INTRODUCTION

The prevalence of obese and overweight individuals has been increasing worldwide for several decades, despite many efforts to prevent the condition. According to the 2016 Global Health Observatory (GHO) data published by the World Health Organization (WHO), in 2016, 13.1% of the global population was obese and 38.9% was overweight, while the equivalent figures in 1975 were 4.7% and 21.5%, respectively. Furthermore, in 2016, 15.1% of women and 11.1% of men aged 18 and over were obese, while 39.2% of women and 38.5% of men were overweight; women showed a higher obesity prevalence than men, although the likelihood of being overweight was about the same between men and women. However, the prevalence and trends by gender differed among countries and regions. In some countries, such as Japan, Korea, China, Germany, France, the United Kingdom, and the United States of America, obesity was more prevalent among men, which is in contrast to the worldwide average data.1 Also, overweight problems by gender are much greater than obesity.

Previous studies have tended to either consider obesity without distinguishing gender or in women only; male obesity has been a less prevalent research topic. Nonetheless, the prevalence of male obesity is increasing, and men appear reluctant to engage in weight loss intervention programs in spite of properly established links between obesity and health-related diseases.2 This reticence may reflect a general failure to recognize gender issues in weight management.2 Generally, men are less concerned with their weight status than women, and they lack basic nutrition knowledge.3,4 Reducing the weight of overweight adults is an important preventive medicine step as it can help to ensure optimal aging. Being overweight tends to precede obesity, at which point it is more difficult to normalize body weight. In this review, we considered...
studies with a higher prevalence of overweight men than overweight women, because the gender gap between men and women has deepened. Therefore, the purpose of the present study was to elucidate the current status of overweight males in specific countries, as well as to identify how to improve weight management in overweight and obese males.

GLOBAL TRENDS IN OVERWEIGHT BY GENDER

In Western populations, adult obesity is defined as having a body mass index (BMI) of \( \geq 30 \) kg/m\(^2\), while being overweight is defined as having a BMI between 25 and 29.9 kg/m\(^2\).\(^3\) In Asians, adult obesity is defined as having a BMI \( \geq 25 \) kg/m\(^2\), which is equivalent to being overweight by the international definition. This definition for adult Asians was suggested by the WHO in 2000.\(^4\) However, in 2004, the WHO, despite weight heterogeneity throughout Asian countries, recommended retaining the western definition for all international populations. Even so, many studies from Asia still adopt the lower BMI cutoff as detailed in the 2000 proposal. For this reason, in the present review, we used the BMI cutoff of \( \geq 25 \) kg/m\(^2\) as defined in Asia, even though other regions only consider this as being overweight.

In 2016, the WHO reported almost no difference in the percentage of overweight men and women.\(^5\) However, within certain regions and income groups, there were several significant gender differences in the prevalence of overweight men and women. The differences in overweight prevalence by region and gender in 1975 and 2016 are presented in Table 1. The global data showed that the prevalence of overweight women was slightly higher than that of men in both 1975 and 2016. With regards to specific regions, there were consistently more overweight females in Africa, South-East Asia, and the Eastern Mediterranean in 1975, whereas there were slightly more overweight males in the Americas and Europe at that time. In 2016, the gender gap had widened in both directions in these regions. In contrast, in the Western Pacific, there were slightly more overweight females in 1975, but the trend was completely reversed in 2016, with the number of overweight males being slightly higher in 2016.

The income and gender differences in the overweight populations in 1975 and 2016 are presented in Table 2. In 1975, the prevalence of overweight females was consistently much higher than

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Table 1. Prevalence of overweight individuals in 1975 and 2016 by WHO region and sex

| WHO region        | 1975 Prevalence of overweight individuals (%) | 2016 Prevalence of overweight individuals (%) |
|-------------------|---------------------------------------------|---------------------------------------------|
|                   | Male | Female | Male | Female | Male | Female |
| Global            | 20.0 (17.6–22.7) | 22.7 (20.3–25.4) | 38.5 (36.5–40.6) | 39.2 (37.3–41.1) |
| Africa            | 7.9 (4.9–12.3)  | 15.0 (11.3–19.3) | 22.8 (20.1–25.7) | 38.8 (36.2–41.7) |
| Americas          | 37.0 (32.0–42.2) | 36.1 (31.5–40.9) | 64.1 (61.3–66.9) | 60.9 (58.1–63.8) |
| South-East Asia   | 4.7 (2.7–7.2)   | 7.0 (4.8–9.8)    | 19.7 (16.5–23.1) | 24.1 (21.0–27.4) |
| Europe            | 39.1 (34.7–44.0) | 38.8 (34.5–43.5) | 63.1 (60.7–65.6) | 54.3 (51.7–56.9) |
| Eastern Mediterranean | 19.3 (14.7–24.5) | 27.6 (22.0–33.5) | 45.4 (42.2–48.7) | 52.6 (48.6–55.7) |
| Western Pacific   | 10.1 (7.2–13.9) | 11.9 (8.9–15.4)  | 33.7 (29.3–38.3) | 29.6 (25.8–33.4) |

Values are presented as median (range). Data from the World Health Organization (WHO) Global Health Observatory (2016).\(^1\)

Table 2. Prevalence of overweight individuals in 1975 and 2016 by World Bank income group and sex

| Income group      | 1975 Prevalence of overweight individuals (%) | 2016 Prevalence of overweight individuals (%) |
|-------------------|---------------------------------------------|---------------------------------------------|
|                   | Male | Female | Male | Female | Male | Female |
| Global            | 20.7 (17.6–22.7) | 22.7 (20.3–25.4) | 38.5 (36.5–40.6) | 39.2 (37.3–41.1) |
| Low               | 6.6 (4.1–10.3)  | 11.4 (8.4–15.1)  | 19.1 (16.5–21.8) | 32.0 (29.3–34.9) |
| Lower–middle      | 8.5 (6.5–11.0)  | 13.1 (10.7–15.8) | 23.9 (21.4–26.7) | 30.0 (27.6–32.6) |
| Upper–middle      | 17.5 (14.2–21.2) | 23.7 (20.3–27.3) | 43.5 (40.0–47.1) | 42.9 (39.9–46.0) |
| High              | 38.4 (34.5–42.5) | 32.9 (29.4–36.5) | 63.0 (60.6–65.3) | 52.0 (48.6–54.4) |

Values are presented as median (range). Data from the World Health Organization Global Health Observatory (2016).\(^1\)
the prevalence of overweight males in the low and lower-middle income groups, while the prevalence of overweight males was higher than that of overweight females in the high income group; this gender gap had widened by 2016. In 1975, the prevalence of overweight females was higher than that of overweight males in the upper-middle income group, but the prevalence of overweight males was higher in 2016.

The GHO data showed that in 2016 the prevalence of overweight men was higher than that of women in several countries (Fig. 1).1 In 1975, the prevalence of overweight males was higher than that of overweight women in Germany and France, and this gender difference became severe in 2016. In the United Kingdom and United States of America, the gender gap was almost the same in 1975 as in 2016; in both countries, the prevalence of both overweight men and women increased by 20% or more. The prevalence of overweight females was slightly higher in Japan, Korea, and China in 1975, but by 2016, there were more overweight males, showing an absolute reversal. The difference in overweight prevalence between men and women was highest in Japan among these three Western Pacific countries in 2016. The difference in overweight prevalence between 1975 and 2016 among these countries was the highest in China.

**OVERWEIGHT AND OBESE MALES IN KOREA**

In the present review, we used data from the Korea National Health & Nutrition Examination Survey,8 which was conducted by the Korea Centers for Disease Control and Prevention in 2017 and adopted the classification of obesity in Asians as stipulated by the WHO in 2000 to analyze overweight and obese males in Korea. Male obesity prevalence has shown a steady increase over the past two decades in Korea, whereas the increase in female obesity has slowed and may even have plateaued over the same period (Fig. 2). Moreover, in older individuals, the prevalence of obese males is lower, whereas the prevalence of obese females is higher (Fig. 3). Specifically, the male obesity prevalence sharply declines after the age of 50 years, while the female obesity prevalence rapidly increases after the age of 30 years. By the age of 60 years, the obesity prevalence escalated more prominently in women than in men as age increased, although the overall prevalence was higher in men. As stated above, for our current study, we used a BMI of ≥ 25 kg/m² as the cutoff for obesity, even though this is considered to be “overweight” according to the international definition (Figs. 2 and 3).

**Figure 1.** The prevalence of overweight individuals among adults aged ≥ 18 years in 1975 and 2016 in several nations. The graph is based on the World Health Organization Global Health Observatory data (2016).1

**Figure 2.** The prevalence trends of adult obesity between 1998 and 2017 in Korea. Data are based on the Korea National Health and Nutrition Examination Survey, which was conducted by the Korea Centers for Disease Control and Prevention in 2017.8
ANDROID AND GYNOID OBESITY

Two types of obesity are often distinguished in terms of fat distribution: android (trunk and upper body) and gynoid (lower body, particularly around the hips and thighs). Android obesity leads to an “apple-shaped” body, or central obesity, and is more common in men, whereas gynoid obesity leads to a “pear-shaped” body. The prevalence of cardiovascular and metabolic diseases varies in the different types of obesity within the overall obese group.9,10

Adipose tissue function and deposition differs by sex: men accumulate more visceral fat, resulting in the typical android obese body shape, which is highly related to increased cardiovascular risk. Females accumulate more subcutaneous fat before menopause, which plays a protective role against the negative outcomes related to obesity and metabolic syndrome.11 Following menopause, fat deposition and accumulation shifts to a more visceral location. This shift leads to a corresponding increase in metabolic risk similar to that seen in men.11 According to one study of android and gynoid fat percentages in adults in the United States, local fat deposition features in the android and gynoid patterns have contrasting consequences on lipid profiles, and fat deposits of the android pattern may increase the risk of developing cardiovascular disease.12 The type of fat distribution—android or truncal vs. gynoid or peripheral— influences systemic metabolism and hence the risk of obesity complications.13
EFFECT OF EXERCISE/PHYSICAL ACTIVITY BY GENDER

The benefits of regular exercise and physical activity have been well documented, and exercise therapy is a necessary component of obesity management. However, studies on the effects of exercise mode, duration, and intensity on weight control have shown only small changes or inconsistent results, especially in the case of visceral adipose tissue. Previous studies have reported that adaptations to exercise intervention differ between men and women, and that they show individual variability as well. One study reported that the effect of exercise mode (combined aerobic resistance exercise [ARE] vs. aerobic exercise) differs by both gender and body composition. The same study suggested that ARE in men tends to increase the fat free mass of the arms, trunk, and whole body and to decrease the percentage of fat in the trunk. In women, ARE reduces the fat mass of the legs. Other studies have reported that the effect of physical activity intensity and duration on body composition differs by gender. Specifically, physical activity intensity has been inversely associated with fat mass in both men and women, whereas physical activity duration has been related to fat loss in men only.

Several hypotheses have been suggested to explain the gender differences in adaptations to exercise intervention. Boutcher and Dunn suggested that the changes may arise because men have a greater body weight and expend greater energy on physical activity than women. Alternatively, McMurray and Hackney determined that fat distribution and adipose tissue characteristics may differ by gender. Zouhal et al. stated that intra-abdominal adipose tissue had a higher adrenergic response to physical activity in men, while Kuk and Ross showed that women had more loss of fat in the gluteal/subcutaneous zone, even though there was similar loss of fat in both genders. Importantly, weight loss enhances testosterone levels in men with obesity, and testosterone can increase lipolysis by induced-adrenergic down-regulated activity of lipoprotein lipase and triglyceride uptake in abdominal adipose tissue. Regardless of whether weight loss has occurred, exercise induces preferential loss of visceral fat in obese men.

Another difference in weight loss between men and women is that men seem less concerned about their weight. According to PubMed search results from the past to 2019, 5,961 studies have investigated the effect of weight loss programs in obese humans. Of these, 4,632 studies (77.7%) were on females and 3,803 studies (63.8%) were on males, showing that fewer studies have involved males. Although men are more susceptible to cardiovascular disease, they are less concerned with their weight, trying to lose weight, or taking part in weight-loss programs. Men generally perceive too many barriers and consider weight-loss programs as a “feminized realm.” Moreover, few programs have been designed for men.

Recently, some weight-loss programs have been designed to appeal specifically to men. In particular, to increase scalability, some have allowed exercise self-administration through written materials, messages such as short message service, videos, emails, or other resources instead of face-to-face interactions. Several studies have reported that such programs were successful for men.

Therefore, to reduce male obesity, special weight-loss programs should be designed and applied specifically to men.

CONCLUSION

In regions where the prevalence of overweight men is higher than that of women, issues such as obesity type, hormones, awareness of body composition or shape, or special resources for exercise programs have rarely been considered. It is important to consider whether unhealthy increases in weight could be prevented, even when the argument is based on the result. To solve the problem of increased numbers of overweight and obese males, integrated approaches are necessary; researchers must consider various socio-demographic characteristics and the physiological mechanisms related to obesity. Since the increasing trend of obese and overweight males has not been improved despite many attempts to address this issue, the underlying cause and treatment not merely addressing symptoms of male overweight and obesity must be investigated.

CONFLICTS OF INTEREST

The authors declare no conflict of interest.
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AUTHOR CONTRIBUTIONS

Review concept and design: KBK; drafting of the manuscript: all authors; critical revision of the manuscript: all authors.

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