

Social and Cultural Influences on Obesity

Jeffery Sobal

Cornell University, Ithaca, New York, USA

INTRODUCTION

Obesity may be defined as the condition of having high levels of stored body fat. Relative body weight is commonly used to describe obesity, and people who are obese are commonly described as being overweight. Obesity and overweight are complex biopsychosocial phenomena that are shaped by many factors, including a variety of social and cultural influences.

This chapter will examine patterns of fatness and thinness using social science perspectives to frame, review, and discuss social and cultural influences on obesity. Framing the influences on obesity first involves examining the larger social contexts of culture and history, and then considering the more specific social characteristics of individuals. Societal mechanisms involved in energy intake and energy expenditure will be discussed in light of their collective contribution to rising levels of body weight. Finally, conclusions about the social aspects of weight will be presented.

SOCIAL CONTEXTS

Two major social contexts provide overarching perspectives for framing obesity: culture and history. The culture within which a person lives is likely to be the most powerful influence on their eating patterns, activity levels, and body weight. Within each

culture, conditions change (sometimes dramatically) over time, and historical period is also a strong influence on levels of fatness and thinness of individuals and populations.

Culture

Culture is the learned system of categories, rules, and plans that people use to guide their behaviors (1,2). A person's culture permeates every aspect of their life, including how they think about fatness and thinness, eating behaviors, activity patterns, and all other facets of living in the world.

Cultural values and norms about body weight vary considerably. Anthropologists estimate that there have been fewer than 8000 cultures that have existed in the world (3), although we only have information about a minority of all cultures that have existed. Information about body weight levels and weight beliefs is not available for the vast majority of cultures. Archaeological evidence about body weight is rare because body fat tissue is not well preserved over long periods of time.

Ancient representations of human figures such as drawings and sculptures provide some information about weight beliefs or ideals, but not necessarily actual weight patterns or fatness norms. The 25 000-year-old Venus of Willendorf is a tiny female statuette with a huge stomach and large, pendulous breasts that is often suggested to be a maternal or

fertility icon, and is an artifact widely discussed as evidence about past cultural preferences for plump body shapes for women (4). However, this figure is not necessarily representative of all icons of the same era because that period is unique and the place it originated from is dissimilar from other ancient cultures (5).

Holocultural analyses examine large samples of cultures (1), but few such investigations have examined perceptions about body weight. Brown and Konner (6) found that information about weight ideals was not available for most cultures, although among the 38 cultures that had data about female shape ideals, 81% (31) preferred plumpness or moderate fat rather than thinness or extreme obesity. Anderson *et al.* (7) also examined cross-cultural data and also found that 81% (50 of 62 cultures for which data was available) preferred fatter individuals. Ritenbaugh (8) suggests that the condition of obesity and the rejection of fatness may be a culture-bound phenomenon (9), meaning that it is particular to contemporary postindustrial societies and not culturally recognized by other societies. Overall, cross-cultural analyses suggest that most cultures in the world have valued moderate fatness and avoided extreme thinness.

People who live in economically developed societies are more likely to be obese than their counterparts in developing societies (10). Modernization is the complex set of social changes that occur as societies shift from being 'traditional' to 'modern' (11). Modernization involves shifts in modes of economic production for whole societies, which has substantial impacts on energy expenditure of human populations. Primary production extracts raw materials from the environment in agriculture, hunting and fishing, gathering, timbering, etc., and traditionally drew energy largely from muscles of humans and animals. Secondary production transforms raw materials into manufactured products, and on a mass scale typically draws energy from fossil, hydrological, or other fuels. Tertiary production provides services to consumers, and is not as dependent on physical energy sources as primary and secondary production. As whole societies shift from being based on primary to secondary to tertiary production as they modernize, the energy expenditure of most people in the population decreases dramatically. Examples from across the globe reveal that people are becoming fatter in modernizing societies (12,13).

Comparisons between various contemporary developed societies reveal substantial differences in body weight (14–16) that may be associated with modernization but also reflect cultural differences. For example, cultural differences between the USA and France in values about food and body weight have strongly shaped the prevalence of obesity in those two cultures (17). Cultural predispositions to obesity exist, with life in contemporary postindustrial cultures more likely to lead members of those cultures to become obese (5).

Migration between cultures places people into new food systems and new social and built environments, and has important health consequences (18). Zelensky (19) proposed that a migration transition is occurring, where people are travelling and moving more frequently and over longer distances. While migration flows occur between most areas of the world, the major migration streams tend to move from less developed to more developed societies. People in these dominant migration streams tend to gain weight after migration (20). The loss of the buffering effects of the traditional culture of many migrants puts them at further risk of illness if they gain weight in a new society (21). Specific mechanisms for relationships between migration and weight vary, with the relative contribution of energy intake and energy expenditure being specific to the circumstances of particular individuals and groups coming from distinctive origins to unique destinations. Also, the relative contributions of selection versus causation (22) are not clearly understood for migration, with a need for further investigation of the extent that migrants have a differential predisposition for weight change or whether the new environments of immigrants changes their weights.

Acculturation occurs as people become socialized into another culture (23,24). Acculturation is a multidimensional phenomenon, and can operate differently for various domains such as social relationships, behaviors, values, and other topics (25). Studies in the USA suggest that acculturation is associated with increases in body weight (26,27). The relationship between relative body weight and acculturation often varies among particular ethnic subgroups, with US Hispanic migrant groups having acculturation more strongly associated with weight for Mexican Americans and less for Cuban Americans and Puerto Ricans (20).

Overall, culture and the dynamics of culture

changes are a crucial influence on the way people live, operating as a strong determinant of energy intake and expenditure. Culture also shapes values, attitudes, and beliefs about fatness and thinness, providing a basis for how people interpret their own body weights and the weights of others. The dynamics of larger cultural changes and individual acculturation and migration reveal the overwhelming importance of culture in body weight and obesity.

History

Historical changes occur as societies move through time, and clear temporal shifts have occurred in body weight and values about obesity in many societies. However, valid and representative population data about actual body weight are rare for time periods prior to the mid-1900s, so conclusions about historical changes in actual weight prior to that time are problematic. Some historical records of weights of select populations do exist, such as military recruits (28), but these are not necessarily generalizable to the broader population. Insurance company data began to provide broader population level historical information in the twentieth century (29,30), but still offered limited generalizability because of the select population that is covered by insurance policies (31). Only with the advent of national nutrition surveys in developed societies beginning in about the 1960s did solid prevalence data about weight become historically available, such as the US National Health and Nutrition Examination Surveys (NHANES) (32). Despite data limitations, several interpretations of historical patterns in weight can be developed.

Obesity appears to be increasing for most societies of the world during the second half of the twentieth century (33–36). The increase has not necessarily been an evenly progressing secular trend over time, with the historical periods in the late 1940s and in the 1970s revealing cohort and history shifts towards higher prevalence of obesity (37). Some observers label this a global obesity epidemic (38–41).

Information is available about historical changes in social values concerning body weight. In Europe and America prior to 1900, plumpness was valued as insurance against consumptive illness (17). The

major transition point when public attitudes moved from valuing or accepting fatness to desiring or seeking thinness appears to be around the beginning of the twentieth century (15). Many types of diets and other weight loss strategies began to be widely available and used after 1900 (42–44). During the second half of the twentieth century, social ideals have increasingly emphasized the value of slimness for women, as evidenced in the increasingly thinner body shapes of idealized women's roles such as beauty pageant winners (45,46) and fashion models (47).

The rejection of fatness has escalated since the beginning of the twentieth century, but is grounded in a prior history of stigmatization of obese individuals both in Europe and in Asia (48). A moral model for thinking about obesity was pervasive in developed societies for most of the twentieth century, treating fatness as badness rather than sickness (49). However, since the 1950s there has been a medicalization of obesity that cast it as an illness rather than a consequence of moral failures of individuals (49).

Overall, historical patterns exist for body weight and attitudes about body weight, and those patterns have been continually changing. Globalization of Western culture is a strong influence on food, eating, and weight (11), and this is leading to a high prevalence of obesity across the world. This suggests that it is essential to frame obesity within historical as well as cultural contexts to fully understand the causes and consequences of fatness and thinness.

SOCIAL CHARACTERISTICS

Many social characteristics of individuals are associated with body weight in postindustrial societies. The social epidemiology of body weight can be usefully examined in relationship to 12 fundamental social characteristics of individuals: sex/gender, age/life stage, race/ethnicity, employment, occupation, income, education, household size, marital status, parenthood, residential density, and region. While there is well-established information about the social epidemiology of body weight for some of these characteristics, for others weight patterns are less clear. The specific mechanisms for most have yet to be well understood.

The relationship of each of these 12 characteristics with body weight will be discussed in the following sections. Most of the discussion will focus on patterns in developed societies at the beginning of the twenty-first century, where more research has been conducted, although some cultural and historical contrasts will be made.

Sex/Gender

Sex refers to the ascribed biological status of being female or male (as differentiated by anatomy and physiology), while gender refers to the achieved social status of being a woman or man (as constructed by psychosociocultural factors). Clear sexual dimorphism exists in body weight, with females generally having more stored body fat than males and being more likely than males to be obese (5,34). Many sex differences are physiological and linked to reproductive functioning (50), with more overall subcutaneous fat present in females and the distribution of body fat deposits being greater in lower body for females and upper body for males.

Beyond biological sex differences in body fat, substantial social and psychological gender differences exist with respect to weight in many societies, with fatness and thinness being more likely to be female and feminist issues (51). Women are judged by and more concerned about their physical appearance than men, with body weight and body shape a major criterion for judging female attractiveness (52–54). Among the public, weight concerns are based more on appearance than health motivations, particularly among women (55). Stigmatization of body weight is more prevalent and severe for women than men (56), leading to pressures in postindustrial societies that make body weight a ‘normative discontent’ for most women (57).

Overall, sex and gender are overriding characteristics when considering obesity. The prevalence and meaning of weight are so different for men and women that much obesity research is done only on one sex or the other, and most data about weight is presented separately for males and females. Clearly, body weight and obesity are gendered issues.

Age/Life Stage

Age refers to the chronological time since an individual’s birth, and life stage refers to the social roles

and expectations that exist for people of a given age. In contemporary postindustrial societies, body weight and obesity tend to increase as a person ages, and then decline in the last decades of a person’s life (5,35). This leads to an inverted ‘U’ or ‘J’ shaped pattern in body weight as a person ages. The prevalence of obesity tends to be lowest among the youngest and oldest segments of the adult population (58). The highest weight gain occurs in both genders between age 25 and 34 (59). Elderly people typically experience weight loss in their later years. Weight changes with age vary among individuals, and for most people weight gains appear to be small and continuous over time (60).

Explaining patterns in the relationship of weight and age is complex, involving many considerations. Aging involves biological as well as psychosocial components, both of which are important influences on body weight. It is difficult to disentangle the relative contribution of biology versus social influences on patterns of weight by age. Metabolic arguments support the tendency to gain weight up to adulthood and lose it as a person becomes elderly.

Mechanisms involved in shaping body weight vary by age. Activity levels of younger people tend to be higher, and decline as people age (61). Eating patterns also vary throughout the life course (62), influencing the caloric intake of individuals and consequently their body weight.

Life stage differences exist in social norms about body shape ideals, with young people emphasizing slimness more than older people (52,63). As people proceed through their life course, they exhibit a personal weight trajectory that is subject to social expectations about age-appropriate standards for body weight (62). Concern about weight varies across life stages for women, with greater concern among younger than older women (64). However, it appears that concerns about body weight are more tied with women’s self-esteem among middle-aged women (age 30 to 49), suggesting that weight concern may be less problematic among most younger and older women.

Overall, age and life stage are consistently associated with body weight and obesity, with younger and older people being thinner and less likely to be obese. The mechanisms for these relationships have yet to be clearly delineated, involving a combination of physiological changes, activity levels, and caloric intake.

Race/Ethnicity

Race refers to physiological subgroups that exhibit biological variations in human populations, while ethnicity refers to the different cultures and subcultures in human societies, particularly complex societies that are multiethnic. When differences in racial/ethnic groups occur, attribution of these differences to biological versus social factors is extremely problematic. This is especially true for body weight, where racial/ethnic differences exist in obesity in many societies. Adding to the complexity of this issue are the differential patterns in socioeconomic status and other variables among racial/ethnic groups (65).

Many investigations in the USA have reported ethnic patterns in body weight and obesity, with minority groups typically being more likely to be obese than the majority and some variation between minority groups (35,66). A meta-analysis of American ethnic differences in body weight (67) found complex patterns in weight variations between ethnic groups. Overall, Polynesians had the highest mean relative body weights, followed by blacks, Caucasians, Thais and others. However, percent body fat did not precisely correspond with weight levels.

The mechanisms for ethnic variations in body weight are problematic, with no consensus about the relative contribution of genetics, activity levels, or caloric intake differences (68,69). Ethnic variations in caloric intake and physical activity have been reported (70), but these are confounded by other factors such as socioeconomic status or residential location.

Beliefs, perceptions, and attitudes about weight differ among ethnic groups in many societies. In the USA, many minority ethnic groups tend to be more accepting of higher body weights than those in the white majority ethnic group (58). Specific differences in ethnic groups in the way that they deal with weight need to be examined and considered as an important factor in the etiology and epidemiology of fatness and thinness.

Overall, ethnicity is a characteristic that is important to consider in relationship to obesity, but presents complex questions about how and why is associated with weight. The ethnic compositions of populations are continually changing, and ethnic groups are migrating and acculturating, making

ethnicity a problematic aspect of the social patterns of obesity.

Employment

Employment involves work paid for by wages or salary in the labor force, and may be full-time or part-time. A person's work role is a major social identity for most adults, with almost all men and the majority of women participating in the labor force in most contemporary postindustrial societies. One of the most significant changes in industrialized societies in the second half of the twentieth century is the entry of the majority of adult women into the labor force.

Many aspects of employment are relevant to body weight and obesity (71). Employment provides financial resources through income, and also access and opportunities for using health care services. Many jobs include health benefits and risks, some related to body weight such as involvement in healthy levels of physical activity or the stress of working varying schedules in 'shift work' (72). An important aspect of employment is that working usually imposes an organized structure on people's lives and provides a social world that is different from the family and household social network.

Despite the potential relevance of work to patterns of body weight, relatively little explicit attention has focused on patterns of work and weight. However, employment information is reported in studies of other aspects of weight. Some studies in postindustrial societies find that women who are not employed are more likely to be obese than their counterparts who participate in the labor force (73). Unemployed men have been reported to be underweight (74). Fuller analysis of employment and employment transitions such as entering the workforce, changing jobs, and retiring need to be conducted to understand their role in body weight and obesity.

Overall, even though the majority of adults in developed societies are employed outside the home, there is a dearth of information about how employment influences obesity. Mechanisms for activity level and caloric intake from employment are not well worked out, so employment and obesity deserves additional research attention in the future.

Occupation

Occupation is the type of work that a person performs in a society. The occupations are diverse, and can be classified on many dimensions relevant to body weight. While occupation has not been a focus in most of the weight literature, differences in weight levels and the prevalence of obesity do occur. Women in low prestige jobs tend to be more obese, but the relationship between occupation and weight is less consistent for men (75).

Energy intake is not necessarily determined by occupation, although jobs that are related to food preparation (such as cooks, clerks in businesses that sell food, etc.) may provide eating opportunities that facilitate overeating. Some occupations also have obligations for employees to eat to perform their jobs, such as salespeople who are expected to take clients to meals, etc. Another aspect of some occupations related to energy intake is whether they are structured to permit, enhance, or prevent eating on the job. Some jobs are flexible about eating at work, while others rigidly provide set times where eating can occur. Many worksites offer foodservice to their employees, which provides a source of calories that may either facilitate or prevent obesity, depending on how the foodservice is used.

Energy expenditure varies considerably by occupation. Some jobs involving high levels of energy expenditure over extended durations of time, while others involve minimal physical activity for long periods. On this basis, some workers expend many calories over the course of their workday and may be underweight, while others spend long sedentary hours at work that can contribute to obesity. Occupations also vary in the flexibility they offer to workers to engage in recreational exercise. Some jobs encourage workers to exercise before, during, and after their workday, and even provide worksite recreational facilities and organized exercise programs. By contrast, other jobs offer no opportunities or facilitation of exercise for their employees.

Another occupational consideration is selection of people into particular jobs because of their weight. Occupational prestige tends to be inversely associated with relative body weight, especially for women, with higher status occupations having thinner workers (10). There is considerable documentation of weight discrimination during the hiring process against the entry of obese individuals into many jobs, particularly those with higher prestige

and public visibility (76–78). Additionally, upward occupational mobility is limited or restricted for obese individuals due to weight discrimination in the promotion process (79–81). This suggests that body weight influences occupation, in addition to occupation influencing body weight, and that the disentanglement of those two causal processes is difficult.

Overall, the high proportion of both men and women who participate in the labor force in postindustrial societies and the long hours that are spent at the worksite suggest that occupation has the potential to become an important factor in the prevalence and treatment of obesity. Occupations provide lifestyles that play a role in eating, exercise, and weight management. Weight and work are topics that need to be examined more completely in the future.

Income

Income is the wages and other benefits provided through employment, as well as from other sources such as investments, inheritance, and government assistance programs. Income provides resources that can influence energy intake and expenditure, which in turn shape body weight.

One of the most consistent patterns in the obesity literature is the direct association between income and body weight in men and women in developing nations, and the inverse association between income and weight among women (and perhaps men) in developed societies (10). There is some debate about whether the direction of causality operates as income influencing weight, weight influencing income, or both (71). Income provides opportunities to exercise control over many aspects of life, including diet and activity levels, and can be used to seek the thin ideal that exists in most postindustrial societies. Low income levels produce stress, which may lead some people to store more body fat as insurance against difficult times in the future, and others to seek solace from their troubles through the comfort of eating.

Energy intake appears to have an inverted ‘U’ shaped relationship with income, with the lowest and highest income groups ingesting fewer kilocalories of food than middle income individuals (70). Income facilitates control over energy intake

by providing resources that permit a person to select foods. Resources are an important consideration in making food choices (82,83). Having adequate income allows someone to focus on other aspects foods than cost, such as health and caloric value. People who experience hunger or food insecurity may overeat when food is available, which leads lower income groups in some societies to be more likely to be obese (84). In postindustrial societies, people with higher incomes have the resources to purchase more expensive low-fat or dieting products to attempt to control their weight, as well as to enroll in sometimes costly weight control classes and programs.

Energy expenditure is generally inversely associated with income at work because most higher paying professions require less caloric activity on the job than the manual, physical labor of many low paying jobs. However, those with higher incomes are more likely to have the resources to afford living in low crime neighborhoods where they can safely participate in outdoor recreational activities. Higher income individuals also can afford to pay for recreational exercise equipment, classes, coaching, travel, etc.

Overall, income is a powerful predictor of body weight levels and obesity. In postindustrial societies, higher income women in particular are thinner and less likely to be obese. Income provides many resources that permit people to avoid or overcome obesity, and needs to be considered in examining patterns of obesity and interventions to prevent or reduce obesity.

Education

Education is usually seen as the amount of formal schooling that a person has experienced. Education provides knowledge about eating, nutrition, activity, health, and weight that is used in assessing food and activity choices and in managing body weight. Education also socializes people into the dominant norms of society about fatness and thinness, providing them with motivations as well as skills to conform to cultural weight expectations.

In developing societies men and women with the most education tend to be heavier than their peers, although often not fat by the standards of developed societies (10). In postindustrial societies and

groups, people with the highest levels of education are least likely to be obese (66). The relationship between education and body weight appears to be bidirectional in postindustrial societies (71). People with lower education have less knowledge about nutrition, activity, and weight, and are more likely to become obese. Additionally, obese people are more likely to be discriminated against in acquiring greater education because they are excluded from admission to various educational opportunities (56).

Energy intake is not clearly associated with education in postindustrial societies (70). People with the lowest levels of education are more likely to eat higher fat foods and less likely to consume fruits and vegetables, but also may experience lower food intake.

Energy expenditure is inversely associated with education (61). People who have the least education tend to have jobs that involve more manual labor and those with the most education have more mental and interactional labor included in their daily work. Energy use in recreational activities is more frequent among those with higher education, who are more likely to participate in sports and exercise programs specifically to manage body weight.

Overall, education is one of the strongest predictors of body weight and obesity in populations, with more highly educated people being thinner. The knowledge, thinking skills, and normative socialization acquired through education appear to be important in preventing gaining of body weight during adulthood, and dealing with weight gains that do occur. Public investments in education for the population may be one of the most effective ways to limit the development and lower the prevalence of obesity.

Household Size

Household size is the number of people that a person resides with in their household or home. Household size is related to eating patterns, activity levels, and body weight, particularly among some portions of the population such as the elderly. In particular, living alone is a risk factor for problematic eating, activity levels, and body weight.

Little research attention has been given to household size, weight, and obesity among the general

population. Among the elderly, however, living alone can be a risk for undernutrition and insufficient body weight even though the collective findings of studies of eating alone and weight are mixed (85).

Energy intake does not necessarily vary by household size (70). However, energy intake is influenced by the presence of others. Commensality is important in encouraging adequate food intake (86), and people who eat alone frequently do not eat enough to maintain body weight levels (87). A body of work on social facilitation concludes that there is a direct relationship between the number of people who are present at meals and the amount that people consume (88). This suggests that household size may influence energy intake, with the more people who live in a dwelling unit the more calories they each consume.

Energy expenditure may be influenced by household size in various ways. Interacting with other individuals involves additional activity beyond being alone. Such interaction may lead to expending more energy among people in larger households. Especially if there are children in a household, people spend more time moving around than when others are not present.

Overall, the number of people with whom a person lives has the potential to influence their caloric intake, activity level, and values about body weight. A particular concern exists for people living alone. However, these relationships between household size and weight have not been a focus of past research and deserve more attention in the future.

Marital Status

Marital status is related to body weight and obesity in many different ways (89). Obese people are stigmatized, which produces problems in dating and attracting marital partners (90,91) and in maintaining partners in marriage (92). Entering and terminating marriage are significant life events when people renegotiate eating and activity patterns which often lead to weight changes (93,94). Obese people enter marriage later (95) and marry heavier partners (96), which is evidence that success in the marriage market is a problem for large individuals, particularly women. Married men, but not necessarily women, weigh more than unmarried individuals (55,73).

People tend to gain weight after entering marriage (93,94,97,98), and married couples tend synchronically to gain and lose weight together (99). People who terminate their marriages tend to lose weight (97,98,100). Overall, entering into marriage is more difficult for obese people, being married is associated with higher body weight, and terminating marriage is associated with weight loss.

Energy intake differs between married and unmarried individuals. Spouses eat the majority of their meals and snacks together both at home and away from home, so that people consume most of their calories with their marital partner. Marriage structures people's eating patterns, providing regular meals and commensal partners. Partners involved in a marriage perceive an obligation to eat with their spouse, sometimes consuming calories that they would not have eaten if they did were not married (101). Men in postindustrial societies cite getting married as one of the most significant reasons that they gained weight and are overweight (102).

Energy expenditure is also influenced by marital status (61,94). The social obligation to spend time together as spousal partners presents an opportunity cost for many forms of individualistic exercise activities (although many partners participate together in sports and recreation). Unmarried people sometimes engage in recreational physical activity to remain thin to attract a desirable partner and also as a form of social activity to interact with other people.

Overall, marriage structures people's lives, provides social obligations for eating and activities, and includes normative perceptions about body weight and shape. This suggests that marital status is a predictor of body weight levels, and that interventions to change or maintain body weights should consider marriage and perhaps be structured around marital partners (103).

Parenthood

Parenthood is having children, involving pregnancy and childbirth among women and the raising of children for both men and women. Being a parent is an important role in many people's lives, and there has been considerable interest in the relationship between having children and body weight.

Adult women in postindustrial societies cite having a child as one of the major reasons that they gained weight and are overweight (102). Many studies have examined postpartum weight retention (controlling for age and other factors), and the consensus of research in postindustrial societies is that a direct association exists between parity and weight but that the effect is small, about an average gain per birth of about one kilogram (2.2 pounds) (104). However, these averages vary widely, with some women gaining and retaining considerable weight after childbirth while others lose weight (105). The association between parity and body weight is modified by many sociodemographic and behavioral factors, with women who are minority, rural, lower socioeconomic status, unemployed, unmarried, and getting little physical activity at greater potential risk of parity-associated weight retention (106,107).

Many questions about parenthood and body weight remain unresolved. While epidemiological studies show that some weight gain is associated with each additional child, the source of this gain is not clear. Williamson *et al.* (105) made the conceptual distinction between the contribution of *childbearing* and *childrearing* to weight gain after pregnancy. Childbearing contributes to weight gain largely through physiological processes involved in pregnancy and childbirth, while childrearing contributes to weight gain largely by changes in the social aspects of households when raising children such as changes in the family food system and parental physical activity patterns (108). Current studies have not been able to distinguish between the relative contributions of childbirth versus parenting to postpartum weight retention, and it is up to future researchers to disentangle those mechanisms. Overall, while women with more children are more likely to have higher body weights and be obese, the patterns and dynamics of this relationship have yet to be fully understood.

Energy intake of pregnant women typically increases as they gain weight during pregnancy (104). These higher calorie consumption patterns may establish longstanding food choice trajectories that persist after the pregnancy for some women but not others (62). During childrearing, many parents consume additional calories as they have special children's foods available in addition to adult foods, as well as when they consume foods uneaten by their children to avoid wasting the foods. All of

these factors suggest that childbearing and childrearing provide risks of increased caloric consumption by mothers (and possibly fathers) that may contribute to weight gain and maintenance of higher body weights by people in the parental role.

Energy expenditure can differ for parents compared to people who do not have children, with childrearing demands and opportunity costs playing a role in parental physical activities. Considerable energy expenditure is often required in the process of caring for children, and childrearing may lead to greater energy expenditure among people who previously were not very physically active during their leisure time. By contrast, for people involved in regular recreational activities the time demands for rearing children can present an opportunity cost that may diminish their voluntary exercise levels and lead to decreasing energy expenditure. The energy demands and time obligations of childrearing can influence both mothers and fathers, and may vary for particular individuals.

Overall, being a parent is a significant role, and includes a myriad of components that can influence parental body weights. Many women attribute weight gains to parental involvement, but it is currently not clear whether this is from bearing or rearing children or how much of any weight patterns associated with parenthood are due to caloric intake or energy expenditure.

Residential Density

Residential density refers to whether a person lives in a rural, suburban, or urban area. Rural and urban may be conceptualized as opposite points on a continuum of residential density, or rural, suburban, and urban areas may be seen as categorically different types of communities. While there have been some studies that provide some data on rural–urban differences in weight and obesity, little specific analysis has examined variations in body weight by residential density, although some investigations provide rural–urban data as descriptive information during the course of studying other issues.

Analysis of rural–urban weight differences in the USA using national data found that rural women are slightly more likely to be obese than their metropolitan counterparts (109). There was an

overall gradient in rural–urban weight without controlling for other variables that revealed that urban men and women had higher relative body weights. However, it is crucial to control for other attributes that also vary between rural and urban areas, such as income, education, age, etc., to attempt to distinguish between inherent rural–urban differences versus compositional differences. When other variables were controlled, the rural–urban differences persisted but were weak for women, and were not present for men.

Energy intake varies somewhat between rural and urban areas, with rural residents having slightly higher caloric intakes (70). Higher population density provides a more diverse foodscape, with more opportunities to eat from a variety of food sources. Rural food options tend to be more limited, and lower calorie foods may not be as available as in suburban or urban areas.

Energy expenditure was traditionally very high in rural areas, due to the large percentage of the population involved in farmwork and the need to walk long distances to engage in social activities. With the rise of the automobile, rural and suburban residents tend to drive at least as much, if not more, than their metropolitan counterparts.

The context a person lives in provides social norms and attitudes about weight. The body shape comparisons between people in cities encourages people to strive for thinness (110). Appearance may be more important for the high number of fleeting interactions in urban areas, with more multifaceted relationships occurring between people in places with lower population density.

Overall, it appears that a relationship exists between obesity and rural–urban residence, with a slight tendency for rural people to have higher body weights even when controlling for other variables. This may be partly due to activity levels, and partly to caloric intake. The attitudes and values in urban areas may underlie these differences, with an emphasis on thinness in cities leading people there to more actively control their weight.

Region

Region is the particular place where people live. Geographers specialize in studying regionality, and use several levels of scale to conceptualize differen-

ces in regions of the world, a continent, a nation, or a city. Only scattered data exist on regional variations in obesity and body weight. An important consideration in examining spatial patterns such as regional differences is the need to differentiate between inherent regional qualities that determine differences in weight, such as eating patterns or activity levels, and compositional differences in the inhabitants of a region, such as when young or lower income people predominate in a particular place. Determinative versus compositional effects can be examined by controlling for key variables in multivariate analyses, and this currently has not been well sorted out for regional patterns of obesity.

In the USA, government studies of obesity during the 1990s reported that it was most concentrated in the south and southeast, but as the entire US population became fatter obesity spread in most regions of the country (66). In Brazil, the more economically developed southern region of the country had greater prevalence of obesity (111). Neighborhoods in a Scottish city exhibited different levels of weight, suggesting that obesity prevention efforts would benefit from focusing on place of residence (112).

Energy intake variations by geographical region have been reported in some studies (65). Geographical location is associated with dietary patterns. Cuisines and taste ratings (113) are widely recognized as having regional differences, but it is less clear whether caloric intake varies between geographical regions.

Energy expenditure may vary among the populations of geographical regions, but it is difficult to clearly establish reasons for such variations. Some may be climactic, some due to regional differences in the composition of the population, and some to specific regional attitudes and norms about physical activity.

Overall, region is strongly influenced by the economic status associated with different places, which in turn appears to influence diet, activity, and body weight. However, more research on this topic is needed to identify systematic patterns.

SOCIETAL MECHANISMS

Many social mechanisms have been proposed to explain variations in weight between individuals, groups, societies, and time periods. These mechan-

isms reflect modifications in energy intake and energy output. Two major societal mechanisms that influence body weight involve large-scale shifts that are occurring in most societies: (1) food system transformations are modifying energy intake, and (2) built environment efficiencies are reducing levels of physical activity.

Food System Transformations

The food system is the complex of activities that provides crops, foodstuffs, and foods to the population as a source of caloric energy and nutrients (114). Significant food system transformations have occurred over time (11) and have had important influences on energy intake and body weight. Technology has greatly increased the volume, diversified the content, and increased the variety of the food supply in many areas of the world. Overall, the food system has moved from offering relatively few calories per person to being a calorically abundant system. An increasing proportion of the calories in the food system are from fat (115). For example, in the USA today there are approximately 3800 kilocalories available per capita, almost twice the requirement for adults. The food system can be divided into six major stages that will be discussed here in relationship to their contribution to increasing caloric intake of the populations of postindustrial societies: production, processing, distribution, acquisition, preparation, and consumption.

Food production in ancient societies involved only hunting and gathering. Those societies experienced fluctuations and uncertainties in maintaining an adequate and constant food supply (116). Famines were common and always a threat to society, leading to an ever-present risk of inadequate caloric intake. Over 10 000 years ago the agricultural revolution led to a more stable food supply that produced surplus foods to insure a constant energy stream in the face of environmental vicissitudes, and create a supply of surplus foods that freed an increasing proportion of society from involvement in food production. The industrial revolution in agriculture beginning in the 1800s further increased food surplus production, permitting the majority of society to forsake food production to pursue other tasks. Currently, industrial and postindustrial societies produce up to twice the number of calories

per capita that can be consumed by members of those societies (115). Thus food production has led to an extremely abundant availability of calories in postindustrial food systems.

Food processing changes crops into foodstuffs and foods. Food processing procedures increase the palatability and durability of foods, preventing the waste of crops and enhancing the desirability of foods for consumption and reducing spoilage. Food processing often involves manufacturing procedures that increase the caloric levels and caloric density of foods over their unprocessed forms, adding to the energy content of the food supply (11). For example, many food manufacturing processes add sugar and fat to raw foodstuffs to produce higher calorie prepared and preserved food products. Thus food processing has tended to increase the caloric density of the food system, typically by adding sugars and fats.

Food distribution has undergone major changes over time that are making food almost universally available and accessible, deterring people from running out of food and facilitating higher levels of energy consumption. The proliferation of institutions offering food such as grocery stores, restaurants, vending machines, take away or carry out foods, food delivery, mobile food vendors, catering, etc., has made it rare to be in a place where food is not available. The ease of obtaining food at all hours of the day or night in almost all places has removed barriers to eating for almost everyone (although because of social inequalities a small portion of society experiences food insufficiency and food insecurity (84)). The increasing durability of food products has also overcome barriers of time and space in making calories more available to virtually all people at all times in postindustrial societies (11). The portion sizes of food in foodservice operations are also increasing, distributing more calories in individual servings than in the past (38). Thus food distribution makes calories beyond basic energy needs available to almost all people at all times in most places in developed societies.

Food acquisition is the procurement of foods from various distribution outlets in raw, processed, and prepared forms. Increasingly, food purchases have been processed foods that have fats and sugars added and are ready to eat, encouraging immediate consumption of energy dense foods. Consumers also are more likely to eat foods prepared by others in commercial establishments, with half of the US

food expenditures spent eating away from home (117), making consumers less aware of the ingredients and caloric content of the foods they eat. Thus easy acquisition of tasty foods without awareness of their ingredients facilitates the increased likelihood of obtaining higher levels of calories when foods are acquired from the food system by individuals.

Food preparation manipulates foodstuffs into foods using a variety of methods. Foodstuffs are increasingly likely to have some preparation steps already performed commercially prior to personal cooking, decreasing the human energy expenditure involved in cooking and making ingredients and caloric content less obvious to food preparers. Cooking methods vary in the number of calories they add to foods, with many techniques involving heating foodstuffs in fats or oils which adds to the caloric content and density of the foods that are prepared. Thus food preparation methods often add calories (particularly as fat) to the food system, increasing caloric intakes of individuals who eat these foods.

Food consumption involves selection, serving, and ingesting foods. Many social food events occur in contemporary societies, providing obligations to ingest calories in foods. Consumption patterns are often divided into meals and snacks between meals, with an increase in the prevalence of snacking across the day (118). Research findings about eating frequency and body weight are mixed. Several studies suggest a gendered relationship where women who eat more frequently have higher body weights, but men who eat more often have lower body weights (119). Thus the more universal availability and accessibility of prepared foods has created a system that facilitates consumption of food energy, which may be linked to eating frequency.

Overall from production to consumption, contemporary food systems increasingly deliver a higher amount of caloric energy that is more easily and cheaply available to more people than ever before. Current trends suggest that ingestible calorie supplies beyond basic metabolic needs are moving towards being universally available across time, place, and people, with a decreasing minority of the population experiencing hunger. Globalization of production, processing, and distribution increase caloric availability, and advances in communication and transportation facilitate caloric acquisition, preparation, and consumption. On a societal scale, these changes have produced an increasingly

fattening food system that contributes to a rising prevalence of obesity.

Built Environment Efficiencies

Humans have modified their physical environments in many ways, including the development and use of many forms of technology to modify clothing, housing, transportation, worksites, communications, and other areas. Natural environments have many features that require people to expend energy by temperature regulation, sheltering from exposure to the elements (sun, precipitation, wind), moving between places, etc. With economic modernization, built environments have expanded to house an increasingly larger scope of human activities. An ever-rising amount of each person's life is spent in built spaces that are shielded from requirements to expend energy to cope with natural forces. Within built environments, technological developments have continually made life tasks more efficient. The sum of all these changes has led to lower energy expenditures by humans because of built environment efficiencies, and these contribute to increased body weights and more obesity.

Clothing has become more energy efficient and more widely available, which has decreased energy expenditure needed to maintain body temperature for the majority of the population (120). The industrial revolution developed mass production of cloth, permitting the population to keep warm efficiently through days and nights in a manner never before possible. Clothing is often taken for granted in contemporary postindustrial societies, even though it saves the expenditure of calories compared with the cruder and less task-specific clothing of hundreds or thousands of years ago.

Two important aspects of the human built environment that have greatly decreased energy are housing and furniture. Housing structures have evolved new materials and forms that increasingly separate built from natural environments. Efficient heating and cooling systems combined with improved insulation of structures separate humans from the world outside of their dwellings and vehicles. Precisely and automatically controlled temperatures decrease the need for people to generate body heat to keep themselves warm in cold weather. Air conditioning permits obese people with high

levels of insulating body fat to remain comfortable in cool weather. Lighting permits people to spend more time inside. Clocks coordinate people's activities (121), minimizing the time spent standing and waiting for others.

Widely available, ergonomically designed and inexpensive furniture (with backs rather than just seats) permits people to conserve energy by sitting rather than standing for an increasing proportion of their waking hours. Padded furniture is more comfortable, making it more attractive to sit for longer periods and causing less energy to be used in fidgeting and shifting positions to vary body position to remain comfortable.

Workplace environments have undergone and are continuing to undergo huge transformations in energy expenditure requirements. People increasingly travel to work in vehicles rather than walking. Occupational activity levels decreased substantially with the industrial revolution, which increasingly substituted mechanically produced energy for human generated energy. Much technological development is geared toward more efficient (and therefore more productive and profitable) workplace activities, substituting mechanical devices for human muscles and minimizing the time and effort of human input required (122). All of these workplace efficiencies have moved worktime for an increasing proportion of the population from being a period of high energy expenditure to being a sedentary part of the day where few calories are expended above those needed to sit (or sometimes stand).

Recreational activity levels of populations have changed significantly over time. An increasing amount of leisure became available as childhood and adolescence became shielded from adult work responsibilities, work weeks shortened, and vacations lengthened. However, the overall energy expenditure of people during their leisure time has tended to be low. Sedentary activities increasingly became available to fill available leisure, including reading, radio, television, and other mass forms of passive consumption that involved little caloric expenditure. Sports and games moved from being active participation to passive spectator activities (although there has been a resurgence in widespread public exercise and sport participation in recent decades among a minority of the population).

Two built environment changes that are cited as particularly significant contributions to population levels of obesity are automobiles and television. The

automobile and related motor powered vehicles such as buses, trucks, motorcycles, etc., were broadly introduced and popularized in the early twentieth century, and revolutionized human activity levels. Human muscle powered transport for more than short distances declined rapidly with the introduction of automobiles. The built environment became designed around automobiles, and task-oriented walking more than short distances became an increasingly unusual activity for most people. Personal energy expenditure for transportation is rapidly being minimized for most people in postindustrial societies.

Television was developed and widely diffused in the middle of the twentieth century, attaining almost universal penetration into the households of people in developed societies (and more recently in developing societies). Television rapidly took up an increasing number of waking hours of the majority of the population, with the US average of over 3 hours of daily viewing constituting the third most frequent use of time (after sleep and work or school) (123). Technological developments in television made it an increasingly attractive activity (with more channels, clearer and colored pictures, and linkage with videotape players) that required progressively less activity (with remote control units used for changing channels and sound levels).

Obesity researchers frequently cite television as a major contributor to higher body weight levels (124). The amount of television viewing is directly associated with body weight in studies of children and adults. Television influences body weight through both decreased energy expenditure and increasing energy intake (125). Energy output reductions occur because the sedentary activity of watching television displaces more active pursuits (126). Energy input increases occur because advertisements on television encourage consumption of high calorie and high fat foods (127).

Children are a special audience deemed to be particularly vulnerable to the influence of television (128). Children are high users of television (2–4 hours/day in the USA), and exhibit high attention levels to television. Television programming that targets children includes a majority of advertisements for food, particularly sweets, cereals, snacks, and soft drinks (129). Children's food purchase requests are related to time spent viewing television (127).

In prior historical time periods, most people en-

gaged in physical labor in their jobs, and used what leisure time they had to rest and recover from workday tasks. Currently, energy expenditure beyond resting metabolic rates must increasingly occur by means of voluntary exercise, where people are purposively active during their 'leisure' time for reasons of health promotion and expending energy to lose weight. However, Western cultures have no concept for 'activity hunger' (130), and the idea of voluntarily engaging in leisure time physical activity to control body weight has lagged behind cultural values about increased energy intake. These cultural and historical discrepancies have contributed to the rising prevalence of obesity.

Built environment efficiencies exert a cumulative and pervasive effect in decreasing human energy expenditure. On a societal scale, these changes have produced increasingly fattening human environments that contribute to a rising prevalence of obesity in individuals and populations.

CONCLUSION

Obesity is a complex, dynamic, and multidimensional biosocial phenomenon, a synergistic product of the interaction between physiology and the social world. Levels of obesity must be seen within their cultural and historical contexts, with each particular society and time period establishing broad conditions within which body weight levels occur for the population. In specific times and places, the social demographics of individuals are important influences on body weight patterns (131). It is also important to recognize that food systems and human environments have become increasingly 'obesi-genic' in their continual increase in caloric availability and activity efficiency (38).

Consideration of the contributions of food system changes to the prevalence of obesity suggests that it is important to consider occurrences 'upstream' in the calorie supply in searching for society-level mechanisms and intervention opportunities for body weight modification of populations. On a societal scale, producing less food and processing foods in ways that are lower in caloric density may decrease obesity in society. The prevalence and types of food supply channels providing food energy to consumers may also be major determinants of the prevalence of obesity among the public,

although distribution of food to all of the population to prevent hunger and food insecurity is also a problem.

Consideration of the contributions of built environment changes to the prevalence of obesity suggest that a focus on the role of energy expenditure on body weight is warranted, particularly in everyday activities. Analysis of national data in several developed nations suggests that small energy reductions can have dramatic influences on the prevalence of obesity, and such changes in energy expenditure can account for the recent rises in obesity of the broader population (132,133). The body weight consequences of a continually developing quest for more efficient activities in all domains of life must be examined. As less energy is required to live, more energy must be voluntarily expended to achieve metabolic balance with caloric intake. The adoption of widespread daily recreational activity equal to the energy savings from efficiencies in the built environment has not been readily accepted by the population, and this presents a major dilemma for future patterns in body weight and interventions to change them.

The major paradigms used in conceptualizing obesity have been biological and psychological, which provide crucial insights but are not exhaustive of ways to think about body weight. Social analysis considers issues beyond behavior and past physiology, applying social science thinking to offer additional insights about the prevalence and patterns of fatness and thinness. Understanding the contributions of culture, history, and sociology to patterns of body weight can help reframe thinking about the influences on obesity in ways that can generate new insights for research and practice.

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