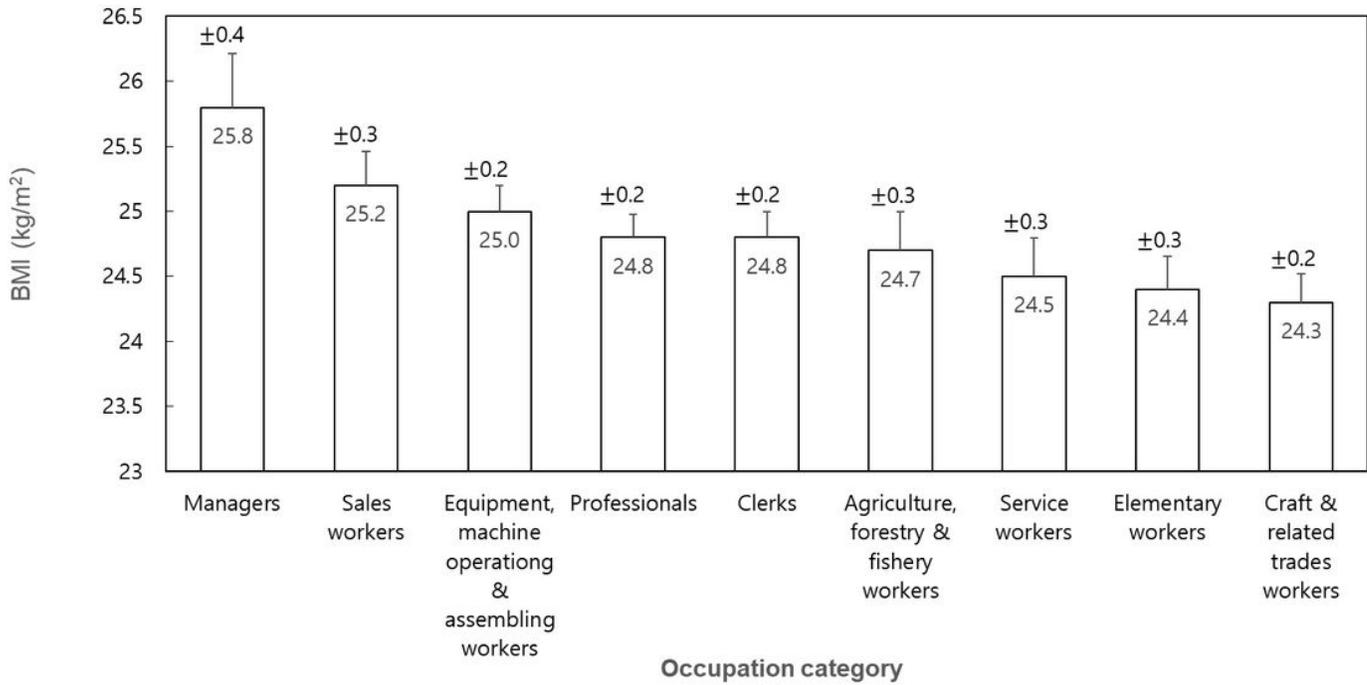
Table 2. BMI and WC according to occupation category

Occupation category	Male n=1862					Female n=1783				
	total	BMI	p-value	WC	p-value	total	BMI	p-value	WC	p-value
		24.8±3.3	0.002	87.0±9.7	0.001		23.3±3.6	0.002	77.8±9.4	0.001
Managers	66	25.7±2.6		90.0±7.2		7	21.9±2.5		75.9±7.3	
Professionals and related workers	387	25.0±3.2		87.3±8.2		430	22.5±3.3		74.7±8.4	
Clerks	300	24.9±3.2		87.1±8.3		307	22.4±3.5		74.6±8.9	
Service workers	123	24.7±3.3		86.1±9.3		341	24.0±3.6		79.5±9.3	
Sales workers	155	25.2±3.5		88.8±9.4		207	23.4±3.5		78.0±8.4	
Skilled agricultural, forestry and fishery workers	145	24.4±3.2		87.5±9.6		79	25.0±3.7		82.4±10.1	
Craft and related trades workers	230	24.3±3.3		85.2±8.4		49	23.9±3.6		78.6±9.0	
Equipment, machine operating and assembling workers	275	24.9±3.4		87.0±9.4		49	23.7±3.3		78.5±9.1	
Elementary workers	181	24.2±3.3		86.4±8.2		314	24.2±3.5		81.7±9.1	

Table3. The p-value of ANCOVA analysis between obesity markers and occupations

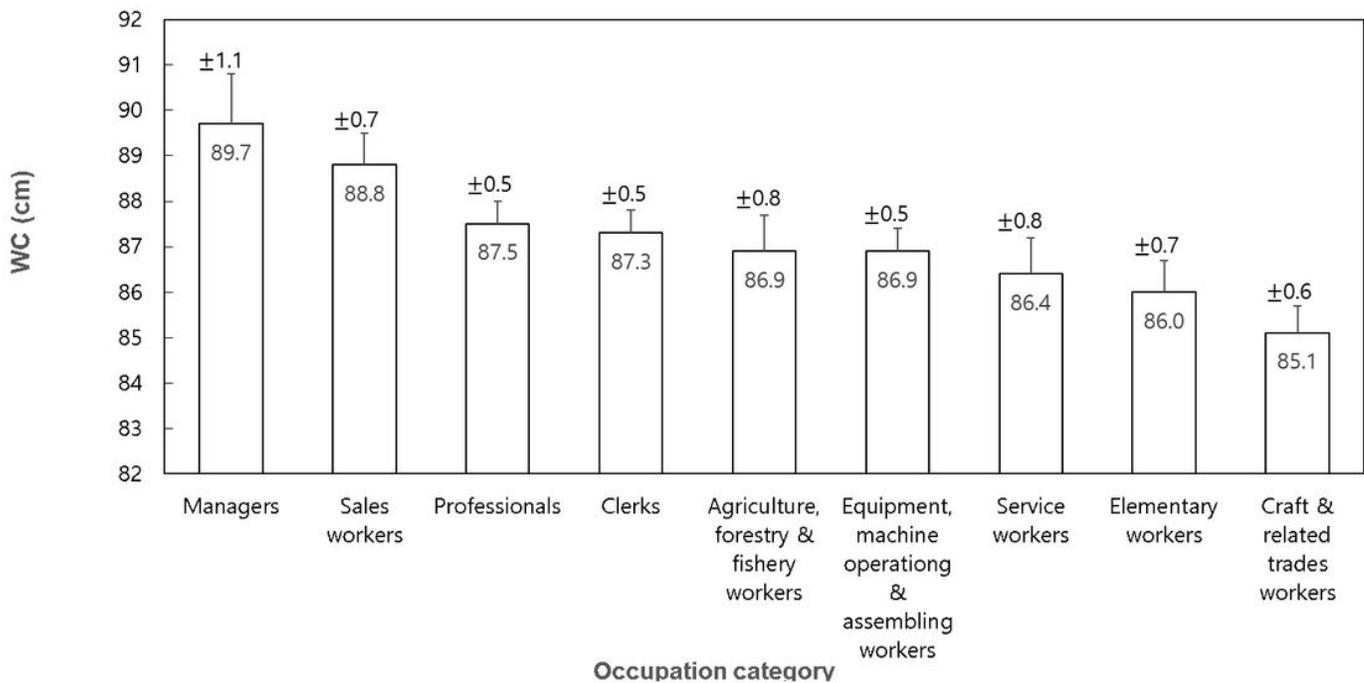
Measure	Occupation	
	Male	Female
BMI	0.042	0.214
WC	0.002	0.293

## Figures



**Figure 1**

The BMI and WC (Mean ± S.D.) estimates were based on the occupational categories using post hoc analysis



## Figure 2

The BMI and WC (Mean  $\pm$  S.D.) estimates were based on the occupational categories using post hoc analysis