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Socioeconomic Status and Obesity

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The objective of this review was to update Sobal and Stunkard's exhaustive review of the literature on the relation between socioeconomic status (SES) and obesity (*Psychol Bull* 1989;105:260–75). Diverse research databases (including CINAHL, ERIC, MEDLINE, and Social Science Abstracts) were comprehensively searched during the years 1988–2004 inclusive, using "obesity," "socioeconomic status," and synonyms as search terms. A total of 333 published studies, representing 1,914 primarily cross-sectional associations, were included in the review. The overall pattern of results, for both men and women, was of an increasing proportion of positive associations and a decreasing proportion of negative associations as one moved from countries with high levels of socioeconomic development to countries with medium and low levels of development. Findings varied by SES indicator; for example, negative associations (lower SES associated with larger body size) for women in highly developed countries were most common with education and occupation, while positive associations for women in medium- and low-development countries were most common with income and material possessions. Patterns for women in higher- versus lower-development countries were generally less striking than those observed by Sobal and Stunkard; this finding is interpreted in light of trends related to globalization. Results underscore a view of obesity as a social phenomenon, for which appropriate action includes targeting both economic and sociocultural factors.

developing countries; obesity; review [publication type]; sex; social class

Abbreviations: HDI, Human Development Index; SES, socioeconomic status.

INTRODUCTION

In 1989, Sobal and Stunkard (1) published a seminal review of the literature on the relation between socioeconomic status (SES) and obesity. On the basis of an exhaustive search of literature that covered the 1960s through the mid-1980s, these authors found 144 published studies on the SES-obesity relation in men, women, and children in the developed and developing world. Primary findings included the observation of a consistently inverse association for women in developed societies, with a higher likelihood of obesity among women in lower socioeconomic strata. The relation for men and children in developed societies was inconsistent. In developing societies, a strong direct relation was observed for women, men, and children, with a higher likelihood of obesity among persons in higher socioeconomic strata. Sobal and Stunkard's work (1) has greatly influenced subsequent research on the socioeconomic patterning of weight, as evidenced by its having been cited well over 500 times, according to the Web of Science Science Citation Index (http://scientific.thomson.com/products/sci/).

While this earlier review continues to have high relevance for current research on SES and weight, it is becoming somewhat limited by its dated content. Therefore, the objective of the present review was to update and build on Sobal and Stunkard's (1) earlier work. Because of the increasing prevalence of obesity in many countries (2–5), coupled with growing interest in social inequalities in health (6–9), continued monitoring of the socioeconomic patterning of weight is important. Although other published reviews have investigated specific aspects of this association (10–12), no one has endeavored to comprehensively examine the overall pattern of findings across the literature. Thus, the specific aims of the current review were twofold: 1) to update Sobal and Stunkard's work through 2004 and to

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continue their focus on patterns by sex and on countries in different stages of socioeconomic development; and 2) to build on the earlier work by looking more closely at different indicators of SES and using a three-category (rather than dichotomous) format to characterize the development status of countries.

It was hypothesized that the findings would resemble those of Sobal and Stunkard's review (1), but with the following qualification: that the differences in patterns between countries at higher versus lower stages of development would not be as pronounced in the present review, due to large-scale societal and nutritional change having to do with economic growth, modernization, and globalization of food markets (5, 13, 14). Such trends could plausibly dilute both between- and within-country variation in obesity-promoting exposures and are consistent with reports of dramatic increases in obesity worldwide, including previously unaffected regions (5, 15). No specific hypotheses were formed regarding the different indicators of SES, because this part of the analysis was exploratory.

METHODS

Search strategy

The following databases were searched for the period 1988–2004 inclusive: ABI Inform, Business Source Premiere, CINAHL, EMBASE, ERIC, MEDLINE, PsychInfo, and Social Science Abstracts. Search terms used included ''obesity'' and synonyms (e.g., body mass index, body weight, overweight) and ''socioeconomic status'' and synonyms (e.g., employment, educational status, salaries, poverty). Language was restricted to English. There were no other limitations specified.

Approximately 4,000 documents were returned, and the title and abstract (when available) were examined in all cases. For those abstracts that indicated or hinted at an association between SES and body size (body mass index, obesity, etc.), the full-text article was retrieved. Additionally, if it appeared from the abstract that the article might speak to the association in question, the full-text article was retrieved. Thus, a conservative approach was taken. Reference lists of key articles were also consulted, the aim being to conduct as exhaustive a search as feasible.

Refining the sample of studies

In light of recent reviews published on longitudinal aspects of the SES-obesity relation (10, 11), the decision was made to exclude such studies from the present review. Thus, the focus was on the relation between any indicator of SES and any indicator of body size at one point in time (i.e., associations based on change in weight were not included). Contemporaneous indicators of SES and body size thus constituted the majority of associations. Although there are limitations associated with cross-sectional data, such as the inability to consider temporal or causal implications, there are now solid data from various high-quality prospective studies indicating that lower SES has implications for higher weight later on in the life course (10, 16, 17). Therefore, the focus here allowed for an overall survey of patterns of association, for which a highly restricted subset of studies is not appropriate. For example, because of their restrictive inclusion and exclusion criteria, Ball and Crawford (11) were unable to study patterns of SES and weight change in developing countries, because only one study that used appropriate methods was identified. In line with Sobal and Stunkard's (1) objective, the aim here was to gather a sufficient number of studies to be able to examine patterns across societies in various stages of socioeconomic development and, in addition, to build on this by examining different patterns by indicator of SES.

In light of the large number of studies identified, a further decision was made to restrict this report to adults (persons aged 18 years or older). Finally, articles that did not present the results of a statistical test of association were excluded.

Tabulating and analyzing study data

Data from each study were tabulated along a number of dimensions, including country, sample, SES indicator, and body size indicator. Based on country and sample, the level of development in each study was classified as high, medium, or low on the basis of the 2003 Human Development Index (HDI) assigned by the United Nations Development Program (www.undp.org). The United Nations Development Program uses the HDI to characterize and rank countries on a number of attributes, including life expectancy at birth, school enrollment and adult literacy, and standard of living based on the gross domestic product. Examples of countries included in the three HDI categories are: Norway, the United Kingdom, and Germany (high); Brazil, Columbia, and Saudi Arabia (medium); and Cameroon, Benin, and Zambia (low). When a study in the present review explicitly concerned a sample of immigrants, HDI status was assigned on the basis of country of origin rather than destination (this occurred in one instance). To be consistent with Sobal and Stunkard (1), traditional subcultures within a larger developed society were classified as being at a lower stage of development. In this case, American Indian and Maori subgroups were classified as having a medium HDI (one instance each), although the studies took place in the United States and New Zealand (both high-HDI), respectively.

For each study, all contemporaneous associations between SES and body size were tabulated. When the investigators provided results from both unadjusted and adjusted models, associations from the adjusted models were recorded, and the variables that were adjusted for were recorded. Many studies incorporated more than one association, and it was often not possible to characterize each study by a single pattern. Thus, similar to the method of Ball and Crawford (11), association rather than study was the unit of analysis. A disadvantage of this approach is that it entails weighting all associations equally; therefore, studies with many associations have more influence on the overall results, regardless of their methodological quality. However, this approach is advantageous in that it allows the

examination of patterns for different indicators of SES, which were often used in the same study.

For conveying results, associations were stratified on three dimensions: HDI status (high, medium, low), sex (women, men, both sexes combined), and SES indicator. Data for men and women combined were only recorded when results for men and women separately were not provided. Eight categories of SES indicator were established: *income and related factors* (income, poverty, inability to afford essentials such as food and shelter); *education* (including schooling and literacy); *occupation* (occupational prestige or status, employment grade or ordered job type); *employment* (work status category—e.g., employed versus not employed); a *composite indicator* (a combination of multiple different indicators of SES); an *area-level indicator* (e.g., deprivation measured at the neighborhood or regional level rather than the individual level); *assets and material belongings* (e.g., car ownership, owning versus renting one's dwelling); and *other* (factors that could not otherwise be classified—e.g., subjective social class). For the area-level indicators, both ecologic and multilevel associations were included and were not distinguished because of the small number of multilevel associations.

For women, men, and both sexes combined, numbers and percentages were tabulated by SES indicator within each HDI status category. To achieve the primary objective of updating Sobal and Stunkard's original work, results were not stratified by body size indicator, because this variable took a number of formats, including body mass index (weight (kg)/height $(m)^2$, based on both measured and self-reported height and weight), skinfold thickness, and waist:hip ratio, and included both continuous (e.g., body mass index) and categorical (e.g., obesity, defined as body mass index $\geq$30) measures. However, because of the potential for bias and inaccuracies associated with self-report data (2, 18), the subset of associations based on measured data was also examined separately (n = 1,400 associations). Each association was classified as positive, negative, or nonsignificant/curvilinear. The decision to combine these latter categories was based on the very small number of curvilinear associations, as well as the possibility that nonsignificant findings obtained using a linear statistical tool may have failed to detect curvilinear associations and therefore the sample of curvilinear findings might not have been accurate.

RESULTS

A total of 333 published studies were included. The number of articles published per year increased between 1988 and 2004. A total of 1,914 associations were examined, as described below.

Women

Results for women are presented in table 1. For women in high-HDI countries, the majority of associations (63 percent) were negative (lower SES associated with higher body size). This effect was especially prominent for the following SES indicators: education (220/305; 72 percent negative), area-level indicators (10/14; 71 percent negative), occupation (100/146; 68 percent negative), and composite indicators (31/46; 67 percent negative). However, as one moved from high to medium to low HDI status, the proportion of positive associations increased, from 3 percent (23/731) in high-HDI countries to 43 percent (75/173) in medium-HDI countries to 94 percent (33/35) in low-HDI countries. Focusing on associations from medium-HDI countries, this positive association was particularly prominent for income (24/34; 71 percent) and material possessions (12/14; 86 percent) as indicators of SES. For associations among women in low-HDI countries, the vast majority were based on education as an indicator of SES (89 percent; 31/35), all of which were positive in nature (100 percent; 31/31). Across the three HDI strata, education was the SES indicator most often studied (47 percent of all associations were based on education).

Men

Results for men are presented in table 2. For men in high- and medium-HDI countries, the predominant finding was that of nonsignificance or curvilinearity. This was particularly true for associations with employment for men in high-HDI countries (85 percent (28/33) nonsignificant or curvilinear) and associations with education (70 percent; 35/50), material possessions (80 percent; 4/5), and employment (100 percent; 3/3) for men in medium-HDI countries (although the latter two findings were based on a small number of associations). Following nonsignificant or curvilinear findings, the next most prominent pattern for men in high-HDI countries was negative associations, and this was particularly true for education as an indicator of SES (50 percent negative; 126/254). Although positive associations were uncommon among studies of men in high-HDI countries (9 percent (53/564) of all associations in this group), associations with income were overrepresented (24 percent of associations with income in this group were positive).

In contrast, for men in medium-HDI countries, the second most common pattern was positive associations (39 percent (50/128) of all associations), and this was most prominent for income (59 percent; 26/44) and composite indicators of SES (83 percent; 5/6). There were only three associations from studies of men from low-HDI countries, and all were positive in nature.

Both sexes combined

Results for associations that combined male and female samples are presented in table 3. Not unexpectedly, these results were somewhat intermediate between the results presented separately for men and women. Among combined associations from high-HDI countries, negative and nonsignificant/curvilinear associations were about equally common (47 percent and 48 percent of associations, respectively), and both were more common than positive associations (5 percent). Negative associations were most often observed with education (65 percent; 31/48), occupation (59 percent; 16/27), and area-level indicators of SES (52 percent; 17/33), whereas nonsignificant/curvilinear

TABLE 1. Associations between socioeconomic status (SES) and body size* among women, according to Human Development Index status, SES indicator, and the nature of the SES-body size association

SES indicator	Nature of the SES-body size association									Total (n = 939)	
	Positive			Negative			Nonsignificant or curvilinear				
	No. of associations	%†	Reference no(s).‡	No. of associations	%†	Reference no(s).‡	No. of associations	%†	Reference no(s).‡	No. of associations	%§
High Human Development Index											
Area	0	0		10	71	48–50	4	29	49, 51, 52	14	2
Composite	0	0		31	67	53–68	15	33	54, 57, 58, 65, 66, 68–71	46	6
Education	4	1	72–75	220	72	52, 53, 55, 59, 68, 72–74, 76–170	81	27	51, 59, 71, 72, 77, 79, 84, 85, 92, 97, 103–105, 122, 125, 126, 131–133, 137, 142, 154, 161, 163, 170–187	305	42
Employment	7	16	66, 77, 152, 175	17	38	52, 79, 105, 119, 139, 149, 155, 166, 171, 188	21	47	57, 66, 75, 77, 100, 119, 130, 156, 171, 175, 181, 185, 187, 188	45	6
Income	9	6	72, 74, 87, 142, 185, 188, 189	69	49	59, 72, 74, 99, 106, 109, 112, 123, 28, 129, 137, 142, 151, 156, 162, 165–167, 171, 177, 183, 188–201	64	45	52, 59, 71, 72, 75, 98, 109, 140, 142, 164, 168, 171, 175, 177, 181, 184, 185, 187, 188, 192, 194, 196, 200–210	142	19
Occupation	2	1	112, 154	100	68	17, 54, 68, 69, 79, 83, 86, 89, 92, 96, 98, 99, 108, 112, 118, 119, 121, 122, 144, 151, 152, 154, 155, 161, 164, 165, 174, 176, 211–231	44	30	51, 66, 87, 89, 90, 92, 96, 98, 122, 130, 133, 140, 150, 177, 184, 202, 211–213, 215, 220, 221, 227, 232, 233	146	20
Other	1	6	173	4	22	78, 166, 173	13	72	73, 139, 173, 177, 234	18	2
Possessions	0	0		6	40	52, 54, 155, 165, 177	9	60	54, 69, 89, 131, 139	15	2
Overall	23	3		457	63		251	34		731	100¶
Medium Human Development Index											
Area	1	17	235	2	33	236	3	50	236, 237	6	3
Composite	4	50	238–240	0	0		4	50	238, 241	8	5
Education	32	31	132, 138, 242–249	39	38	131, 132, 137, 138, 250–261	31	30	131, 132, 137, 138, 173, 237, 246, 249, 251, 260, 262–267	102	59
Employment	0	0		0	0		0	0		0	0
Income	24	71	240, 249, 250, 252, 260, 267–272	1	3	272	9	26	245, 246, 258, 260, 271, 273–275	34	20
Occupation	1	17	267	3	50	244, 251	2	33	213, 251	6	3
Other	1	33	265	1	33	173	1	33	173	3	2

Possessions	12	86	131, 242, 244, 257, 276	0	0		2	14	246, 276	14	8
Overall	75	43		46	26		52	30		173	100¶
Low Human Development Index											
Area	0	0		0	0		0	0		0	0
Composite	0	0		0	0		0	0		0	0
Education	31	100	131, 132, 138, 277	0	0		0	0		31	89
Employment	0	0		0	0		0	0		0	0
Income	1	50	277	0	0		1	50	278	2	6
Occupation	1	100	279	0	0		0	0		1	3
Other	0	0		0	0		0	0		0	0
Possessions	0	0		0	0		1	100	131	1	3
Overall	33	94		0	0		2	6		35	100¶

* Body size includes both continuous (e.g., body mass index) and categorical (e.g., obesity defined as body mass index ≥30 kg/m²) measures.
† Percent values apply to each SES indicator and should be read across each row.
‡ The number of references listed does not necessarily match the number of associations indicated, because studies may contain multiple associations.
§ Percent values apply to the entire Human Development Index category and should be read down the column.
¶ Percentages may not add up to exactly 100 because of rounding.

associations were most often observed for employment as an indicator of SES (88 percent; 7/8). For medium- and low-HDI countries, positive associations were more common (49 percent and 60 percent in medium- and low-HDI countries, respectively), and in the case of medium-HDI countries, this reflected a large proportion of positive associations when income (63 percent; 17/27) and area-level indicators of SES (62 percent; 13/21) were used.

Associations based on measured data only

Associations based on measured indicators of body size only (e.g., measured height and weight, body fat based on measured skinfold thickness) were also examined for women ($n = 710$ associations), men ($n = 525$ associations), and both sexes combined ($n = 165$ associations). In relation to associations based on self-report indicators only (229 for women, 170 for men, and 115 for both sexes combined), the overall pattern of findings was quite similar (results not shown). One difference of interest is that among women from high-HDI countries, the proportion of negative associations was lower in the measured data subset (59 percent) than in the self-report data subset (71 percent). The proportion of positive associations among women from medium-HDI countries was also lower in the measured data subset (42 percent) than in the self-report data subset (70 percent); however, this latter value was based on only 10 associations.

DISCUSSION

These results update and build on our understanding of the relation between SES and body size, initially reviewed by Sobal and Stunkard (1). Overall, a primary observation was the gradual reversal of the social gradient in weight: As one moved from high- to medium- to low-HDI countries, the proportion of positive associations increased and the proportion of negative associations decreased, for both men and women. However, this finding masked nuances by sex and indicator of SES. With regard to sex, this updated review revealed a predominance of negative associations for women in countries with a high development status, although this finding (63 percent negative) was not as striking as that observed by Sobal and Stunkard (1), who observed 93 percent and 75 percent negative associations for women in the United States and other developed countries, respectively. Furthermore, when the sample was restricted to associations based on measured body size data only, the proportion of negative associations was further reduced to 59 percent. This could reflect the widespread and relatively nondiscerning nature of the current obesity epidemic: Although some demographic variation in obesity rates may be evident, virtually all social groups are increasingly affected to some extent, speaking to the existence of large-scale social drivers at work. Thus, although women in higher social strata in developed countries may still be more likely to value and pursue thinness (19), our obesogenic environment (20, 21) may make it increasingly difficult for women of any class group to maintain resistance.

However, since the inverse association remains the predominant finding among women from developed societies,

TABLE 2. Associations between socioeconomic status (SES) and body size* among men, according to Human Development Index status, SES indicator, and the nature of the SES-body size association

SES indicator	Nature of the SES-body size association									Total (n = 695)	
	Positive			Negative			Nonsignificant or curvilinear				
	No. of associations	%†	Reference no(s).‡	No. of associations	%†	Reference no(s).‡	No. of associations	%†	Reference no(s).‡	No. of associations	%§
High Human Development Index											
Area	0	0		0	0		3	100	48, 50, 52	3	1
Composite	7	16	58, 66, 280, 281	13	30	53, 54, 56, 58, 60–63, 69	23	53	53, 57, 58, 62, 64–66, 280–282	43	7
Education	14	6	75, 84, 95, 96, 137, 159, 163, 283, 284	126	50	53, 74, 81, 86, 87, 90–92, 96, 97, 100–102, 105, 107–112, 115–117, 120, 121, 124, 126–128, 130, 133–137, 140–142, 145–147, 152, 153, 155–159, 161, 164–166, 170, 176, 178, 285–293	114	45	52, 73, 74, 76, 84, 93–99, 102, 103, 105, 106, 115–117, 124, 126, 133, 137, 141, 142, 144, 150, 151, 161, 163, 170, 174, 175, 177, 182, 184, 185, 187, 280, 282–284, 287, 294–299	254	45
Employment	3	9	75, 187	2	6	105	28	85	52, 57, 77, 100, 105, 130, 152, 155, 156, 166, 175, 185, 188, 287, 291	33	6
Income	20	24	74, 98, 112, 128, 164, 184, 185, 187, 188, 195, 196, 200, 205, 206, 208, 283	12	14	74, 156, 165, 166, 177, 195, 200, 206, 207	51	61	52, 75, 87, 98, 99, 106, 109, 137, 140, 142, 151, 162, 166, 175, 177, 185, 187, 188, 195, 196, 198, 199, 202–205, 207, 208, 282, 283, 295	83	15
Occupation	7	6	54, 87, 98, 112, 215, 218	49	39	17, 92, 108, 112, 121, 155, 161, 174, 176, 184, 211, 213, 216, 222, 224–230, 286, 288, 299–304	70	56	17, 54, 66, 69, 77, 86, 90, 92, 96, 98, 99, 112, 130, 133, 140, 144, 150–152, 164, 165, 177, 202, 212, 213, 215, 217, 218, 223, 227, 229, 231, 232, 282, 295–297, 304, 305	126	22
Other	0	0		3	25	73, 285	9	75	70, 73, 166, 177, 202, 287	12	2
Possessions	2	20	54	4	40	54, 69, 155	4	40	52, 54, 165, 177	10	2
Overall	53	9		209	37		302	54		564	100¶
Medium Human Development Index											
Area	2	40	236, 237	0	0		3	60	236	5	4
Composite	5	83	239–241	1	17	306	0	0		6	5
Education	12	24	137, 245, 246, 248, 255, 263, 264, 295	3	6	263, 295, 307	35	70	137, 237, 246, 249, 250, 254, 255, 258–261, 267, 295, 308, 309	50	39
Employment	0	0		0	0		3	100	307, 309	3	2

Income	26	59	240, 249, 250, 267–271, 274, 295, 310	1	2	273	17	39	245, 246, 258, 260, 268, 269, 275, 295, 307	44	34
Occupation	4	27	267, 295	3	20	295, 308	8	53	213, 295, 308	15	12
Other	0	0		0	0		0	0		0	0
Possessions	1	20	257	0	0		4	80	246, 276	5	4
Overall	50	39		8	6		70	55		128	100¶
Low Human Development Index											
Area	0	0		0	0		0	0		0	0
Composite	0	0		0	0		0	0		0	0
Education	1	100	277	0	0		0	0		1	33
Employment	0	0		0	0		0	0		0	0
Income	1	100	277	0	0		0	0		1	33
Occupation	1	100	279	0	0		0	0		1	33
Other	0	0		0	0		0	0		0	0
Possessions	0	0		0	0		0	0		0	0
Overall	3	100		0	0		0	0		3	100¶

* Body size includes both continuous (e.g., body mass index) and categorical (e.g., obesity defined as body mass index $\geq$30 kg/m^2) measures.
† Percent values apply to each SES indicator and should be read across each row.
‡ The number of references listed does not necessarily match the number of associations indicated, because studies may contain multiple associations.
§ Percent values apply to the entire Human Development Index category and should be read down the column.
¶ Percentages may not add up to exactly 100 because of rounding.

some consideration of this finding is necessary. There is evidence from several countries (including Europe, the United States, Australia, and Canada) of a socioeconomic gradient in diet, whereby persons in higher socioeconomic groups tend to have a healthier diet, characterized by greater consumption of fruit, vegetables, and lower-fat milk and less consumption of fats (22). On the one hand, this reflects a person's income or economic capacity to purchase these foods, which have been shown to be more expensive than less nutritious food items (23–25). Research on gendered aspects of food and eating in families suggests that, despite structural changes in gender roles over recent decades, women often remain responsible for food purchase and preparation (26, 27); thus, these factors probably have some relevance to understanding the social gradient in weight among women from higher-income countries. However, given that income is not the only, or even the most consistent, inverse correlate of obesity/fatness among women in these countries, consideration of other mechanisms is also important. A useful framework here is the sociology of Bourdieu and his theory of class (22, 28–30). Of particular relevance is Bourdieu's concept of ''habitus,'' which refers to the embodiment of social structures in individuals. According to the concept of habitus, the body (inclusive of appearance, style, and behavioral affinities) is a social metaphor for a person's status. Thus, class or status is not just about money but rather comprises a constellation of attributes that Bourdieu calls ''capital,'' which may be economic, cultural, or social in nature. Furthermore, these forms of capital can take on symbolic value when they are recognized as legitimate; for example, a particular accent or a certain body shape/size may have prestige that is not necessarily in keeping with its economic dimensions (30, 31). From this perspective, a thinner body may be socially valued and materially viable to a greater extent for those women in higher socioeconomic strata, and even within obesity-promoting environments these factors could help maintain class differences for women, for whom thinness continues to be promoted as an ideal of physical beauty (32–34).

By examining patterns of association for different SES indicators, additional understanding is gained. For women in highly developed countries, negative associations were especially common when education, occupation, and area-level indicators of SES were used, all of which operate in plausible ways. The area-level indicators were primarily deprivation indices at the postcode level, and it is plausible that living in an affluent area conveys heightened exposure to and pressure for thinness (35, 36), as well as more opportunities for physical activity and easier local access to healthy foods (37–39). Regarding occupation, in line with research on stigma and discrimination associated with excess weight (40), it is possible that persons high in the occupational hierarchy may internalize the symbolic value of a thin body and a healthy lifestyle (in line with their class) and at the same time face exposure to a workplace environment that likewise promotes these values. For example, in a white-collar office environment with on-site exercise and shower facilities, it is easy to imagine social norms surrounding practices such as going to the gym during lunch hour. Educational qualifications, as a form of cultural capital

TABLE 3. Associations between socioeconomic status (SES) and body size* among both sexes combined, according to Human Development Index status, SES indicator, and the nature of the SES-body size association

SES indicator	Nature of the SES-body size association									Total (n = 280)	
	Positive			Negative			Nonsignificant or curvilinear				
	No. of associations	%†	Reference no(s).‡	No. of associations	%†	Reference no(s).‡	No. of associations	%†	Reference no(s).‡	No. of associations	%§
High Human Development Index											
Area	3	9	311	17	52	50, 312–320	13	39	311, 312, 314, 317–319, 321–323	33	18
Composite	0	0		2	50	62	2	50	324	4	2
Education	1	2	321	31	65	93, 140, 213, 312, 321, 325–344	16	33	213, 323–325, 328, 330, 332, 345–350	48	26
Employment	0	0		1	13	166	7	88	323, 325, 326, 336, 337	8	4
Income	5	8	203, 328, 348, 351	19	31	312, 328–330, 333, 340, 342, 343, 347, 350–355	38	61	140, 203, 213, 311, 324, 330, 336, 337, 347, 348, 350–352, 355–357	62	34
Occupation	1	4	334	16	59	213, 314, 334, 339, 358–361	10	37	213, 314, 321, 323, 324, 362	27	15
Other	0	0		0	0		1	100	335	1	1
Possessions	0	0		0	0		0	0		0	0
Overall	10	5		86	47		87	48		183	100¶
Medium Human Development Index											
Area	13	62	363–365	2	10	364	6	29	237, 363, 366	21	24
Composite	1	50	367	0	0		1	50	367	2	2
Education	8	32	268, 368–370	7	28	348, 366, 371	10	40	213, 237, 257, 348, 369, 372–375	25	29
Employment	1	50	371	1	50	371	0	0		2	2
Income	17	63	268, 274, 365, 368–370, 374–376	3	11	366, 370	7	26	213, 257, 348, 366, 369, 373	27	31
Occupation	3	38	369, 372	1	13	374	4	50	213, 257, 369, 372	8	9
Other	0	0		0	0		0	0		0	0
Possessions	0	0		0	0		2	100	377	2	2
Overall	43	49		14	16		30	34		87	100¶
Low Human Development Index											
Area	0	0		0	0		0	0		0	0
Composite	0	0		0	0		0	0		0	0
Education	0	0		0	0		1	100	378	1	10
Employment	0	0		0	0		0	0		0	0
Income	5	71	378, 379	0	0		2	29	379	7	70
Occupation	1	50	378	0	0		1	50	277	2	20
Other	0	0		0	0		0	0		0	0
Possessions	0	0		0	0		0	0		0	0
Overall	6	60		0	0		4	40		10	100¶

* Body size includes both continuous (e.g., body mass index) and categorical (e.g., obesity defined as body mass index $\geq$30 kg/m^2) measures.
† Percent values apply to each SES indicator and should be read across each row.
‡ The number of references listed does not necessarily match the number of associations indicated, because studies may contain multiple associations.
§ Percent values apply to the entire Human Development Index category and should be read down the column.
¶ Percentages may not add up to exactly 100 because of rounding.

(30, 31), may have implications for the extent to which someone is attuned to or influenced by societal standards of attractiveness and health messages regarding diet and physical activity, thereby underscoring recognition and pursuit of attributes that are valued in developed societies, such as health and a thin body. Education may also imply expectations for personal achievement, whether in a general sense or specific to health, weight, and physical appearance. Previous work has identified education as the SES variable most strongly associated with body dissatisfaction (19), and thus a constellation of attributes favoring pursuit of thinness among highly educated women is plausible.

For women in medium- and low-HDI countries, positive associations between SES and body size were most common. This is in line with Sobal and Stunkard's findings (1). In the present review, there were a sufficient number of associations from medium-HDI countries to examine different indicators of SES; those results revealed that income and material possessions were the two indicators most likely to show a positive association. This probably reflects the relatively more important role of the economic or material dimension of class in the developing world: Where food is less ubiquitous, the ability to afford food is an important factor in the socioeconomic patterning of weight. As Monteiro et al. (12) suggested, patterns of high energy expenditure among the poor and cultural values favoring a larger body size may also continue to contribute to the positive associations observed in lower-income countries. Another interesting observation within the medium-HDI countries was that for certain indicators of SES (education, occupation, and area-level indicators), the association was more often negative than positive, suggesting that the social patterning of weight-related attributes is perhaps in transition across the development spectrum. Monteiro et al. (12), in their review of the socioeconomic patterning of obesity in developing countries, similarly alluded to a transition, highlighting a shift of obesity towards persons with low SES (i.e., a shift from a positive association to a negative association) as a country's annual gross national product increases; this is consistent with our finding that associations are much more often negative in medium-HDI countries (many of which would have been included in Monteiro et al.'s ''developing country'' category) than in low-HDI countries.

Thus, on the one hand, there exist large-scale factors contributing to dramatic increases in obesity worldwide, particularly in the developing world (5, 15); on the other hand, there are forces acting to shift the burden of obesity onto the poor within developing countries. The factors contributing to rising obesity rates worldwide are believed to include large-scale societal and nutritional changes having to do economic growth, modernization, and globalization of food markets (5, 13, 14). These are well-illustrated by case studies of societies in developmental transition. For example, exorbitantly high levels of excess weight among residents of Kosrae, Micronesia (nearly 90 percent of adults are overweight) have been attributed to a constellation of factors related to foreign dependence and influence, the global food trade, and massive associated social changes—epitomized by the popularity and prestige of imported foods such as Spam (Hormel Foods Corporation, Austin, Minnesota) and potato chips on an island that is overrun with breadfruit and coconut and has one of the world's richest sources of tuna (41, 42). However, the present results and those of Monteiro et al. (12) suggest that the impact of these factors within societies is not equal, and that the burden in fact is falling disproportionately on persons of lower SES within middle-income countries. Hawkes (13) points out that key processes related to globalization and the nutrition transition (including production and trade of agricultural goods, foreign direct investment in food processing and retailing, and global food advertising and promotion) serve to worsen inequalities in diet between the rich and the poor. In particular, whereas high-income groups (especially in developing countries) tend to benefit from a more dynamic marketplace, lower-income groups are more likely to bear the brunt of economic and cultural convergence towards low-quality diets (e.g., use of inexpensive vegetable oils and *trans*-fats), which in some cases are popular because of earlier promotion and popularity of these products among the rich (13). Adding to this, there is evidence of global exportation of the thin ideal of beauty in the form of Western media images. In their work with ethnic Fijian schoolgirls, Becker et al. (43, 44) observed an increase in disordered eating attitudes and behaviors over the 3 years following introduction of Western television. Within this context of rapid social change in a culture that did not traditionally value thinness, girls' comments indicated a desire to emulate television characters. If the situation in higher-income countries is any indication, pursuit of thinness as an aesthetic ideal may well become an upper-class aspiration in the developing world, and potentially further exacerbate the emerging inverse social gradient in weight observed in this review.

Among men, associations in high- and medium-HDI countries were most often nonsignificant or curvilinear. This finding is similar to Sobal and Stunkard's results (1) in that these authors also detected inconsistency among male samples. However, when examining those effects that did emerge as significant and linear, it becomes apparent that indicator of SES is important. For example, for men in high-HDI countries, a negative association was common when education was the indicator of SES, yet associations with income were often positive in nature (in nearly one quarter of associations), even though the overall proportion of positive associations for men in high-HDI countries was much lower (less than 10 percent). This direct effect of income was also apparent in men from medium-HDI countries. This seemingly contradictory finding may be reconciled by drawing on the work of Power (30) and Bourdieu (31) as above, particularly the notion of habitus and Bourdieu's theory of the body as a symbolic metaphor. While body size and shape has symbolic value for both men and women, the dimensions of the valued body differ between the sexes. For men, more so than for women, a larger body size is likely to be valued as a sign of physical dominance and prowess. This is consistent with research on body image in children, which shows that while girls often wish to be thinner, boys often wish to be larger and more muscular (45). With men being the traditional wage earners in families, it is plausible that income and pursuit of physical dominance remain linked.

One reason why the associations in general for men are less consistent than those for women may be that for men, contrary forces are at work: weight-based stigma and discrimination on the one hand (which, though it may be more salient for women, remains a societal phenomenon) and the valuation of a large body size on the other as an indication of power and dominance.

Some limitations of the present review must be acknowledged. First, the restriction to English-language articles probably resulted in missing some studies from countries with a lower status of development. However, through the use of three categories of HDI status, it was possible to detect graded associations across these categories (e.g., an increasing proportion of positive associations from high to medium to low), which lent support to the findings detected in the small number of associations from lower-HDI countries. Second, because of the present review's reliance on published articles, there may have been an element of publication bias, whereby articles that contain significant effects tend to be more likely to be published than articles containing nonsignificant results (46). However, it is believed that this bias may be minimal, for two reasons: Nonsignificant results were actually quite plentiful in some subgroups (e.g., men in high- and medium-HDI countries), and many studies contained other findings not extracted for this review (due to irrelevance) that could have influenced publication likelihood, even if the body mass index-body size association was nonsignificant.

A third limitation is that associations based on child samples were not included in this review, largely because of the enormity of the task (as it stands, over 300 studies were scrutinized). Certainly it is important to examine the SES-body size association among children, since this can provide clues as to the origins of social patterning of weight, as well as possibly foreshadow secular trends in this association. Relatedly, there is the issue of age variation within the adult samples examined and whether this may have influenced the overall pattern of findings. In a follow-up examination of the associations that adjusted for age among women (n = 511) and men (n = 424) in relation to those that did not adjust for age (428 in women and 271 in men), the overall pattern of findings in high-HDI countries was very similar. For women in medium-HDI countries, however, the proportion of positive associations was lower (37 percent vs. 49 percent) and the proportion of negative associations was higher (32 percent vs. 22 percent) in the age-controlled data set than in the non-age-controlled data set. For men in medium-HDI countries, a similar but less pronounced pattern was found for the proportion of positive associations: 37 percent in age-controlled data versus 43 percent in non-age-controlled data. Thus, there is the suggestion that age may be an effect modifier (47) whereby the SES-obesity relation varies across age in medium-HDI countries, particularly for women.

A fourth limitation is that results of studies were tabulated and synthesized descriptively; no meta-analysis was conducted, and all associations were weighted equally. Although there may have been benefits associated with a more sophisticated analysis (e.g., estimation of overall effect magnitudes), the aim of this review was to describe cumulative patterns in the literature in a way that facilitated continuity between this study and Sobal and Stunkard's original work (which was also descriptive).

Finally, this review focused primarily on cross-sectional associations. While there are certainly limitations associated with interpreting cross-sectional associations (e.g., one cannot draw any conclusions regarding causality or temporality), a large benefit of using cross-sectional studies is that, because of the very large number available, it was possible to examine patterns across a variety of SES indicators and across three categories of HDI status, in a way that would not have been possible had more stringent exclusion criteria been employed. Furthermore, high-quality reviews that tapped into the longitudinal dimensions of SES and weight have previously been published (10, 11); thus, the present review can be viewed as complementary to this other work.

In conclusion, the current review updates the seminal work of Sobal and Stunkard (1) and builds on this work by incorporating multiple indicators of SES and three graded categories of societal development status. For a number of reasons, this work was timely. When Sobal and Stunkard published their review in 1989, they reported that of the 144 studies included, most did not specifically set out to study the relation in question (SES-obesity); rather, most studies investigated the association in the course of examining other issues (1). In contrast, there have since been a large number of studies that focused specifically on the social patterning of weight. Therefore, this topic is currently of great interest, reflecting the highly topical nature of both obesity and social/socioeconomic influences on health. This review represents an exhaustive search of a diverse array of databases and thus makes an important contribution to this exciting research area.

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