Global Gender Disparities in Obesity: A Review[1]

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AN Advances in Nutrition An International Review Journal

ABSTRACT

There is a global obesity pandemic. However, the prevalence of overweight and obesity among men and women varies greatly within and between countries, and overall, more women are obese than men. These gender disparities in overweight and obesity are exacerbated among women in developing countries, particularly in the Middle East and North Africa. Yet, in developed countries, more men are overweight than women. Current knowledge suggests that myriad sociocultural dynamics throughout the world exacerbate gender disparities in excess weight gain. Different contextual factors drive gender differences in food consumption, and women often report consuming healthier foods, yet may consume more sugar-laden foods, than men. Acculturation, through complex sociocultural pathways, affects weight gain among both men and women. The nutrition transition taking place in many developing countries has also affected excess weight gain among both genders, but has had an even greater impact on the physical activity levels of women. Furthermore, in some countries, cultural values favor larger body size among women or men as a sign of fertility, healthfulness, or prosperity. As the global obesity pandemic continues, more research on gender disparities in overweight and obesity will improve the understanding of this pandemic. *Adv. Nutr. 3: 491–498, 2012.*

Introduction

What was a global obesity epidemic is now a pandemic (1,2). In general, excess weight gain occurs due to energy imbalance. Excessive energy intake, particularly of energy-dense foods [e.g., sugar-sweetened beverages (SSB)[4]], and increased portion sizes, and sedentary activity are often ascribed as the main causes that have led to this pandemic. According to WHO, sex "refers to the biological and physiological characteristics that define men and women," whereas gender "refers to the socially constructed roles, behaviors, activities, and attributes that a given society considers appropriate for men and women" (3). The causes of obesity are both biological and social and may vary considerably by sex or gender (4–7). A review by Power and Schulkin (8) goes into greater detail about the sex differences in adipose tissue storage and metabolism and speculates about the evolutionary origins of these disparities. The implications of excess weight gain on health may also vary by sex (9–12). In females, the biological factor of menopause affects fat distribution that may increase risk or exacerbate negative effects of obesity on health (13,14). Yet, despite these biological differences related to the sex-specific differences in excess weight gain, gender disparities and related sociocultural factors are largely absent from the public health (obesity) discourse and therefore from potential policies and solutions (15–18).

Global survey data indicate that the prevalence of both male and female overweight and obesity varies by region and has rapidly increased between 1980 and 2008 (19). Studies have documented global trends in female overweight and obesity by a country's economic status (gross national product or gross domestic product), but not among males (or both sexes) (16,20). However, some studies suggest that not only do the global differences in the prevalence of obesity vary by sex, but also that the social determinants of obesity vary by gender (21–23). This review examines the global trends in the prevalence of overweight and obesity by gender and how these trends are related to sociocultural gender differences and thus their subsequent affect on overweight and obesity worldwide.

We conducted a literature review of published survey data focused on epidemiological studies that included overweight and obesity prevalence data for both male and female adults. Only articles written in English were included, and we defined the general adult population as community-dwelling persons who did not have special nutritional needs and who were not pregnant or lactating. We searched the MEDLINE (accessed through PubMed) and EMBASE databases for articles

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[4] Abbreviations used: OECD, Organisation for Economic Co-operation and Development; SSB, sugar-sweetened beverages; WC, waist circumference.

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published from 1988 to February 2011. Additional articles were identified by searching references in pertinent articles and hand-searching the table of contents of relevant journals (*Obesity Reviews*), and Google Scholar, published from 1988 to February 2011. Efforts were made to find studies regarding countries not found in the initial search. Approximately 1800 items were returned; based on the inclusion and exclusion criteria, 287 articles were selected for potential eligibility, and of these, 191 were reviewed. Overweight and obesity were defined according to the criteria used in the published article. The majority of articles used the CDC BMI cutoffs for overweight (25.0 ≤ BMI < 30.0) and obesity (BMI ≥30.0). However, most articles regarding populations in East Asia and the Pacific and a few regarding populations in Sub-Saharan Africa or Latin America and the Caribbean used alternative criteria for overweight (27.0 ≤ BMI < 31.0) and obesity (BMI ≥31.0), respectively.

We found that when the 105 different countries and territories examined were grouped by categories of World Bank income, all income groups had a greater overall prevalence of female obesity compared with male obesity (**Fig. 1**). However, among the high-income [non–Organisation for Economic Co-operation and Development (OECD) and OECD) groups, there was a greater prevalence of male compared with female overweight. Following the World Bank classification, OECD (all high-income) countries and territories included Australia, Belgium, Canada, Denmark, England, Estonia, Finland, France, Germany, Greece, Ireland, Israel, Italy, Japan, Luxemburg, the Netherlands, Norway, Poland, Portugal, Slovenia, Spain, South Korea, Sweden, Switzerland, and the United States; and high-income non-OECD countries and territories included Barbados, Bahrain, Bermuda, Greenland, Oman, Kuwait, Latvia, New Caledonia, Saudi Arabia, Singapore, Trinidad, and Tobago, and the United Arab Emirates. Furthermore, when grouped by region, the Middle East and North Africa had the greatest disparities of female overweight and obesity (Fig. 1), whereas there was a greater prevalence of male overweight compared with female in both Europe and Central Asia and the OECD regions. Within each income group and region, gender disparities in overweight and obesity were also observed among urban and rural areas whereby urban areas had greater gender disparities in overweight and obesity than rural areas (data not shown).

Yet, given these global gender disparities in the prevalence of overweight and obesity, we also found that the majority of studies did not explain why these gender disparities exist. Physical activity, cultural values, biological factors (e.g., menopause), and urbanization were the most commonly discussed explanations regarding gender disparities in overweight and obesity. However, rarely did these studies elaborate beyond general terms. In the following, we build off the explanations provided in the selected studies and further discuss how sociocultural factors may influence why global gender disparities in overweight and obesity exist.

Current status of knowledge

According to the World Bank, we defined developed countries as high-income countries and developing countries as all low- and middle-income countries. Sociocultural factors are difficult to measure (24). However, globally, social and cultural factors appear to influence both dietary intake and physical activity and may be related to gender disparities in excess weight gain. As sociocultural factors vary between

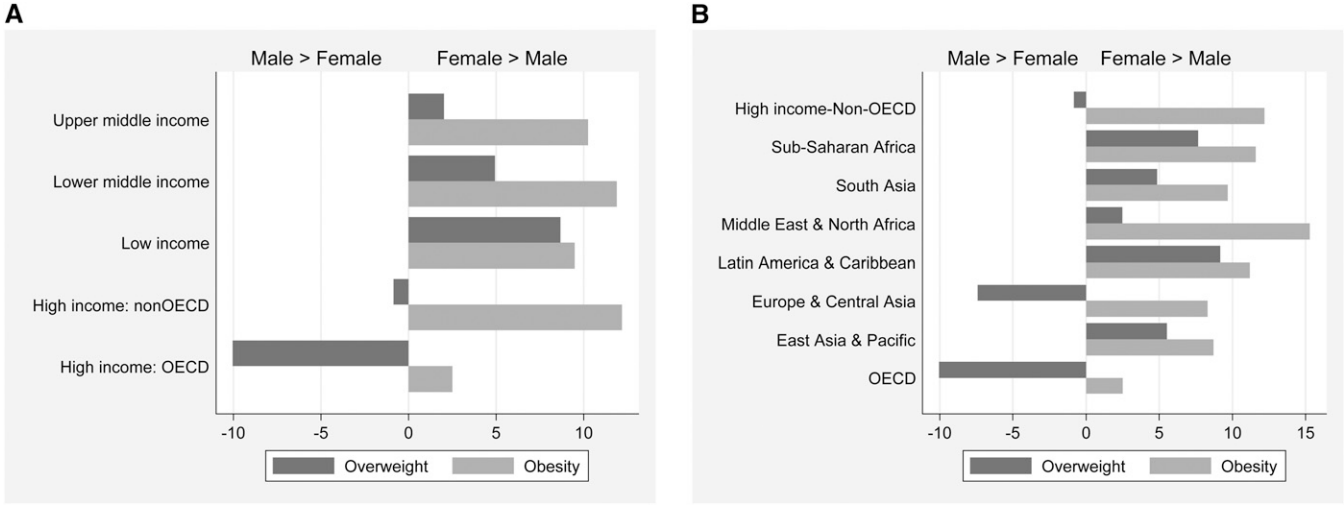

Figure 1 Worldwide gender disparities in overweight and obesity prevalence. To illustrate gender disparities in overweight and obesity, we calculated the mean difference between female and male prevalence of overweight (or obesity). The bars >0 indicate the mean percentage of greater female (than male) overweight or obesity, whereas the bars <0 indicate the mean percentage of male (than female) overweight or obesity; thus, the greater the magnitude of the bar, the greater the gender disparity is in overweight or obesity. *A*, The mean percentage of difference between female and male overweight and obesity prevalence by World Bank income group. *B*, the mean percentage of difference between female and male overweight and obesity prevalence by World Bank region. OECD, Organisation for Economic Co-operation and Development.

AN Advances in Nutrition An International Review Journal

developed and developing countries, we discuss these countries separately. Last, we discuss together particular Arab countries that include both some developing and some high-income countries, respectively but that have similar very specific traditional cultures.

Developed countries

In the latter half of the 20th century in developed countries, the majority of occupational roles have been sedentary for both men and women, and leisure time physical activity in both men and women is sparse. For example, in the United States, <5% of adults comply with the public health recommendation to perform at least 30 min of physical activity per day (25). In all countries of the European Union, the majority of physical activity is sedentary and also does not vary greatly by gender (26). Therefore, dietary intake rather than or in addition to physical activity and related sociocultural factors likely drive the gender disparities in overweight and obesity in these countries.

Although food consumption patterns are often driven by sociocultural factors, the proportion of energy intake from animal source foods is highest in high-income countries (27). Based on a worldwide analysis, Gerbens-Leenes et al. (27) also found that high-income countries consume the greatest amount of kilocalories per capita per day and the greatest proportion of energy intake from fat. Furthermore, studies using data from developed countries have demonstrated that gender-based food preferences exist and that one's sociocultural environment likely influences these preferences (6,28). However, although women are more likely to report eating or wanting to eat "healthier" foods, they seem to prefer and consume more foods high in added sugars than men including energy-dense processed foods such as cookies, chocolate, and ice cream (6,28). National survey data from both the United States and Europe confirms that women often consume more dairy foods than men, whereas men often consume substantially greater amounts of alcohol than women (29–31). Studies also indicate that men consume a greater percentage of their energy intake from protein, likely due to their greater preference for and thus consumption of meat-based products than women (28–31). However, a recent randomized, controlled trial in healthy American adults who overate during the experiment showed that increased energy intake as a result of greater protein intake does not affect fat mass, but rather fat-free mass (32). Thus, in developed countries, more than developing countries, intake of (animal-source) dairy foods and high-energy alcoholic beverages may affect gender disparities in obesity. Although increased SSB intake is associated with the increased prevalence of obesity in the United States among men and women, dairy intake may differentially affect sex-specific weight gain (33,34). In the United States, between 1988 and 2002, whole-milk consumption has decreased, whereas low-fat milk consumption has increased (34). There are few studies that have examined the relationship between milk and dairy intake and obesity among both men and women. One study in the United States found that among all ethnicities, overall dairy intake was higher among men, whereas skim milk and yogurt intake was higher among women and, furthermore, that yogurt intake was significantly negatively associated with obesity, but the authors did not stratify their results by sex (35). Although the association between dairy intake and measures of excess weight gain has been examined in many studies, it has not been thoroughly examined by sex (36).

Globally, alcohol intake is perceived either as a cause of or associated with excess weight gain in men but not women (37–40). Although men often consume more alcohol than women, there are also sex-specific differences in alcohol metabolism (41,42). Whether alcohol consumption causes excess weight gain appears to vary by both frequency of consumption and type of alcohol consumed (43). Cross-sectional studies in numerous populations have found a positive relationship between alcohol consumption and waist circumference (WC) in both men and women (44,45). However, in a large prospective study of Danish middle-aged men and women, Tolstrup et al. (46) found that, in men, drinking frequency was not associated with changes in WC and was inversely associated with major WC gain (that the authors defined as 5-y change in WC above the highest quintile of the sex-specific distribution, 6.9 cm for men). In women, drinking frequency was inversely associated with both WC and major WC gain (46). Furthermore, in this study, there was no significant relationship between amount or type of alcoholic beverage and major WC gain among either sex (46).

Tolstrup et al. (46) posit that alcohol intake through various biological pathways (e.g., alcohol dehydrogenase and the microsomal ethanol-oxidizing system) may increase thermogenesis. Therefore, men who consume a greater percentage of their energy intake from alcohol may store less of this energy compared with energy from other nonalcoholic food sources even though alcohol intake may be associated with subsequent short-term overconsumption of energy intake through other food items (47). There may also be a genetic basis for the relationship between alcohol consumption and obesity in both sexes, independent of both BMI and sex (48). Among Polish adults (20–74 y) Sobczyk-Kopciol et al. (48) found a fat mass– and obesity-associated gene variant to be significantly associated with lower total alcohol consumption, specifically with lower drinking frequency, that remained after adjusting for drink size and was protective against alcohol dependence. Therefore, although men, on average, in developed countries may consume a considerable amount of energy from alcohol, alcohol may be inversely associated with weight gain. However, although some dairy foods, like yogurt, may be also inversely associated with weight gain, the increased consumption of energy from dairy products with added sweeteners, such as ice cream, and other foods high in added sugars by women may be one of main reasons why a dramatic gender disparity in obesity prevalence exists in developed countries.

Related to the influence of sociocultural factors on excess weight gain as a result of gender differences in dietary intake, sociocultural factors may also influence excess weight gain through other means that are more difficult to measure. A

novel social network analysis of the Framingham Heart Study cohort by Christakis et al. (5) revealed that males had a 100% increase in the chance of becoming obese if their male friend became obese, whereas this same effect of friendship on obesity was not significant among females. Acculturation may also be associated with gender disparities in obesity. The majority of studies that have examined associations between acculturation and obesity and its related factors (e.g., dietary intake and physical activity) are in regard to acculturation in the United States and particularly in Mexican Americans, one of the fastest growing segments of the U.S. population. Mexican Americans are not only more obese than their non-Hispanic white counterparts, but significantly more Mexican-American women than men are obese, whereas there is not a significant gender difference in obesity prevalence among non-Hispanic whites. However, like non-Hispanic whites, more Mexican-American men are overweight compared with women (49). A review by Oza-Frank and Cunningham (50) concluded that there is a significant positive relationship between BMI and the length of residence in the United States among migrants and found that this relationship was greater among females than males and particularly Hispanic females. Furthermore, among Mexican-American men, acculturation regarding family attitudes was associated with a less favorable body fat distribution, whereas structural assimilation (or assimilation with the social network and structure of the host country) was associated with a more favorable body fat distribution and less excess weight gain in Mexican-American women (51). The effect of acculturation on excess weight gain is postulated to be caused by the adaptation of dietary and physical habits that are often unhealthier (e.g., higher in added fats and sugars) and more sedentary than an immigrant's native country (50,52). The association between acculturation and obesity-related health factors among U.S. Latinos has also been reviewed whereby physical activity and smoking both significantly increase with acculturation among women but not men (53). In an extensive review of gender disparities and acculturation specifically among Mexican-Americans, Gorman et al. (54) found that increasing acculturation exacerbates chronic health conditions (e.g., type 2 diabetes, hypertension, heart disease) at a greater rate among men compared with women and that gender disparities in the effect of acculturation on health are mediated by the significantly lower tendency of men to use health care services (54). Thus, although acculturation likely affects excess weight gain among both Mexican-American men and women and likely immigrants from other countries, it appears to have a greater influence on women; yet more related to the development of chronic diseases among men.

In other developed countries, such as Greece and Spain, cultural factors that associate obesity with social status among men, but place increasing pressure on women to be thin are attributed to the gender disparities in overweight and obesity (40,55). As a result, these or similar cultural factors that emphasize a thin body image among women may be part of the reason why there are substantially more overweight men than women in developed countries. Taken together, myriad sociocultural factors affect gender disparities in excess weight gain in developed countries such that more women than men are obese, whereas more men than women are overweight.

Developing countries

Driven primarily by economic growth, everyday diet and lifestyle have significantly changed in many developing countries. What constitutes the traditional diet or the agrarian lifestyle has become blurred. These are often middle-income developing countries undergoing a nutrition transition. The nutrition transition is characterized by economic, demographic, environmental, and cultural changes taking place in a society that negatively affect both energy intake and energy expenditure (56). Rapid urbanization and the increased domestic production and imports of edible oils have had an indelible nutritional impact on countries experiencing economic growth (57). As nutrition transitions emerge, diets tend to include greater amounts of fat, sugar, and refined carbohydrates, and lifestyles become increasingly sedentary (58).

Compared with developed countries, in many developing countries, occupation remained a significant source of physical activity for much of the latter half of the 20th century. In a number of countries and areas in South Asia, the Middle East, North Africa, Sub-Saharan Africa, and Latin America, and the Caribbean, men perform a much higher daily amount of physical activity than women (59–64). However, toward the end of the 20th century in many developing countries, there has been a transition away from agricultural labor (both for production and subsistence) to wage labor that has decreased the physical activity of women more than men (65–68). Among both men and women, the change in occupation leading to a subsequent decrease in daily physical activity is greater in rural areas. In Russia, physical inactivity related to un- or underemployment may also be associated with excess weight gain (69).

Changing physical activity patterns and sociocultural beliefs also affect excess weight gain, particularly among women compared with men in Latin America and the Caribbean. In Mexico, most rural men used to have manual labor jobs, but now travel or migrate to urban areas for (often nonmanual) work, whereas many rural Mexican women, due to increased food accessibility of kiosks, do not need to manually grind their own maize (for tortillas, a Mexican staple food) or carry water from distance sources (70). According to the most recent National Health and Nutrition Survey (ENSANUT), adult men not only perform more physical activity overall than women in Mexico, but physical activity was inversely associated with overweight and obesity only among Mexican men (71). However, in Jamaica, obesity is more culturally acceptable among women because excess weight gain is associated with maternity and nurturing (72). Therefore, in developing countries, changes in occupation type and sociocultural factors that affect physical activity, particularly among women, are related to why there are

AN Advances in Nutrition An International Review Journal

more overweight and obese women in these countries compared with men.

In East Asia and the Pacific, as suggested by Davis et al. (73) in a review of the literature, although Westernization has greatly affected diet and lifestyle habits, traditional beliefs about body image persist. In these countries, a larger body type is accepted and still may be culturally associated with a greater socioeconomic status (73). Data from the Marshall Islands also suggest that cultural beliefs may influence the perception of overweight and obesity in these countries. Thinness, particularly among women, may be associated with infertility or illness, whereas larger body shapes are associated with being healthy (74). In the Marshall Islands, cultural beliefs such as these may have a subsequent influence on food choice and lifestyle habits (74).

Sociocultural beliefs and practices also appear to affect gender disparities in overweight and obesity in North and Sub-Saharan Africa, respectively. Throughout both North and Sub-Saharan Africa, obesity and physical inactivity among both sexes was associated with high social status, fertility, good health, and prosperity (63,75–78). Furthermore, the gender differences in the cultural (regional) dress may intensify the gender differences in obesity (75). In North Africa, Mokhtar et al. (75) astutely equate the traditional loose-fitting female dress (that often hides a woman's body shape) with "hidden fatness" or "hidden obesity," in other words, the converse phenomenon of "hidden hunger." These restrictions among North and Sub-Saharan African women and related sociocultural beliefs may indirectly discourage leisure time physical activity among women and thus may affect excess weight gain among women more than men in these regions.

Concomitant with the changing physical activity patterns in many developing countries, since the 1990s, there has been an influx in processed food products that consist of refined carbohydrates and added sweeteners. Thus, associated with the nutrition transition and with the rapid increase in overweight and obesity in many developing countries is that dietary carbohydrate intake is composed mostly of refined, rather than complex, carbohydrates (27). However, there are gender differences in carbohydrate metabolism that cause a greater increase in triglyceride levels in women (11). Therefore, the increased refined carbohydrate intake in developing countries may affect excess weight gain in women more than in men.

Furthermore, there has also been a dramatic increase in the consumption of SSB in developing countries that may also be related to the gender disparities in overweight and obesity in these countries. In some areas, men consume more SSB than women, whereas women consume more diet beverages than men. In Mexico, men had nearly twice the soda consumption, and greater overall energy intake from nonalcoholic beverages (mostly from SSB) compared with women (79). However, in Mexico between 1999 and 2006, among women, low-fat milk consumption decreased and whole milk consumption increased (79). Therefore, SSB intake may be more related to the development of overweight and obesity in Mexican men, whereas whole milk consumption may be more related to weight gain in Mexican women.

This influx of energy-dense foods may exacerbate the affect of the myriad sociocultural factors that have had a greater affect on physical activity levels of women compared with men in many developing countries. For example, in Iran, and perhaps indicative of other Middle Eastern and North African countries, sedentary Iranian females have more opportunities to consume non-nutritive snack foods (80). Iranian females have also been found to consume more sweets than their male counterparts (81). Thus, Azizi et al. (80) conclude that gender differences in dietary intake are important and must be considered in explaining gender disparities in obesity prevalence.

Arab countries with very specific traditional cultures

There are also other sociocultural factors that may be related to physical inactivity that in turn may affect excess weight gain. In conservative societies, particularly in the Middle East and North Africa region and the high-income non-OECD countries of Oman, Kuwait, and Saudi Arabia, women are often overprotected and, due to cultural or religious barriers, cannot publicly participate in physical activity (82–88). Greater cultural acceptance of excess weight gain among women than men has also been observed in Egypt and the West Bank (88,89). Furthermore, in Oman, Al-Riyami et al. (83) posit that both (high) fertility and illiteracy, by affecting a woman's awareness of "the importance of [her] physique," are associated with greater central adiposity. Consequently, the larger macroeconomic changes that have taken place, in conjunction with the preexisting sociocultural environment, have had an even greater impact on physical activity levels among women in certain countries.

Conclusions

The myriad sociocultural dynamics throughout the world affect gender disparities in excess weight gain. Yet, the topic of gender disparities in obesity remains largely underresearched, let alone addressed. In developed countries, where occupations have been largely sedentary among both men and women, since the middle of the 20th century, sociocultural factors related to dietary habits appear to have a greater influence on gender disparities in overweight and obesity in these countries. Although recently in many developing countries, physical activity patterns have dramatically changed, which has particularly affected women. Taken together with a concomitant nutrition transition that has driven an increased consumption of energy-dense foods high in refined carbohydrates, women, often more sedentary than men, appear more vulnerable to the effects of these foods on excess weight gain. Sociocultural beliefs and values around physical activity and fatness are also more apparent in developing countries and thus appear to have a greater effect on gender disparities in overweight and obesity compared with those in developed countries.

The majority of studies reviewed in this article focused on gender disparities in physical activity and alcohol consumption, rather than or in addition to other more specific

gender disparities in dietary intake or related sociocultural factors, as reasons for gender disparities in overweight and obesity. Energy expenditure is only half of the energy balance equation. In general, it is harder to get individuals to increase their energy expenditure than to modify their dietary intake, especially in culturally conservative societies where it may be difficult for women to perform physical activity in public. Therefore, more research is needed that describes the dietary patterns of a population by gender. By identifying the foods highest in fats, sugars, and energy density that are most frequently consumed by men and women, additional factors behind the gender disparities in overweight and obesity may become more apparent, especially with additional research to determine why men and women consume these foods. In a particular complex sociocultural context that may be difficult to change, it may be more feasible to change aspects of dietary intake, rather than physical activity, in terms of the further prevention of excess weight gain.

In addition to more research that addresses the potential sociocultural causes of gender disparities in obesity, both quantitative and qualitative research methods should be refined to better assess gender-specific characteristics. This is particularly apparent when it comes to epidemiological surveys that ask about occupational status. Often in surveys, women may answer that they are unemployed, even though, for example, they may have a full day of household duties and child care as well as jobs in the informal labor market. Therefore, we suggest that surveys be better designed to capture the majority of duties that a woman may perform in a typical day. From a national perspective, more research on the influence of policies and related cultural norms on excess weight gain is imperative to understanding how gender disparities in obesity may be both driven and mitigated by macro-level factors.

Given that global gender disparities in obesity exist, gender-specific or gender-tailored solutions may be necessary if the global obesity pandemic is to slow down or decline. Ultimately, solutions aimed at obesity prevention, from community-level programs to national-level policies, may be the same for both men and women. But these may be more effective at obesity prevention if they are conveyed in a gender-specific manner. Tools and strategies designed to aid obese individuals with weight loss or the prevention of further weight gain may be more effective if (better) tailored to gender. However, care must be taken to ensure that obesity prevention programs and policies do not inadvertently cause or exacerbate gender disparities in excess weight gain or reduction.

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