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Does weight bias depend on educational attainment and level of income? A systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-027673
Article Type:	Research
Date Submitted by the Author:	12-Nov-2018
Complete List of Authors:	Bernard, Marie; Leipzig University Medical Center , IFB Adiposity Diseases; SRH University of Applied Health Sciences, Fankhänel, Thomas; SRH University of Applied Health Sciences, Riedel-Heller, Steffi; University of Leipzig, Institute of Social Medicine, Occupational Health and Public Health (ISAP), Medical Faculty Luck-Sikorski, Claudia; SRH University of Applied Health Sciences; University of Leipzig, Integrated Research and Treatment Center (IFB) Adiposity Diseases
Keywords:	obesity, stigma, discrimination, education, income

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Does weight bias depend on educational attainment and level of income?

A systematic review

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Word count 3,792

Abstract

Objectives: Obesity is considered a worldwide health issue, not only because of its health-related consequences, but also because of its impact on social status as a result of stigma. The aim of this study is to review the quantitative state of research regarding to socioeconomic characteristics' impact on weight-related attitudes. Based on Bourdieu's Theory of Class and his concept of "habitus", it is assumed that people with a higher level of education and income show greater and more negative attitudes toward people with obesity.

Method: A systematic literature review was conducted in 2017 using PubMed, PsychINFO, Web of Science, and the Cochrane Library. Fifteen studies that measured weight bias and either educational attainment or level of income were included in the analysis.

Results: The results of the studies included were inconsistent: six of these studies were found to support the hypothesis, whereas two of the studies contradicted it. The remaining seven studies did not show any significant correlation between weight bias and either education or income.

Conclusion: In light of these inconclusive and overall heterogeneous results, we cannot determine a reliable correlation between level of education or income with weight bias. Controversial findings might be caused by cultural and governmental differences. Furthermore, educational attainment seems to be more likely to predict weight bias than income. The review revealed a lack of research when it came to examining the impact of socioeconomic capital on weight bias.

Keywords: obesity, stigma, discrimination, education, income

Strength and limitations of this study

- Systematic review of the correlation between weight bias and socioeconomic status
- Considering macro level structures as moderating determinants of weight bias
- Attempt to explain heterogeneous and inconclusive results by appealing to governmental and cultural differences

Introduction

According to the World Health Organization (WHO), the worldwide prevalence of obesity, defined by a body mass index (BMI) of over 30 kg/m², nearly tripled between 1975 and 2016 [1]. To give but two examples, current data reveal an obesity rate of over 21% in Germany and 37.7% in the US [2, 3]. In regard to its escalating rate, obesity can be classified as a worldwide health issue, especially because it is associated with numerous comorbid diseases, such as diabetes mellitus, cardiovascular diseases, and certain forms of cancer [4].

Not only health-related consequences are connected to obesity, but also psychological implications that affect those concerned on a social level [5]. In particular, obesity is classified as a stigmatized condition. Therefore, being obese is a characteristic that sets those affected apart from people with normal weight. Since obesity is mislabeled as a self-inflicted situation, numerous negative stereotypes, such as laziness, lack of willpower, unhealthy lifestyle, and being unintelligent are associated with the condition [6]. Stigmatization leads to discriminating behavior toward people with obesity in the form of mistreatment in several areas of life, such as labor market, healthcare, and educational system [6, 7].

The systematic review of Spahlholz [8] revealed an increased perceived discrimination toward people with obesity in comparison to people with normal weight, especially toward people with more extreme obesity (BMI >35 kg/m²) as well as toward women. Moreover, the prevalence of weight-related discrimination accelerated over time. In the US, the prevalence of weight-related discrimination was nine times higher (66%) in 2005 than in 1995 (7.3%) [7, 8] and is thus similar to the rate of racial discrimination, particularly against women [9]. To prevent discriminating behavior, it is necessary to understand the origin of stigma, which can be seen as the catalyst of structural discrimination.

Determinants of stigmatizing attitudes and weight bias can be found, for example, in sociodemographic variables. There is some evidence that older age is associated with greater stigmatizing attitudes [10–12] and stronger evidence that men show greater weight bias than women [13–16]. When looking at the body and beauty

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3 perception of people, the cultural framework also needs to be considered as a
4 determinant of stigma. According to Bourdieu, the predominant cultural framework
5 determines which values and characteristics can be seen either as desirable or traits
6 to be stigmatized [17]. Depending on regional characteristics, weight is perceived as
7 a sign of class distinction. In undeveloped countries, overweight was associated
8 positively with well-being and wealth, while in developed countries a negative view of
9 being overweight was widespread. Thus, in developed countries thinness has been
10 viewed as a sign of beauty, success, and an overall high (socioeconomic) status [18].
11 Although, in the last decades the perception of obesity or rather slim-body ideals in
12 developing countries might have changed [19, 20], results indicate that educational
13 attainment and level of income seem to be relevant in regard to divergent weight
14 bias.

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17 Although, socioeconomic variables and obesity correlate closely, the impact of
18 educational attainment and level of income on weight bias remain ambiguous.
19 Several studies have shown the negative impact of being overweight on the labor
20 market, especially for women [21, 22] as well as in the education system [23]. In
21 addition, a lower level of education and income is associated with obesogenic
22 behavior such as a poor diet and a lack of exercise caused by factors such as stress
23 [24]. Moreover, Bourdieu [25] sees in socioeconomic class the most decisive
24 determinant of healthy lifestyle. While people that belong to the working class
25 preferred tasty and nutritious food, people from the upper-middle class preferred
26 tasty food that can be described as light, healthy, and low in calories, according to his
27 study. Subsequently, people with a higher level of education and income might
28 choose a healthier lifestyle in order to distance themselves from people with obesity
29 [26].

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32 As a superior framework to generate missing hypotheses, Bourdieu's Theory of
33 Class can be applied [25]. In accordance with his concept of "habitus", a person's
34 general attitude, lifestyle, and even body shape can be seen as a metaphor for social
35 status [18]. Furthermore, Bourdieu considers stigma as a form of symbolic power and
36 a tool to serve the interests of the powerful [27]. Phelan and colleagues [28] continue
37 with his line thought and presented three motives of stigma, namely *keeping people*

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3 *in, away, or down.* Particularly, *keeping people down* applies to the review's
4 theoretical framework. Link and Phelan [17] discuss stigma as an instrument of a
5 dominant group to keep another group down in order to attain or rather maintain a
6 high social status, wealth, and power. However, a person's educational attainment
7 and level of income are mainly invisible characteristics; thus, there are other
8 attributes that more readily show social status. Assuming that obesity is perceived as
9 a metaphor for lower social status, groups with higher social status might be aware of
10 this link and keep people with obesity down in order to empower themselves. In this
11 review, it is therefore assumed that people with a higher level of education and
12 income display negative attitudes toward people with obesity in comparison to people
13 with lower educational attainment and income. The impact of educational attainment
14 and level of income on weight bias will be examined and compared.

25 Based on a sociological perspective, this systematic literature review attempts to
26 outline the current state of research and reveal the relationship between weight bias
27 and educational attainment and/or level of income. Such as Tyler and Slater [29]
28 criticized inter alia "*that one of the major limitations of existing understandings of*
29 *stigma is the ways in which they have 'bracketed off' key questions, such as where*
30 *stigmatizing attitudes come from, how and by whom is stigma crafted, mediated,*
31 *produced and why [...].*", the general aim of this review is to identify social and
32 economic groups that stigmatize and discriminate against those who are obese. In
33 the future, this information could help researchers to develop and implement
34 interventions in a more targeted manner.

43 **Methods**

44 Search Strategy

45 A systematic review of published studies reporting anti-fat attitudes held by differing
46 socioeconomic status groups was conducted by using the relevant scientific
47 electronic databases: PubMed, PsychINFO, Web of Science, and the Cochrane
48 Library. The review followed the Prisma Guidelines [30].

49 The systematic review of literature was performed independently by two reviewers
50 from November 2016 until January 2017 using the following key words: stigma*,
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3 discrimination, "weight bias", or prejudice; education*, income, salary, wage, status,
4 socio-economic, socioeconomic*, SES, sociodemographic, or socio demographics;
5 and obes*, overweight, or fat. Giving of the very high number of results, the search
6 was limited to the publications' titles and abstracts. Only work published in English or
7 German was included. There was no restriction in regard to the year of publication.
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10 11 12 Data extraction

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14 The systematic search of literature revealed 1,788 studies, whereby 1,234 studies
15 remained after removing duplicates. Furthermore, 1,100 studies were excluded
16 because screening their titles and abstracts for eligibility revealed no association to
17 the research question that will be examined in this review. Disagreement and
18 uncertainty between the two reviewers over the eligibility of certain abstracts were
19 resolved by reinspecting the papers in detail and discussing disparate perspectives.
20 For the remaining 134 studies, full papers were screened in detail to assess their
21 eligibility by applying the following inclusion and exclusion criteria. The stages of the
22 systematic literature search are provided in Figure 1.
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30 31 Inclusion criteria

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33 Studies were only included if they investigated weight bias in form of stigmatizing
34 attitudes, discrimination (e.g., measured, for example, by policy and law support), or
35 beliefs about causes of obesity. These causes included a lack of willpower as a proxy
36 measure for stigmatizing attitudes. Furthermore, studies included had to report some
37 kind of association between weight bias and either educational attainment or level of
38 income.
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43 44 Exclusion criteria

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46 The following exclusion criteria were used to eliminate studies that were not
47 applicable: (a) studies with a sample of health care professionals, dietitians,
48 psychologists, and physical educators; (b) studies that investigated stigmatizing
49 attitudes of children and/or adolescents; (c) studies that investigated stigma toward
50 childhood obesity; (d) studies with an overweight and/or obese sample that
51 investigated perceived stigmatization; (e) studies with a homogenous sample in
52 regard to educational attainment (e.g., students) or level of income; (f) studies that
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3 investigated weight bias toward extended stigma groups (e.g., obese and binge
4 eating); and (g) reviews or qualitative studies.

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6 The stages of the systematic literature search are provided in Fig. 1. In summary, 41
7 studies were excluded because they did not report the participants' educational
8 attainment or income. In addition, 8 studies provided a lack of information with regard
9 to the samples' socioeconomic variance and 21 studies were excluded because of
10 the samples' characteristic (overweight/obese sample n=10; children/adolescents
11 sample n=11). Two studies were excluded because they followed a qualitative
12 approach, and 22 studies were excluded because they could be categorized as
13 reviews. Twenty-one studies were found that did not meet the criteria for the aimed
14 outcome of weight bias. Two studies were neither published in English nor in
15 German. Moreover, one paper had to be excluded because of its lack of academic
16 background.
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27 After excluding the studies that did not meet our criteria, 15 studies were identified as
28 relevant for in-depth investigation. Therefore, sampling characteristics, study design,
29 assessment of weight bias, and measurement of educational attainment and income
30 were systematically examined.
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34 Patient and Public Involvement

35 Within this study no data was assessed. We conducted a systematic review and
36 analyzed therefore data that has already been collected. Thus, patients were not
37 involved in this study.
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43 **Results**

44 The 15 studies included were tabulated according to the following characteristics:
45 origin of the sample, sample size (N), sample characteristics, study design,
46 instruments to assess weight bias, educational attainment or income, and a brief
47 summary of results. Studies reviewed in detail are tabulated by either educational
48 attainment (Table 1) or by level of income (Table).
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Study characteristics

All relevant study characteristics are summarized in Table 1 and Table , respectively. Six out of fifteen studies are based entirely on an American sample [31–36, 36]. Two other studies are based on an American and an Icelandic adult sample [37, 38]. These two studies also provided data based on a Canadian sample of health care professionals and American, Australian, and Icelandic student samples that did not meet the inclusion criteria and therefore all four samples had to be excluded. Two studies were based on a German sample [10, 39], and five studies based on one sample, from Paraguay [40], Mexico [41], Sweden [42], Denmark [43], and Great Britain [44] respectively. The study by [40], based on a Paraguayan sample also provided data of a comparison group of US-undergraduate students that was not considered in the analysis because of the homogenous study sample in terms of educational attainment. The fifteen studies included showed a wide variation of sample sizes ranging from 146 [36] to 3,331 participants [32].

Since the aim of the study was to outline the impact that socioeconomic status in form of educational attainment and level of income have on weight bias, attention was paid to a variation in these variables within the samples. The studies included therefore focused either on a population-based sample [10, 33, 34, 39, 42] or an adult sample [31, 32, 36–38, 43]. Although Jiminez-Cruz and colleagues [41] investigated stigmatizing attitudes of an entirely low-income sample, but divided the socioeconomic factors (level of education and income) into five and four categories respectively; thus, variation within the sample could be ensured. Moreover, an investigation of weight bias in different gradations of lower status groups could provide further insight into the topic. In one study [35], the general population was included, whereby the overweight participants received an alternative questionnaire assessing the perceived stigmatization and not their stigmatizing attitudes toward obesity. Therefore, only the normal weight sample could be included.

The distribution of women and men was equally considered in the majority of studies, even though more women than men were included. However, two studies posed an

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3 exception. The study of Brewis et al. [40] and the study of Jiminez-Cruz [41]
4 investigated only the stigmatizing attitudes of female participants.
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Table 1. Summary of Selected Studies: Weight Bias Depending on Educational Attainment

Study	N	Sample description	Study Design	Instruments	Weight bias	Educational attainment	Association education/weight bias	Direction of Correlation
[35]; USA	396	General, not overweight population (ø age: 42.7 years; 43.7% female)	Experimental online survey	Short-FPS[45]		Educational attainment	FPS: No	–
[31]; USA	1,118	US adult sample (ø age: 43.8 years; 50.2% female)	Online survey	Opinions about obesity as a disease [31]		Educational attainment (High School or less, Some college/Technical or vocation degree, college graduate or higher)	No	–
[37]; USA and ISL	899	US adult sample (ø age: 40.9 years; 46.1% female)	Online survey	Short-FPS [45]; UMB-FAT [46]		Educational attainment (High school or less; some college/technical or vocation degree; College graduate or higher)	FPS: inconsistent findings; greater fat phobia in some college vs. reference category (high school or less) (p<0.05) UMB-Fat: inconsistent findings; greater stigma in some college vs. reference category (high school or less) (p<0.05)	–
	659	ISL adult sample (ø age: 45.9 years; 55.1% female)					FPS: No UMB-Fat: Yes; Higher education leads to higher stigmatizing attitudes (p<0.05)	Positive
[34]; USA	981	US representative sample (62% female)	CATI	Beliefs about obesity as a burden for society Beliefs about the controllability of obesity		Educational attainment (less than some high school; High-school graduate; some college; higher than a college degree)	Beliefs about obesity as a burden for society: Yes; Higher educational attainment leads to higher agreement on stigmatizing statement Beliefs about the controllability: No	Positive –
[39]; GER	3003	population based (ø age: 51.7 years; 52.8% female)	CATI with vignette-based approach	Short-FPS[45]		Educational attainment (no degree, 9th grade degree; 10th grade degree, 12th grade degree)	Yes; Higher educational attainment leads to less stigmatizing attitudes	Negative
[10]; GER	1,000	Population based sample (ø age: 45.9 years; 56.9% female)	CATI	WCB [47]; Support for obesity prevention		Educational attainment (low= <13 years of education high= ≥ 13 years of education)	WCB: Yes; Higher educational attainment leads to less stigmatizing attitudes Support for obesity prevention: No	Negative –
[40]; PRY	200	Women (ø age: 38.9 years)	Questionnaires in personal interview	ATOP [48]; IAT [49]		Educational Attainment (years of formal education)	ATOP: No IAT: No	– –
[42]; SWE	2,436	Representative Swedish population aged 25-64 (ø age: 47.8 years; 63% female)	Face-to-face interview	ATOP [48]		Educational attainment (low; medium; high)	ATOP: No	–

Table 1 (continued)

Study	N	Sample description	Study Design	Instruments	Weight bias	Educational attainment	Association education/ weight bias	Direction of Correlation
[44]; GB	198	Community-based (ø age: 32.58 year; 50.5% female)	Paper-pencil questionnaire	PFRS [50]		Educational attainment	No	–
[41]; MEX	1,100	Women aged 18-40 of low SES (ø age: 37.5 years)	Questionnaires in personal interviews	Beliefs about the causes of obesity		Educational attainment (none, some elementary, elementary, middle, high school)	Yes; Higher education leads to higher agreement with stigmatizing statements (self-responsibility as cause for obesity) (P<0.001)	Positive
[32]; USA	3,331	Adults (age 21-65; 61.9% female)	Online survey	Support for three weight-related antidiscrimination laws 1.Law: protections for people with disabilities 2.Law: civil rights statutes 3.Law: reducing weight-based workplace discrimination		Educational attainment (High school or less; some college/ technical or vocation degree; College graduate or higher)	Chi-square test: Yes; Higher education leads to less support for disability and civil rights for people with obesity	Positive
							Logistic regression model: Yes; Higher education leads to less support for disability and civil rights for people with obesity	Positive
[38]; USA and ISL	893	US adult sample (ø age:40.9 years; 46.1% female)	Online survey	Support for policies/laws to prohibit weight discrimination (antidiscrimination laws specific to employment/ broader antidiscrimination laws and policies)		Educational attainment (High school or less; some college/technical or vocation degree; College graduate or higher)	No	–
	658	ISL adults sample (ø age:45.9 years; 55.1% female)		Assessing support for measures to prohibit weight discrimination by evaluating 6 different laws		Educational attainment (High school or less/ College)	Yes; Higher education leads to less agreement with Broad Policies/Laws	Positive
[33]; USA	1,001	Population based sample (ø age:43.8 years; 51% female)	Online survey	Attitudes toward weight-loss surgery & medical treatment of obesity		Educational attainment (High School; college degree; Postgraduate degree)	Yes; Higher education leads to less agreement with antidiscrimination laws	Positive
[43]; DNK	1,003	Citizens aged 18-65	Online survey			Educational attainment	No	–

Note: Positive = demonstrates greater anti-fat attitudes with increasing educational attainment; Negative = demonstrate greater anti-fat attitudes with decreasing educational attainment; N = sample size; FPS = Fat Phobia Scale; UMB = Universal Measure of Bias; WCB = Weight Control/Blame of the Anti-Fat Attitudes Test; ATOP = Attitudes to Obese People; IAT = Implicit Association Test; PFRS = Photographic Figure Rating Scale; SES = Socioeconomic status

Table 2. Summary of Selected Studies: Weight Bias Depending on Level of Income

Study	N	Sample description	Study Design	Instruments	Weight bias	Level of income	Association level of income/ weight bias	Direction of Correlation
[35]; USA	396	General, not overweight population (ø age: 42.7 years; 43.7% female)	Experimental online survey	Short-FPS [45]		Annual household income	FPS: No	–
[36]; USA	272	US adults (ø age:32.7 years; 64% female)	Questionnaire study with vignette-based approach	UMB [46]; Belief in stereotypes; Acceptability of weight stigmatization		Family income level (divided in seven categories including the category "I don't know")	UMB: No Beliefs in stereotypes: No Acceptability of weight stigmatization: No	–
	146	US adults (ø age:33.2 years; 63.6% female)					UMB: No Beliefs in stereotypes: No Acceptability of weight stigmatization: No	–
[31]; USA	1,118	US adult sample (ø age:43.8 years; 50.2% female)	Online survey	Opinions about obesity as a disease [31]		Household income (divided in five categories)	No	–
[34]; USA	981	US representative sample (62% female)	CATI	Beliefs about obesity as a burden for society		Income (divided in six categories)	Beliefs about obesity as a burden for society: Yes; A higher income level leads to higher agreement on stigmatizing statement	Positive
				Beliefs about the controllability of obesity			Beliefs about the controllability: No	–
[39]; GER	3003	population based (ø age:51.7 years; 52.8% female)	CATI with vignette-based approach	Short-FPS [45]		Income (divided in four categories)	No	–
[10]; GER	1,000	Population based sample (ø age: 45.9 years; 56.9% female)	CATI	WCB [47]; Support for obesity prevention		Household income (low=2.000€; high>=2.000€)	WCB: No Support for obesity prevention: Yes; Higher income leads to higher financial support (P<0.01)	Negative
[41]; MEX	1,100	Women aged 18–40 of low SES (ø age: 37.5 years)	Questionnaires in personal interviews	Beliefs about the causes of obesity		Weekly income (divided in four categories)	No	–
[42]; SWE	2,436	Representative Swedish population aged 25–64 (ø age: 47.8 years; 63% female)	Face-to-face interview	ATOP [48]		Yearly income	ATOP: No	–

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Table 2 (continued)

Study	N	Sample description	Study Design	Instruments	Weight bias	Level of income	Association level of income/ weight bias	Direction of Correlation
[32]; USA	3,331	Adults (age 21-65; 61.9% female)	Online survey	Support for three weight-related antidiscrimination laws 1. Law: protections for people with disabilities 2. Law: civil rights statutes 3. Law: reducing weight-based workplace discrimination		Household income (divided in five categories)	Chi-square test: Yes; Higher income leads to less support for disability right and civil rights for people with obesity Logistic regression model: No	Positive -
[33]; USA	1,001	Population based sample (ø age: 43.8 years; 51% female)	Online survey	Assessing support for measures to prohibit weight discrimination by evaluating 6 different laws		Annual income (divided in five categories)	Yes; Higher income leads to less agreement with antidiscrimination laws	Positive
[43]; DNK	1,003	Citizens (age 18-65)	Online survey	Attitudes toward weight-loss surgery & medical treatment of obesity		Income	No	-

Note: Positive = demonstrates greater weight bias with increasing level of income; Negative = demonstrate greater weight bias with decreasing level of income; N = sample size

Instruments

Educational attainment and level of income

Fifteen studies were found that assessed attitudes toward obesity in association with participants' educational attainment and/or level of income. Out of fifteen studies, fourteen reported the participants' educational attainment [10, 31–35, 37–44]. Depending on the origin of the sample and the analogous countries' educational system, categories were formed or years of educational attainment were gathered.

From fifteen studies, eleven assessed participants' level of income [10, 31–36, 39, 41–43]; therefore, income was either assessed by the annual, weekly, household, or individual income.

Weight Bias

The studies included were divided with regard to the dependent variable (weight bias) into two groups. The first group consists of studies that investigated participants' discriminatory attitudes toward people with obesity [32, 33, 38, 43, 44] the second group included studies that examined either participants' stigmatizing attitudes or participants' beliefs about the causes of obesity [10, 31, 34–37, 39–42, 42, 44]. As described before, beliefs about the causes of obesity in form of evaluating obesity as a controllable condition – which is supposedly preventable by a higher extent of self-discipline – can consequently be seen as one decisive factor in determining stigmatizing attitudes [51]. The instruments used in both groups are presented in Figure 2.

Findings

The studies included showed a very heterogeneous picture regarding their results. Eight out of the fifteen studies significantly associated educational attainment with stigmatizing and/or discriminatory attitudes toward people with obesity [10, 32–34, 37–39, 41]. These studies are presented in Table 3.

Associations between educational attainment and weight bias

Six of the overall fifteen studies showed a positive association between higher educational attainment and each of the following three factors: greater stigmatizing attitudes, higher perceptions of personal responsibility, and lower support for antidiscrimination measures [32–34, 37, 38, 41]. However, two German studies [10,

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3 39] showed an inverse correlation. Both of these studies found evidence that higher
4 education is associated with lower stigma [39] and less belief in individual
5 responsibility [10] for an obese condition.
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8 9 Associations between level of income and weight bias

10 Three out of 15 studies showed a significant association between income and weight
11 bias [10, 32–34, 38, 39, 41]. Two American studies [10, 32–34, 38, 39, 41] revealed
12 higher weight bias with increasing income, whereas one German study [10] found an
13 inverted association.
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18 Two additional studies [37, 38], using the same instruments and the same US and
19 Iceland sample, found no significant association between weight bias and
20 educational attainment in the US sample, but did find an association in the Icelandic
21 sample. The statistical analysis of these two studies revealed significant correlation
22 between educational attainment and discriminating ($p<0.01$) and stigmatizing
23 ($p<0.05$) attitudes, respectively, in the Icelandic sample [37, 38].
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Table 3. Studies That Show Significant Associations Between Weight Bias and Educational Attainment or Level of Income

Study	Direction of correlation	Instrument Weight Bias	SES indicator	Result	Adjusted for
[39]	Negative	Short-FPS	Education	Higher educational attainment leads to lower stigmatizing attitudes	Gender, age, income, residence, emigrational background
[10]	Negative	WCB	Education	Higher educational attainment leads to less stigmatizing attitudes (P<0.001)	Causal attributions to behavior, Labeling obesity as an illness, Age, Causal attributions to heredity
[37]	Positive	UMB-Fat	Education	Higher educational attainment leads to higher stigmatizing attitudes (ISL sample; P<0.05)	Gender, race/ethnicity, BMI, perceived causes of obesity, weight-related attributions
[41]	Positive	Beliefs about the causes of obesity	Education	Higher educational attainment leads to greater belief in individual responsibility (P<0.001)	Unadjusted
[34]	Positive	Belief in obesity as a burden for society	Education	Higher educational attainment leads to greater belief in statement "Obesity is a major burden to society in terms of healthcare costs" (P<0.01)	Race/ethnicity, sex, income, employment, age group, marital status, BMI, smoking status
[32]	Positive	Support for weight-related laws	Education	Higher educational attainment leads to lower support for weight-related laws (P<0.01)	Other socio-demographic variables
[38]	Positive	Support for weight-related laws	Education	Higher educational attainment leads to less support for weight-related laws (P<0.01)	Sex, age, race/ethnicity, BMI
[33]	Positive	Support for weight-related laws	Education	Higher educational attainment leads to lower support for weight-related laws	Sex, body weight, age, education, income, race, political affiliation, history of weight-based victimization
[10]	Negative	Financial support of obesity prevention	Income	Lower income leads to lower financial support (P<0.01)	Unadjusted
[34]	Positive	Belief in obesity as a burden for society	Income	Yes; A higher income level leads to greater belief in statement "Obesity is a major burden to society in terms of healthcare costs" (P<0.05)	Race/ethnicity, sex, education, employment, age group, marital status, BMI, smoking status
[33]	Positive	Support for weight-related laws	Income	Higher income leads to lower support for weight-related laws	Sex, body weight, age, education, income, race, political affiliation, history of weight-based victimization

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Discussion

The systematic literature review conducted reveals heterogeneous results based on factors such as country of origin, study type, and instruments used. Overall, eight out of the fifteen studies showed that weight bias is significantly associated with either educational attainment or level of income. Of these eight studies, six, based on American [32–34, 38, 41], Icelandic [37, 38], or Mexican [41] samples, indicate support for the working hypothesis that weight bias is in fact greater with increasing educational attainment or level of income. In contrast, two German studies [10, 39] found the reverse association, i.e. diminished weight bias with increasing educational attainment or level of income. However, the remaining seven studies did not show any significant association between weight bias and socioeconomic determinants. The heterogeneous and inconclusive results might be caused by diverging study designs, sample sizes, and instruments assessing weight bias, educational attainment, and level of income. In light of these inconclusive and overall heterogeneous results, a reliable correlation between level of education or income with weight bias cannot be determined.

Studies that did not show a significant association between weight bias and either educational attainment or level of income excluded the overweight portion of the sample [35] or were characterized by a small sample (ranging from n=146 to n=396) size [35, 36, 40, 44]. Furthermore, the association between weight bias with either educational attainment or level of income were not seen in instruments such as the Attitudes to Obese People scale (ATOP) [40, 42], the Implicit Association Test (IAT) [40] agreement ratings as to whether obesity can be classified as a disease [31], and measurement of attitudes toward weight-loss surgery and medical treatment [43].

However, it remains unclear why in the eight studies that indicate significant associations, the correlations between weight bias and socioeconomic variables found seem to be inconsistent. American, Mexican, and Icelandic studies were found to support the working hypothesis, whereas two German studies revealed findings to the contrary. These contradicting findings might be ascribed at a macro level to

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3 Bourdieu's theory about how cultural frameworks determine how certain values and
4 characteristics are perceived. It can be assumed that cultural frameworks shape
5 governmental systems and are strengthened at the same time through them,
6 especially through the national health and welfare systems. Tyler and Slater [29], for
7 example, outline the political and social function of stigma as a form of power. They
8 discuss macro level structures, particularly those used actively and passively by
9 governments, as determinants shaping stigmatizing attitudes, a level of
10 understanding often left out in social psychology. Hence, stigma is not only an
11 instrument used by individuals to enforce personal interests but also one put in place
12 (intended or not) by governments.
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21 Since all four counties here discussed can be considered as developed, a deeper
22 insight in cultural differences is needed. In cultures in which individual responsibility is
23 considered as one of the main causes for self-fulfillment, health, and wealth, obesity
24 might be perceived as a self-inflicted condition. Highly educated and more affluent
25 people might attempt to keep people down in order to maintain their high social
26 status. In contrast, in cultures in which individuals' situations are principally
27 considered as a result of manifold circumstances, obesity might consequently not
28 only be seen as self-inflicted. In these cultures especially highly educated and more
29 affluent people might be aware of social barriers as determinants for self-fulfillment,
30 wealth, and health, i.e. body weight. In conclusion, it might be possible that our
31 working hypothesis is more applicable in countries or rather cultures in which the
32 governmental and cultural structures enforce stigma as an instrument to 'nudge
33 people into desired patterns of behavior' [29]. Hence, future research should consider
34 an expansion and reorientation of stigma's theoretical framework by focusing on the
35 meso and macro socio-cultural structures, as Bonnington and Rose [52] suggest.
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47 Furthermore, it seems striking that educational attainment is more likely to predict
48 weight bias than participant's level of income. While educational attainment
49 associates significantly with weight bias in eight out of fifteen studies, only three
50 studies indicated an association between income and weight bias. Therefore, a
51 possible explanation might be that income can be seen as a proxy variable for
52 education. Suh and colleagues [32], for example, found a significant association
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3 between low income and higher support for weight-related laws until they controlled
4 for other sociodemographic variables, such as educational attainment.
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7 **Limitations**

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9 Every review has its limitations, nor is this one immune to them. First, the current
10 research only includes papers written in English or German. Second, just as any
11 overview must contend with heterogeneous samples and instruments, this systematic
12 review has likewise attempted to cope with varying data. The studies reviewed
13 differed with respect to the instruments used to assess education and income. In
14 particular, the measurement of educational attainment was strongly influenced by the
15 different organization and structure of the varied local educational systems. In
16 addition, the instruments to assess weight bias were also heterogeneous, particularly
17 those used to measure stigmatizing attitudes. Furthermore, some studies used
18 validated scales, whereas other studies used single items only. Thus, the manner of
19 gathering data and classifying categories can be described as heterogeneous itself –
20 and therefore caused the study team to decide against a meta-analysis.
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30 In addition, the study aimed to investigate socioeconomic determinants of weight bias
31 in the general population, as discussed in the inclusion and exclusion section.
32 Therefore, we excluded inter alia studies that focused on overweight and/or obese
33 samples only. We assumed that people try to differentiate themselves from lower
34 status groups, which might be characterized by varying body sizes, i.e. excess weight
35 or obesity. However, overweight and obese samples were included as part of the
36 general population in some studies. Also, these studies did not differentiate their
37 results by participants' body sizes. In the general population we assume that people
38 try to differentiate themselves not only by socioeconomic status but by other status
39 markers as well, such as excess weight. Although we attempted to explain the
40 heterogeneous and inconclusive results by appealing to governmental and cultural
41 differences, there was insufficient evidence to reach a conclusion about the role of
42 cultural and governmental structures on weight bias.
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Conclusion

The aim of the literature review was to investigate to what extent weight bias can be traced back to socioeconomic variables, such as educational attainment and level of income. It was assumed that a higher level of education or income leads to greater stigmatization and discrimination. Therefore, the current study situation was analyzed systematically. Although data of education and income are always collected as mandatory sociodemographic information, research is lacking when it comes to examining their impact on weight bias. Since this question has not yet been answered in a sufficient manner, this review was supposed to close this research gap.

Our working hypothesis that weight bias increases with higher educational attainment or level of income could not be verified. Particularly, we found 6 studies that supported our hypothesis, two German studies indicating the reverse conclusion, and seven studies that did not show a significant association at all.

The key to identifying effective interventions to battle stigmatization, discrimination, and consequences for those affected, might lie in exposing the characteristics of stigmatizing groups and their motivations. Therefore, future research should pay more attention to the link between weight bias and socioeconomic factors and cultural or rather governmental structures. Moreover, meta-analysis should be considered as an important direction for future research.

Figure legends

Figure 1. Phases of the systematic review

Figure 2. Instruments assessing weight bias

Funding Sources

This study was supported by the Federal Ministry of Education and Research (BMBF), Germany, FKZ: 01EO1501. The founding source had no involvement in study design, collection, analysis, and interpretation of data. Furthermore, we acknowledge support from the German Research Foundation (DFG) and University Leipzig within the program of Open Access Publishing.

Disclosure Statement

The authors have no conflicts of interest to declare.

Author contributions

MB, CLS and SRH outlined and specified the research question. MB and CLS conducted the systematic search of literature. Furthermore MB, CLS and TH discussed papers in detail in case of disagreement and uncertainty over the eligibility of abstracts. MB wrote the first draft of the manuscript. TH, SRH and CLS revised it critically for important intellectual content. All authors contributed to and have approved the final manuscript.

Data sharing statement

No unpublished data is available following this study.

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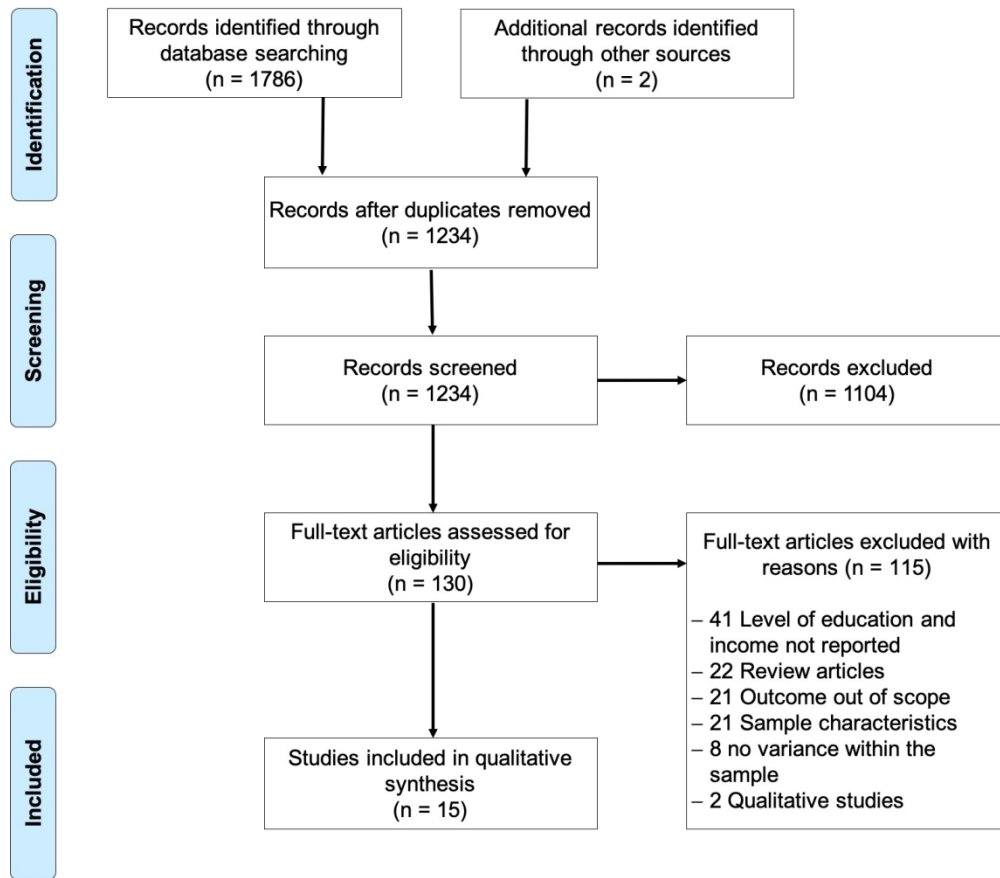


Figure 1. Phases of the systematic review

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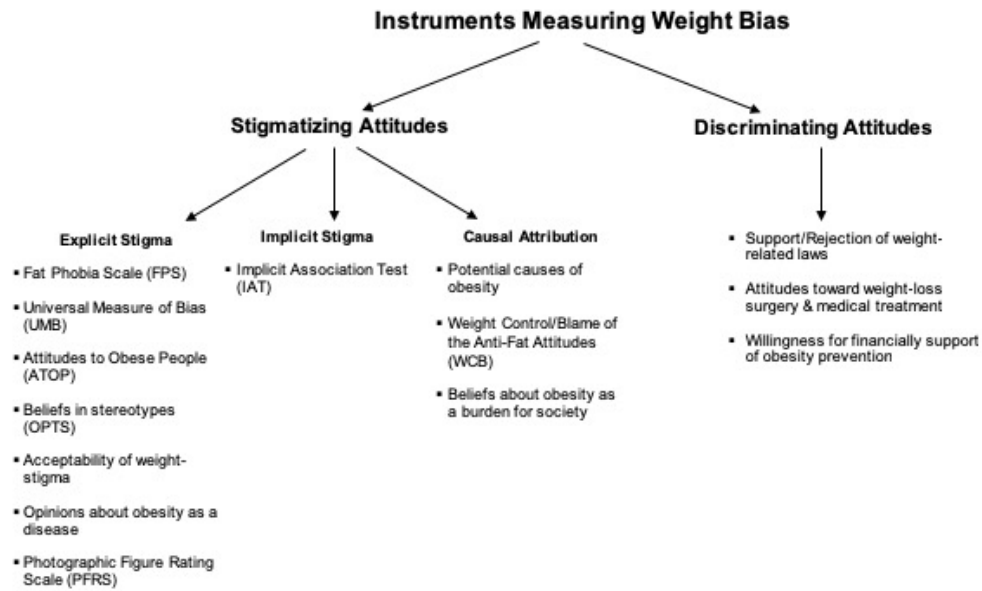


Figure 2. Instruments assessing weight bias

203x125mm (72 x 72 DPI)



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3-5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	-
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5-7
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5-6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5-7
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6-7
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6-7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6-7
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	14-15
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	No meta-analysis



PRISMA 2009 Checklist

Page 1 of 2

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	5
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	No meta-analysis
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	10-13
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	5
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	11-14
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	No meta-analysis
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	5
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	-
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	15-18
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	20
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	18-20
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	22

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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Does weight-related stigmatization and discrimination depend on educational attainment and level of income? A systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-027673.R1
Article Type:	Original research
Date Submitted by the Author:	16-Aug-2019
Complete List of Authors:	Bernard, Marie; Integrated Research and Treatment Center AdiposityDiseases (IFB), University of Leipzig; SRH University of Applied Health Sciences, Fankhänel, Thomas; SRH University of Applied Health Sciences, Riedel-Heller, Steffi; University of Leipzig, Institute of Social Medicine, Occupational Health and Public Health (ISAP), Medical Faculty Luck-Sikorski, Claudia; Integrated Research and Treatment Center AdiposityDiseases (IFB), University of Leipzig; SRH University of Applied Health Sciences
Primary Subject Heading:	Sociology
Secondary Subject Heading:	Sociology, Public health
Keywords:	obesity, stigma, discrimination, education, income

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10 4 **Bernard, Marie** ^{a,b,*}, **Fankhänel, Thomas** ^b, **Riedel-Heller, Steffi G.** ^c, **Luck-Sikorski, Claudia** ^{a,b}

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Word count 5,327

26 **Abstract**

27 **Objectives:** Obesity is considered a global health issue, not only because of its health-related
28 consequences but also because of its impact on social status as a result of stigma. This study
29 aims to review the quantitative state of research regarding socioeconomic characteristics'
30 influence on weight-related stigmatization and discrimination. Based on Bourdieu's Theory of
31 Class and his concept of "habitus," it is assumed that people with a higher level of education
32 and income show stronger negative attitudes toward people with obesity.

33 **Method:** A narrative systematic literature review was conducted in 2017 using PubMed,
34 PsychINFO, Web of Science, and the Cochrane Library. Seventeen studies that measured
35 weight bias and either educational attainment or level of income were included in the analysis.

36 **Results:** The results of the studies included were inconsistent: six of these studies were found
37 to support the hypothesis, whereas two of the studies contradicted it. The remaining seven
38 studies did not show any significant correlation between weight bias and either education or
39 income.

40 **Conclusion:** In light of the inconsistent and heterogeneous results of the studies that report a
41 significant association between weight bias and socioeconomic variables, the findings must be
42 discussed concerning their cultural context, i.e., cultural and governmental differences.
43 Furthermore, educational attainment seems to be more likely to predict weight bias than
44 income. The review revealed a lack of research when it came to examining the impact of
45 socioeconomic capital on weight bias.

46 **Keywords:** obesity, stigma, discrimination, education, income

47 **Strength and limitations of this study**

- 48 ▪ A systematic review following the PRISMA guidelines was conducted to investigate the
49 relationship between weight bias and the socioeconomic status of studies published in
50 English or German.
- 51 ▪ Study selection was performed by two independent reviewers to minimize subjectivity
52 and random errors.
- 53 ▪ This study is limited since no meta-analysis could be performed due to divergent study
54 designs, instruments used, or different ways items were operationalized for statistical
55 analysis

56 Introduction

57 According to the World Health Organization (WHO), the worldwide prevalence of
58 obesity, defined by a body mass index (BMI) of over 30 kg/m², nearly tripled between
59 1975 and 2016 [1]. To give but two examples, current data reveal an obesity rate of
60 over 21% in Germany and 37.7% in the US [2, 3]. With its escalating rate, obesity can
61 be classified as a global health issue, primarily because it is associated with numerous
62 comorbid diseases, such as diabetes mellitus, cardiovascular diseases, and certain
63 forms of cancer [4].

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65 Not only health-related consequences are connected to obesity, but also psychological
66 implications that affect those concerned on a social level [5]. In particular, obesity is
67 classified as a stigmatized condition. Therefore, being obese is a characteristic that
68 sets those affected apart from people with normal weight. Since obesity is mislabeled
69 as a self-inflicted situation, numerous negative stereotypes, such as laziness, lack of
70 willpower, unhealthy lifestyle, and being unintelligent are associated with the condition
71 [6, 7]. Stigmatization leads to discriminating behavior toward people with obesity in the
72 form of mistreatment in several areas of life, such as labor market, healthcare, and
73 educational system [6, 7].

74 The systematic review of Spahlholz [8] revealed increased perceived discrimination
75 toward people with obesity in comparison to people with normal weight, especially
76 toward people with more extreme obesity (BMI >35 kg/m²) as well as toward women.
77 Moreover, the prevalence of weight-related discrimination accelerated over time. In the
78 US, the prevalence of weight-related discrimination was nine times higher (66%) in
79 2005 than in 1995 (7.3%) [7, 8] and is thus similar to the rate of racial discrimination,
80 particularly against women [9]. Understanding the origin of stigma, which can be seen
81 as the catalyst for structural discrimination, is necessary to prevent discriminating
82 behavior. Although weight-related stigmatization and discrimination are closely linked,
83 they need to be considered as two divergent concepts. However, in the following, we
84 will refer to weight-related stigmatization and discrimination as “weight bias”, but will
85 differentiate between both concepts whenever needed.

86 Some people are more prone to display weight bias than other: There is some evidence
87 that older age is associated with stigmatizing attitudes [10–12] and stronger evidence

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3 88 that men show stronger weight bias than women [13–16]. When looking at the body
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5 89 and beauty perception of people, the cultural framework also needs to be considered
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7 90 as a determinant of stigma. According to Bourdieu, the predominant cultural context
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9 91 determines which values and characteristics can be seen either as desirable or traits
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11 92 to be stigmatized [17]. Depending on regional characteristics, weight is perceived as a
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13 93 sign of class distinction: In undeveloped countries, overweight was associated
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15 94 positively with well-being and wealth, while in developed countries a negative view of
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17 95 being overweight was widespread. Thus, in developed countries, thinness has been
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19 96 viewed as a sign of beauty, success, and an overall high (socioeconomic) status [18].
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21 97 Although in the last decades the perception of obesity or rather slim-body ideals
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23 98 developing countries might have changed [19, 20], results indicate that educational
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25 99 attainment and level of income seem to be relevant regarding weight bias.

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101 Although socioeconomic variables and obesity correlate closely, the impact of
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103 educational attainment and level of income on weight bias remain ambiguous. Several
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105 studies have shown the negative impact of being overweight on the labor market,
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107 especially for women [21, 22] as well as in the education system [23]. In addition, a
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109 lower level of education and income is associated with obesogenic behavior such as
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111 a poor diet and a lack of exercise caused by factors such as stress [24]. Moreover,
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113 Bourdieu [25] sees the most decisive determinant of a healthy lifestyle in
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115 socioeconomic class. While people that belong to the working class preferred tasty
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117 and nutritious food, people from the upper-middle class preferred food that can be
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119 described as light, healthy, and low in calories, according to his study. Subsequently,
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121 people with a higher level of education and income might choose a healthier lifestyle
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123 to distance themselves from people with obesity [26].

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125 As a superior framework to generate missing hypotheses, Bourdieu's Theory of Class
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127 can be applied [25]. Following his concept of "habitus," a person's general attitude,
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129 lifestyle, and even body shape can be seen as a metaphor for social status [18].
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131 Furthermore, Bourdieu considers stigma as a form of symbolic power and a tool to
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133 serve the interests of the powerful [27]. Phelan and colleagues [28] continue with his
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135 line thought and presented three motives of stigma, namely *keeping people in, away,*
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137 or *down*. Particularly, *keeping people down* applies to the review's theoretical

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3 120 framework. Link and Phelan [17] discuss stigma as an instrument of a dominant group
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5 121 to keep another group down to attain or maintain high social status, wealth, and power.
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7 122 However, a person's educational attainment and level of income are mainly invisible
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9 123 characteristics; thus, there are other attributes that more readily show social status.
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11 124 Assuming that obesity is perceived as a metaphor for lower social status, groups with
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13 125 higher social status might be aware of this link and keep people with obesity down to
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15 126 empower themselves. In this review, it is therefore assumed that people with a higher
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17 127 level of education and income display negative attitudes toward people with obesity in
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19 128 comparison to people with lower educational attainment and income. The impact of
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21 129 educational attainment and level of income on weight bias will be examined and
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23 130 compared.

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27 132 Based on a sociological perspective, this systematic literature review attempts to
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29 133 outline the current state of research and reveal the relationship between weight bias
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31 134 and the level of education and income. Tyler and Slater [29] criticized inter alia "*that*
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33 135 *one of the major limitations of existing understandings of stigma is the ways in which*
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35 136 *they have 'bracketed off' key questions, such as where stigmatizing attitudes come*
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37 137 *from, how and by whom is stigma crafted, mediated, produced and why [...].*" The
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39 138 general aim of this review is thus to identify social and economic groups that stigmatize
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41 139 and discriminate against those who are obese. In the future, this information could help
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43 140 researchers to develop and implement interventions in a more targeted manner.

44 45 141 **Methods**

46 47 142 Search Strategy

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49 143 A systematic review of published studies reporting weight-related attitudes held by
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51 144 differing socioeconomic status groups was conducted by using the relevant scientific
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53 145 electronic databases: PubMed, PsychINFO, Web of Science, and the Cochrane
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55 146 Library. The review followed the Prisma Guidelines [30].

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57 147 The systematic review of literature was performed independently by two reviewers
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59 148 using the following keywords: stigma*, discrimination, "weight bias", or prejudice;
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149 education*, income, salary, wage, status, socio-economic, socioeconomic*, SES,
150 sociodemographic, or socio-demographics; and obes*, overweight, or fat. Giving a very

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3 151 high number of results, the literature search was limited to the publications' titles and
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5 152 abstracts. Only published studies written in English or German were included. There
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7 153 was no restriction regarding the year of publication. The stages of the systematic
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9 154 literature search are provided in Fig. 1. The literature review was conducted for all
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11 155 studies that have been published until June 2019.

12 156 Data extraction

14 157 The systematic search of the literature revealed 2,331 studies, whereby 1,708 studies
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16 158 remained after removing duplicates. Furthermore, 1,510 studies were excluded
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18 159 because screening their titles and abstracts for eligibility showed no association with
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20 160 the research question. Disagreement and uncertainty between the two reviewers over
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22 161 the eligibility were resolved by reinspecting the papers in detail and discussing
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24 162 disparate perspectives. For the remaining 198 studies, full articles were screened in
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26 163 detail to assess their eligibility. For data extraction we used an adjusted PICO scheme
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28 164 [31]: Studies that collected data of an adult sample (P) which assessed stigmatizing
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30 165 and discriminating attitudes (I) depending on socioeconomic variables (C) to
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32 166 investigate if weight bias is associated with socioeconomic status (O). The detailed
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34 167 inclusion and exclusion criteria are presented in the following.

34 168 Inclusion criteria

36 169 Studies that report associations between weight bias and either educational attainment
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38 170 or level of income were included. Weight bias was operationalized to reflect
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40 171 stigmatizing and discriminating attitudes. Therefore, studies that measured
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42 172 stigmatizing attitudes by applying explicit and implicit instruments will be included, but
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44 173 also studies that assessed causal beliefs about obesity, which can be considered as
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46 174 proxy variable as previously done before [32]. Studies that assessed discriminating
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48 175 attitudes, for example, by measuring the support for weight-related antidiscrimination
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50 176 policies and law, or considering obesity as a financial burden are considered for
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52 177 inclusion. According to Woolford et al. [33], who found less support to cover obesity-
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54 178 related costs by public health insurances, the public's opinion can be seen as a
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56 179 potential guideline for insurance funds [33]. In other words, based on the public's view,
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58 180 discrimination might occur in the field of health insurance policies. This assumption
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3 181 might be of particular importance when considering the increased obesity-related
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5 182 healthcare cost [34].
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7 183 Exclusion criteria
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9 184 The following exclusion criteria were used to eliminate studies that were not applicable:
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11 185 (a) studies with a sample of health care professionals, dietitians, psychologists, and
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13 186 physical educators; (b) studies that investigated stigmatizing attitudes of children
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15 187 and/or adolescents; (c) studies that investigated stigma toward childhood obesity; (d)
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17 188 studies with an overweight and/or obese sample that investigated perceived
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19 189 stigmatization; (e) studies with a homogenous sample in regard to educational
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21 190 attainment (e.g., students) or level of income; (f) studies that investigated weight bias
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23 191 toward extended stigma groups (e.g., obese and binge eating); and (g) reviews or
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25 192 qualitative studies. The flowchart (Figure 1) displays how many studies were excluded
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27 193 in accordance with the exclusion criteria. In summary, 50 studies were excluded
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29 194 because they did not report the participants' educational attainment or income. In
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31 195 addition, 29 studies did assess data of a sample with no variance concerning
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33 196 socioeconomic characteristics, and 23 studies were excluded because of the samples'
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35 197 characteristics (overweight/obese or children/adolescents sample). Five studies were
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37 198 excluded because they followed a qualitative approach, and 34 studies were excluded
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39 199 because they could be categorized as reviews. Thirty-nine studies were found that did
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41 200 not meet the criteria for the aimed outcome of weight bias. Two studies were neither
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43 201 published in English nor German.

40 202 Moreover, one paper had to be excluded because of its lack of academic background.
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42 203 After excluding the studies that did not meet our criteria, 17 studies were identified as
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44 204 relevant for in-depth investigation (Figure 1). Therefore, sampling characteristics,
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46 205 study design, assessment of weight bias, and measurement of educational attainment
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48 206 and income were systematically examined.

49 207 Assessment of Risk of Bias
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51 208 We assessed the risk of bias of all studies included using the Appraisal tool for Cross-
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53 209 Sectional Studies (AXIS) developed by Downes and colleagues [35]. The studies were
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55 210 therefore examined regarding potential causes that might induce a specific risk of bias.
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57 211 Despite a risk of bias due to non-responds that might occur among every study, the
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212 majority of studies included showed a low risk of bias. Only a few studies were detected
213 to be at moderate risk of bias concerning the sampling procedure [36–41]. The
214 summarized risk of bias assessment of all studies included is provided as
215 supplementary material.

216 Patient and Public Involvement

217 Within this study, no patient data was collected. We conducted a systematic review
218 and analyzed data that had already been collected. Thus, patients were not involved
219 in this study.

220 **Results**

221 The 17 studies included were tabulated according to the following characteristics: the
222 origin of the sample, sample size (N), sample characteristics, study design,
223 instruments to assess weight bias, educational attainment or income, and a summary
224 of results. Studies reviewed in detail are tabulated by either educational attainment
225 (**Error! Reference source not found.**) or by the level of income (Table 2).

226 Study characteristics

227 All relevant study characteristics are summarized in Table 1 and Table 2, respectively.
228 Eight out of seventeen studies are based entirely on an American sample [10, 42, 42,
229 42]. Two other studies are based on an American and an Icelandic sample [43, 44].
230 These two studies also provided data based on a Canadian sample of health care
231 professionals and American, Australian, and Icelandic student samples that did not
232 meet the inclusion criteria and therefore all four samples had to be excluded. Three
233 studies were based on a German sample [10, 42], and five studies based on one
234 sample, from Paraguay [36], Mexico [38], Sweden [37], Denmark [40], and Great
235 Britain [41] respectively. The study by Brewis and Wutich [36], based on a Paraguayan
236 sample also provided data of a comparison group of US-undergraduate students that
237 were not considered in the analysis because of the homogenous study sample in terms
238 of educational attainment. The seventeen studies included showed a wide variety of
239 sample sizes ranging from 198 [41] to 3,502 participants [45].

240 Since the aim of the study was to outline the impact that socioeconomic status in the
241 form of educational attainment and level of income have on weight bias, attention was

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3 242 paid to a variation in these variables within the samples. The studies included therefore
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5 243 focused either on a population-based sample [10, 37, 42, 46–48] or an convenience
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7 244 sample [40, 43–45, 49, 50]. Although Jiminez-Cruz and colleagues [38] investigated
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9 245 stigmatizing attitudes of an entirely low-income sample, they divided the
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11 246 socioeconomic factors (level of education and income) into five and four categories
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13 247 respectively; thus, variation within the sample could be ensured. Moreover, an
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15 248 investigation of weight bias in different gradations of lower status groups could provide
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17 249 further insight into the topic. In one study [39], the general population was included,
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19 250 whereby the overweight participants received an alternative questionnaire assessing
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21 251 the perceived stigmatization and not their stigmatizing attitudes toward obesity.
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23 252 Therefore, only the normal weight sample could be included.

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25 253 The distribution of women and men was equally considered in the majority of studies,
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27 254 even though more women than men were included. However, two studies posed an
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29 255 exception. The study of Brewis et al. [36] and the study of Jiminez-Cruz [38]
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31 256 investigated only the stigmatizing attitudes of female participants.
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257 Table 1 Summary of Selected Studies: Weight Bias Depending on Educational Attainment

Study	N	Sample Discription	Instruments Weight bias	Educational attainment	Association's Direction ¹	Magnitude of Association
Form of weight bias: stigmatizing attitudes						
[42]; GER	3003	population based (ø age: 51.7 years; 52.8% female)	Short-FPS[1]	4 subgroups: - No degree - 9 th grade degree - 10 th grade degree - 12 th grade degree	Negative	Multivariate Regression: - No degree = reference category - 9th grade: $\beta = -0.278$, $p < 0.01$, (std. error 0.0852) - 10th grade: $\beta = -0.251$, $p < 0.01$ (std. error 0.0838) - Upper secondary school: $\beta = -0.214$, $p < 0.05$, (std. error 0.0835)
[10]; GER	960	US adults (ø age: 43.8 years; 50.2% female)	WCB [2];	2 subgroups: - Low; <13 years of education) - High; ≥ 13 years of education)	Negative	Multiple linear regression - $\beta = -0.16$, $p < 0.001$ Zero-order association - $r = -0.18$, $p < 0.0001$
[38]; MEX	1,100	Women aged 18-40 of low SES (ø age: 37.5 years)	Beliefs about the causes of obesity	5 subgroups: - None - some elementary - elementary - middle - high school	Positive	Logistic regression - "Having an unhealthy lifestyle": unadjusted OR=2.56, $p < 0.001$, Confidence Interval 1.88-3.49
[43]; USA and ISL	899	US adults (ø age: 40.9 years; 46.1% female)	Short-FPS [1]; UMB-FAT [3]	3 subgroups: - High school or less - Some college/technical or vocation degree - College graduate or higher	FPS: Mixed	Linear regression: - High school or less = reference category - Vocational training/some college ($\beta = 0.202$, $p < 0.05$) - College ($\beta = 0.141$, $p > 0.1$) - Postgraduate ($\beta = -0.017$, $p > 0.1$)
					UMB-Fat: Positive	Linear regression: - High school or less = reference category - Vocational training/some college: $\beta = 0.102$, $p > 0.1$ - College: $\beta = 0.189$, $p < 0.05$ - Postgraduate: $\beta = 0.034$, $p > 0.1$
					FPS: Positive	Linear regression: - High school or less = reference category - College: $\beta = 0.068$, $p > 0.1$
	659	ISL adults (ø age: 45.9 years; 55.1% female)		2 subgroups: - High school or less - College	UMB-Fat: Positive	Linear regression: - High school or less = reference category - College: $\beta = 0.160$, $p < 0.05$

[37]; SWE	2,436	Representative Swedish population aged 25-64 (ø age: 47.8 years; 63% female)	ATOP [4]	3 subgroups: - Low - Medium - High	Negative	Spearman zero-order correlations: - $r = -0.023$, $p = 0.260$
[49]; USA	1,118	US adults (ø age: 43.8 years; 50.2% female)	Opinions about obesity as a disease [5]	3 subgroups: - High school or less - Some college/ Technical or vocation degree - College graduate or higher	Mixed	Linear regression - High school or less = reference category Agreement with statements in support of classification - Some college/ technical degree: $\beta = -0.036$, $p > 0.1$ - College graduate or higher: $\beta = 0.035$, $p > 0.1$ Agreement with statements in support of classification - Some college/ technical degree: $\beta = -0.03$, $p > 0.1$ - College graduate or higher: $\beta = 0.095$, $p < 0.1$ but > 0.05
[41]; GB	198	Community-based (ø age: 32.58 year; 50.5% female)	PFRS [6]	5 subgroups - General Certification of Secondary Education - Advanced Level - Undergraduate degree - Postgraduate degree - other qualification	/	Univariate analysis of variance (ANOVA): - $F(1, 197) = 0.47$, $p = .705$, $\eta^2 < 0.01$
[39]; USA	396	General, not overweight population (ø age: 42.7 years; 43.7% female)	Short-FPS[1]	3 subgroups: - High school or less - Some college/associate degree - Bachelor's degree or higher	/	Adjusted model of correlates: - $F(2) = 0.026$, $p = 0.974$
[36]; PRY	200	Women (ø age: 38.9 years)	ATOP [4]; IAT [7]	Metric measurement: years of formal education	/	/
Form of weight bias: both, stigmatizing and discriminating attitudes						
[47]; USA	981	US representative sample (62% female)	Beliefs about obesity as a financial burden for society	4 subgroups: - Less than some high school - High-school graduate - Some college - Higher than a college degree	Positive	Logistic regression - \leq some HS: adjusted OR= 0.25, $p < 0.05$ - Some College: adjusted OR= 1.61, $p < 0.05$ - \geq College: adjusted OR= 1.97, $p < 0.01$
			Beliefs about the controllability of obesity		Mixed	Logistic regression - \leq some HS: adjusted OR= 0.99, $p > 0.05$ - Some College: adjusted OR= 0.90, $p > 0.05$ - \geq College: adjusted OR= 1.68, $p > 0.05$

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Form of weight bias: discriminating attitudes						
[50]; USA	1,114	Adults (ø age: 44.87 years; 48% female)	6 Statements assessing support of general and employment-specific antidiscrimination laws or policies	3 subgroups: - High school or GED completed - 2-Year vocational/technical degree or some college - College graduate	Positive	Ordinal logistic regression, for all 6 statements - High school/GED = reference category - College: OR 0.28-0.49, p<0.05)
[45]; USA	3,502	Adults (age 21-65; 61.9% female)	3 statements assessing support of legal protection and employment-specific antidiscrimination laws or policies	3 Subgroups: - High school or less - some college/ technical or vocation degree - College graduate or higher	Positive	Multiple logistic regression - High school or less = reference category - Some college/Technical or vocation degree ▪ Law 1: adjusted OR=0.7, p>0.01 ▪ Law 2: adjusted OR=0.9, p>0.05 ▪ Law 3: adjusted OR=1.2, p>0.05 - College graduate or higher ▪ Law 1: adjusted OR=0.7, p>0.01 ▪ Law 2: adjusted OR=0.8, p<0.05 ▪ Law 3: adjusted OR=0.3, p=0.05
[44]; USA and ISL	893	US adults (ø age:40.9 years; 46.1% female)	13 statements assessing support for employment-specific and broader antidiscrimination laws or policies	3 Subgroups - High school or less - some college/technical or vocation degree - College graduate or higher	Positive	Tobit Regression - High school or less = reference category Broad laws and policies - Vocational training/some college: Coeff= -0.135, p>0.05 - College: Coeff = -0.223, p>0.05 - Postgraduate: Coeff = -0.040, p>0.05 Employment-specific laws and policies - Vocational training/some college: Coeff= -0.115, p>0.05 - College: Coeff= -0.220, p>0.05 - Postgraduate: Coeff.= -0.087, p>0.05
	658	ISL adults (ø age:45.9 years; 46.1% female)				2 subgroups - High school or less - College
[46]; USA	1,001	Population-based sample (ø age:43.8 years; 51% female)	6 statements assessing support for general, employment-specific and broader policies/ antidiscrimination laws or policies	3 subgroups - High school - college degree - Postgraduate degree	Positive	Logistic regression, five of six statements - High school = reference category - Higher degree: OR= 0.56-0.72, p<0.05

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[51]; USA	909	US adults	2 statements assessing support for antidiscrimination policies	Only 2 subgroups reported: - less than High school - College degree	Positive	Probit Model - Less than High school = reference category "Government should do more to protect obese" - College degree: $\beta = -0.100$, $p < 0.05$ "Overweight should get same protections as disabled" - College degree: $\beta = -0.136$, $p < 0.01$
[48]; GER	2,531	Population-based sample (ø age: 48.79 years; 55.5% female)	6 Statements assessing support of general and employment-specific antidiscrimination laws or policies	2 subgroups: - Low (<12 years of education) - High (≥ 12 years of education)	General laws Positive Employment-specific laws: Negative	Logistic regression - Education ≥ 12 years: OR= 0.60, $p = 0.005$ Logistic regression - Education ≥ 12 years: OR= 1.25, $p = 0.016$
[40]; DNK	1,003	Citizens aged 18-65	Attitudes toward weight-loss surgery & medical treatment of obesity	No details reported	/	/

260 Note: ¹ Bold characters display significant association, Positive = demonstrates greater anti-fat attitudes with increasing educational attainment; Negative = demonstrate greater anti-fat attitudes
 261 with decreasing educational attainment; N = sample size; FPS = Fat Phobia Scale; UMB = Universal Measure of Bias; WCB = Weight Control/Blame of the Anti-Fat Attitudes Test; ATOP =
 262 Attitudes to Obese People; IAT = Implicit Association Test; PFRS = Photographic Figure Rating Scale; SES = Socioeconomic status

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Table 2 Summary of Selected Studies: Weight Bias Depending on Level of Income

Study	N	Sample Discription	Instruments Weight bias	Level of income	Direction of Correlation ¹	Magnitude of Association
Form of weight bias: stigmatizing attitudes						
[38]; MEX	1,100	Women aged 18-40 of low SES (ø age: 37.5 years)	Beliefs about the causes of obesity	Weekly income, 4 subgroups: - USD < 1,200 - USD 1,200-2,000 - USD 2,000-4,000 - USD ≥ 4,000	Negative	Logistic regression - "Having an unhealthy lifestyle: unadjusted OR= 1.13, p>0.05, Confidence Interval 0.78-1.62
[10]; GER	960	Population based sample (ø age: 45.9 years; 56.9% female)	WCB [2]	Monthly Income, 2 subgroups: - EUR < 2,000 - EUR ≥ 2,000	Negative	Zero-order association - r= -0.02, p>0.01
[37]; SWE	2,436	Representative Swedish population aged 25-64 (ø age: 47.8 years; 63% female)	ATOP [4]	Annual household income; no subgroups reported	Positive	Pearson and Spearman zero-order correlations: - r=0.018, p= .382
[49]; USA	1,118	US adults (ø age:43.8 years; 50.2% female)	Opinions about obesity as a disease [5]	Annual household income, 5 subgroups - USD < 25,000 - USD 25,000-49,999 - USD 50,000-74,999 - USD 75,000-99,999 - USD > 100,000	Mixed	Linear regression - Less than \$25,000 = reference category Agreement with statements in support of classification - USD 25,000 - 49,999: β= 0.045, p>0.1 - USD 50,000 - 74,999: β= 0.113, p<0.1 - USD 75,000 - 99,999: β= 0.084, p>0.1 - > USD 100,000: β= -0.026, p>0.1 Agreement with statements in opposition of classification - USD 25,000 - 49,999: β=0.06, p>0.1 - USD 50,000 - 74,999: β=-0.019, p>0.1 - USD 75,000 - 99,999: β=0.041, p>0.1 - > USD 100,000: β=0.061, p>0.1
[42]; GER	3003	population based (ø age:51.7 years; 52.8% female)	Short-FPS [1]	Monthly household income, 4 subgroups: - EUR < 999 - EUR 1,000-1,999 - EUR 2,000-2,999 - EUR > 3,000	/	/

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[39]; USA	396	General, not overweight population (ø age: 42.7 years; 43.7% female)	Short-FPS [1]	Annual household income, 5 subgroups: - USD < 20,000 - USD 20,000-39,000 - USD 40,000-59,000 - USD 60,000-79,000 - USD > 80,000	/	Correlation: - Unadjusted, correlation coefficient not reported, p= 0.305
Form of weight bias: Both, stigmatizing and discriminating attitudes						
[47]; USA	981	US representative sample (62% female)	Beliefs about obesity as a financial burden for society	Annual household income, 4 subgroups: - USD < 25,000 - USD 25,000 < 50,000 - USD 50,000 < 75,000 - USD ≥ 75,000	Positive	Logistic regression - USD < 25,000 = reference category - USD 25,000 < 50,000: adjusted OR= 1.02, p>0.05 - USD 50,000 < 75,000: adjusted OR= 1.57, p>0.05 - USD ≥ 75,000: adjusted OR= 3.18, p<0.001
			Beliefs about the controllability of obesity		Negative	Logistic regression - USD < 25,000 = reference category - USD 25,000 < 50,000: adjusted OR= 0.82, p>0.05 - USD 50,000 < 75,000: adjusted OR= 0.96, p>0.05 - USD ≥ 75,000: adjusted OR= 0.51, p>0.05
Form of weight bias: discriminating attitudes						
[51]; USA	710	US adults (aged 18 – 65)	2 statements assessing support for civil protections for the obese	Annual household income - USD < 15,000 - USD > 100,000	Positive	Probit Model - USD < 15,000 = reference category "Government should do more to protect obese" - USD > 100,000: β= -0.098, p<0.01 Overweight should get same protections as disabled" - USD > 100,000: β= -0.077, p<0.01
[48]; GER	2,531	Population-based sample (ø age: 48.79 years; 55.5% female)	6 Statements assessing support of general and employment-specific antidiscrimination laws or policies	Monthly Income, 2 subgroups: - EUR < 2,000 - EUR ≥ 2,000	Positive	Logistic regression General laws or policies - EUR < 2,000 = reference category - EUR ≥ 2,000: OR=0.67, p=0.002 Logistic regression Employment-specific laws or policies - EUR < 2,000 = reference category - EUR ≥ 2,000: OR=0.91, p=0.376
[46]; USA	1,001	Population based sample (ø age: 43.8 years; 51% female)	6 statements assessing support for general, employment-specific and broader policies/ antidiscrimination laws or policies	Annual household income, 5 subgroups - USD 15,000-25,000 - USD 25,000-49,999 - USD 50,000-74,999 - USD 75,000-99,999 - USD > 100,000	Positive	Logistic regression, five of six statements - USD 15,000-25,000 = reference category - Adjusted OR= 0.52-0.64, p<0.05

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[50]; USA	1,114	Adults (ø age: 44.87 years; 48% female)	6 Statements assessing support of general and employment-specific antidiscrimination laws or policies	Annual household income, 5 subgroups: - USD < 25,000 - USD 25,000-49,999 - USD 50,000-74,999 - USD 75,000-99,999 - USD > 100,000	Positive	Ordinal logistic regression - USD < 25,000 = reference category - Significant results among women but not men "Obesity should be considered a disability under the ADA to protect obese people from weight discrimination in the workplace" - USD 75,000-99,999: OR= 0.52, p<0.05 "Congress should pass the WDEA to protect overweight Americans from discrimination in the workplace" - USD 75,000-99,999: OR= 0.49, p<0.05
[45]; USA	3,502	Adults (age 21-65; 61.9% female)	3 statements assessing support of legal protection and employment-specific antidiscrimination laws or policies	Annual household income, 5 subgroups - USD < 25,000 - USD 25,000-49,999 - USD 50,000-74,999 - USD 75,000-99,999 - USD > 100,000	Mixed	Logistic Regression Model - USD 15,000-25,000 = reference category - USD 25,000-49,999 - Law 1: OR=1.0, p>0.05) - Law 2: OR=1.2, p>0.05) - Law 3: OR=1.0, p>0.05) - USD 50,000-74,999 - Law 1: OR=1.0, p>0.05) - Law 2: OR=1.2, p>0.05) - Law 3: OR=1.0, p>0.05) - USD 75,000-99,999 - Law 1: OR=1.2, p>0.05) - Law 2: OR=1.3, p>0.05) - Law 3: OR=0.9, p>0.05) - USD > 100,000 - Law 1: OR=0.8, p>0.05) - Law 2: OR=1.0, p>0.05) - Law 3: OR=0.9, p>0.05)
[40]; DNK	1,003	Citizens (age 18-65)	Attitudes toward weight-loss surgery & medical treatment of obesity	No details reported	/	/

Note: ¹ Bold characters display significant association, Positive = demonstrates greater weight bias with increasing level of income; Negative = show greater weight bias with decreasing level of income; N = sample size

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268 Instruments

269 The studies included were found to be heterogeneous with regard to the instruments
270 used (Table 3 and 4). Therefore, the study team has decided against a meta-analysis
271 and for a systematic narrative literature review.

272 Educational attainment and level of income

273 Seventeen studies were found that assessed attitudes toward obesity in association
274 with participants' educational attainment and/or level of income. All of these seventeen
275 studies reported the participants' educational attainment [10, 36–51]. Depending on
276 the origin of the sample and the analogous countries' educational system, categories
277 were formed or years of educational attainment were gathered. From seventeen
278 studies, thirteen assessed participants' level of income [10, 37–40, 42, 45–51];
279 therefore, income was either assessed by the annual, weekly, household, or individual
280 income.

281 Weight Bias in Form of Stigmatizing Attitudes

282 Studies that examined either participants' stigmatizing attitudes or participants' beliefs
283 about the causes of obesity [10, 36, 37, 37–39, 41–43, 47, 49] were included.
284 Stigmatizing attitudes were thereby measured with instruments such as the Fat Phobia
285 Scale (FPS), the Universal Measure of Bias (UMB), the Weight Control/Blame of the
286 Antifat Attitude Test (WCB), the Attitudes to Obese People (ATOP), the Implicit
287 Association Test (IAT), or the Photographic Figure Rating Scale (PFRS). As described
288 before, beliefs about the causes of obesity in the form of evaluating obesity as a
289 controllable condition – which is supposedly preventable by a greater extent of self-
290 discipline – can consequently be seen as one decisive factor in determining
291 stigmatizing attitudes [52] and was therefore included. The instruments used are
292 presented in Table 3.

293 **Table 3 Overview of the instruments used to measure stigmatizing attitudes**

Instruments measuring Stigmatizing attitudes	Studies that apply the instrument
<i>Explicit Stigma</i>	
- Fat Phobia Scale (FPS)	[39, 42, 43]
- Universal Measure of Bias (UMB)	[43]
- Attitudes to Obese People (ATOP)	[36, 37]
- Opinions about obesity as a disease	[49]
- Photographic Figure Rating Scale (PFRS)	[41]
<i>Implicit Stigma</i>	
- Implicit Association Test (IAT)	[36]
<i>Causal Attribution</i>	
- Weight Control/Blame of the Anti-Fat-Attitudes (WCB)	[10]
- Potential causes of obesity	[38]
- Individuals responsibility ("Obese people can do something about their weight")	[47]

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295 Weight Bias in the form of Discriminating Attitudes

296 We found eight studies that investigated participants' discriminating attitudes toward
 297 people with obesity [40, 44–48, 50, 51]. All instruments used to measure discriminating
 298 attitudes are listed in Table 4. Discrimination was measured for example, by examining
 299 policy and law support, but also the ratings on the statement "Obesity is a major burden
 300 to society in terms of healthcare costs" as well as attitudes toward weight-loss surgery
 301 and medical treatment. We found some studies [44–46, 48, 50, 51] that investigated
 302 support for the same or almost identical laws or policies (Law/policy a-i). However,
 303 these items were analyzed in such heterogeneous way, for example, by merging
 304 different items into one, that a meta-analysis could not be conducted.

305 **Table 4 Overview of the instruments used to measure discriminating attitudes**

Instrument measuring discriminating attitudes	Studies that apply the instrument
<i>Attitudes toward weight-loss surgery & medical treatment</i>	[40]
<i>Beliefs about obesity as a financial burden for society</i>	[47]
<i>Statements measuring support/rejection of weight-related laws or policies</i>	
^a My country/state should include body weight in our civil rights law in order to protect people from discrimination based on their body weight	[44–46, 48, 50]
^b It should be illegal for an employer to refuse to hire a qualified person because of his or her body weight.	[44–46, 48, 50]
^c It should be illegal for an employer to terminate or fire a qualified employee because of his or her body weight.	[44–46, 48, 50]
^d Fat/overweight persons should be subject to the same legal protections and benefits offered to people with physical disabilities.	[44–46, 48, 50, 51]
^e It should be illegal for an employer to deny a promotion or appropriate compensation to a qualified employee because of his or her body weight.	[44–46, 50]
^f Obesity should be considered a disability (under the ADA) so that people will be protected from weight discrimination in the workplace	[44, 46, 48, 50]
^g Congress/Government should pass the Weight Discrimination in Employment Act (WDEA) to protect overweight Americans from discrimination in the workplace/employees from discrimination in the workplace based on their body-weight.	[44, 46, 50]
^h The government should play a more active role in protecting overweight people from discrimination.	[46, 50, 51]
ⁱ It should be illegal for an employer to assign lower wages to a qualified employee because of his or her body weight.	[44, 48]
^j The government should have specific laws in place to protect people from weight discrimination.	[44]
^k The government should penalize (or fine) those who discriminate against persons because of their weight.	[44]
^l Individual companies should have the right to determine whom to hire based on an employee's personal body weight.	[44]
^m Employers should be allowed to assign different salaries to employees based on their body weight.	[44]
ⁿ My country should pass a Healthy Workplace Law to address workplace bullying	[44]

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307 **Findings**

308 The studies included showed a very heterogeneous picture regarding their results.
 309 Eleven out of the seventeen studies significantly associated educational attainment
 310 (Table 5) and/or level of income (Table 6) with stigmatizing and/or discriminatory
 311 attitudes toward people with obesity [10, 38, 42–48, 50, 51].

312 Associations between educational attainment and weight-related stigmatization

313 We found ten studies that reported an association between educational attainment and
314 stigmatizing attitudes, whereas only two of them [38, 43] showed a positive association
315 between higher educational attainment and weight-related stigmatization. In addition,
316 the study of Puhl and colleagues [43, 44] found a significant association in the Icelandic
317 (Beta=0.160, $p<0.05$), but not in the American sample. However, two German studies
318 [10, 42] showed an inverse correlation. Both of these studies found evidence that
319 higher education is associated with lower stigma [42] and less belief in individual
320 responsibility [10] for an obese condition. The remaining studies did not report
321 significant associations.

322 Associations between educational attainment and weight-related discrimination

323 Six studies [44–47, 50, 51] reported increased discriminating attitudes with higher
324 education. The study of Puhl and colleagues found no significant association between
325 weight bias and educational attainment in the US sample, but did find an association
326 in the Icelandic sample (Beta = -0.221, $p<0.01$). The study of Hilbert and colleagues
327 [48] revealed inconsistent findings: Higher education is associated with less support
328 for general but more support for employment specific weight-related antidiscrimination
329 laws or policies.

330 Associations between the level of income and weight-related stigmatization

331 We found no study that reported a significant association between the level of income
332 and weight-related stigmatization. Associations between the level of income and
333 weight-related discrimination

334 Four American [46, 47, 50, 51] revealed stronger weight-related discrimination with
335 increasing income. One German study [48] found less support for general, but not for
336 employment specific policies and laws among more affluent people. Although the study
337 of Suh et al. [45] found a significant positive association between level of income and
338 support for two laws and policies (law a: $\chi^2=6.06$, $p=0.01$; law d: $\chi^2=3.81$, $p=0.05$),
339 these results could not be validated by logistic regression analysis. Moreover, the
340 assumption that discrimination, in the form of views on the funding for medical or
341 weight-loss surgery, is somehow associated with income was not found [40].

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342 Table 5. Studies That Show Significant Associations Between Education Attainment and Weight-Related Stigmatization and Discrimination

Study	Direction of correlation	Form of Weight Bias	Instrument Weight Bias	Result	Adjusted for
[42]	Negative	Stigmatization	Short-FPS	Higher educational attainment is associated with lower stigmatizing attitudes	Gender, age, income, residence, emigrational background
[10]	Negative	Stigmatization	WCB	Higher educational attainment is associated with less stigmatizing attitudes (P<0.001)	Causal attributions to behavior, Labeling obesity as an illness, Age, Causal attributions to heredity
[43]	Positive	Stigmatization	UMB-Fat	Higher educational attainment is associated with higher stigmatizing attitudes (ISL sample; P<0.05)	Gender, race/ethnicity, BMI, perceived causes of obesity, weight-related attributions
[38]	Positive	Stigmatization	Beliefs about the causes of obesity	Higher educational attainment is associated with greater belief in individual responsibility (P<0.001)	Unadjusted
[47]	Positive	Discrimination	Belief in obesity as a financial burden for society	Higher educational attainment is associated with greater belief in the statement "Obesity is a major burden to society in terms of healthcare costs" (P<0.01)	Race/ethnicity, sex, income, employment, age group, marital status, BMI, smoking status
[45]	Positive	Discrimination	Support for weight-related laws or policies	Higher educational attainment is associated with lower support for weight-related laws or policies (P<0.01)	Other socio-demographic variables
[44]	Positive	Discrimination	Support for weight-related laws or policies	Higher educational attainment is associated with less support for weight-related laws or policies (P<0.01)	Sex, age, race/ethnicity, BMI
[46]	Positive	Discrimination	Support for weight-related laws or policies	Higher educational attainment is associated with lower support for weight-related laws or policies	Sex, body weight, age, income, race, political affiliation, history of weight-based victimization
[51]	Positive	Discrimination	Support for civil protections for the obese	Higher educational attainment is associated with lower support for civil protection of the obese	Sex, age, BMI, race/ethnicity, income, political orientation, perceived causes for obesity
[50]	Positive	Discrimination	Support for general and employment specific antidiscrimination laws or policies	Higher educational attainment is associated with less support for weight-related laws or policies	Body weight, age, race, political affiliation, income, history of weight-based discrimination, divergent vignettes describing obesity and obesity-related (workplace) discriminations
[48]	Positive	Discrimination	Support for general antidiscrimination laws or policies	Higher educational attainment is associated with less support for general antidiscrimination laws or policies	Sex, age, weights status, income, residence, church membership, readiness to vote in following week, weight-based victimization, weight bias internalization
	Negative		Support for employment-specific antidiscrimination laws or policies	Higher educational attainment is associated with stronger support for employment specific antidiscrimination laws or policies	

Positive = demonstrates greater weight bias with increasing educational attainment; Negative = show greater weight bias with decreasing educational attainment

343 Table 6 Studies That Show Significant Associations Between Level of Income and Weight-Related Stigmatization and Discrimination

Study	Direction of correlation	Form of Weight Bias	Instrument Weight Bias	Result	Adjusted for
[47]	Positive	Discrimination	Belief in obesity as a burden for society	Yes; A higher income level is associated with greater belief in statement "Obesity is a major burden to society in terms of healthcare costs" (P<0.05)	Race/ethnicity, sex, education, employment, age group, marital status, BMI, smoking status
[46]	Positive	Discrimination	Support for weight-related laws or policies	Higher income is associated with lower support for weight-related laws or policies	Sex, body weight, age, education, income, race, political affiliation, history of weight-based victimization
[51]	Positive	Discrimination	Support for civil protections for the obese	Higher income is associated with lower support for civil protection of the obese	Sex, age, BMI, race/ethnicity, education, political orientation, perceived causes for obesity
[50]	Positive	Discrimination	Support for general and employment specific antidiscrimination laws or policies	Higher income is associated with less support for weight-related laws or policies	Body weight, age, race, political affiliation, education, history of weight-based discrimination, divergent vignettes describing obesity and obesity-related (workplace) discriminations
[48]	Positive	Discrimination	Support for general antidiscrimination laws or policies	Higher income is associated with less support for general antidiscrimination laws or policies	Sex, age, weights status, education, residence, church membership, readiness to vote in following week, weight-based victimization, weight bias internalization

Positive = demonstrates greater weight bias with increasing level of income; Negative = show greater weight bias with decreasing level of income

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345 Discussion

346 This systematic literature review aimed to summarize the current state of research on
347 socioeconomic status and its impact on weight-related stigmatization and
348 discrimination. As it was outlined earlier, the association between socioeconomic
349 factors and weight bias has not been investigated sufficiently [50]. This review aimed
350 therefore to address this gap. Although many studies were found that investigated
351 various forms of weight bias and assessed socioeconomic data, an association was
352 only reported in 17 studies. The underlying reason why an association was not reported
353 might be a different research focus, but also insignificant findings. Overall, eleven out
354 of the seventeen studies showed that weight bias is significantly associated with either
355 educational attainment or level of income. In the following the results are discussed
356 separated by education and income, as well as weight-related stigmatization and
357 discrimination.

358 Educational Attainment, Level of Income, and Stigmatizing Attitudes

359 Overall, ten studies reported an association between educational attainment and
360 stigmatizing attitudes. However, we found no systematic pattern in which way
361 educational attainment and stigmatizing attitudes are associated: Two studies [38, 43]
362 supported the hypothesis that stigmatizing attitudes are more likely in people with
363 higher educational attainment, whereas two German studies [10, 42] contradict this.
364 Moreover, six studies [36, 37, 39, 41, 47, 49] did not show any significant association,
365 nor a clear direction of the assumed association. In light of divergent results of studies
366 that report a significant association between socioeconomic variables and stigmatizing
367 attitudes, the findings must be discussed with regard to their cultural context: American,
368 Mexican, and Icelandic studies were found to support the working hypothesis, whereas
369 two German studies [10, 42] revealed findings to the contrary.

370 These differences might be explained when considering cultural distinctions. In
371 cultures, in which individual responsibility is considered as one of the leading causes
372 of self-fulfillment, health, and wealth, obesity might be perceived as a self-inflicted
373 condition. Highly educated people might attempt to keep people down to maintain their
374 high(er) social status. In contrast, in cultures in which individuals' situations are
375 principally considered as a result of various circumstances, obesity might consequently

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3 376 not only be seen as self-inflicted. In these cultures, especially highly educated people
4 377 might be aware of social barriers as determinants for self-fulfillment, wealth, and health,
5 378 i.e., body weight. In conclusion, the direction of the relationship between weight bias
6 379 and socioeconomic status might depend on divergent socio-cultural perspectives.
7 380 Hence, future research should consider expansion and reorientation of stigma's
8 381 theoretical framework by focusing on the meso and macro socio-cultural structures, as
9 382 Bonnington and Rose [53] suggest.

10 383
11 384 Overall, we found eight studies that investigated (or rather reported) the association
12 385 between level of income and stigmatizing attitudes. None of these studies showed a
13 386 significant relationship. However, the direction of the (insignificant) associations did not
14 387 show any pattern. We found three studies reporting an (insignificant) positive
15 388 association [10, 38, 47], and one study each reporting an (insignificant) positive [37] or
16 389 mixed associations [49].

27 390 Educational Attainment, Level of Income, and Discriminating Attitudes

28 391 Of the seventeen studies included, eight studies were found that reported an
29 392 association between educational attainment and discriminating attitudes. Five of these
30 393 studies reported a positive relationship, i.e., stronger discriminating attitudes (in the
31 394 form of law and policy support) with increasing education. Another study [44] that
32 395 applied the same instruments for an American and an Icelandic sample found only
33 396 indications for our assumption (i.e., higher education is associated with stronger
34 397 discriminating attitudes) in the Icelandic, but not in the American sample. This study
35 398 [44] was also replicated by Hilbert et al. [48], who report heterogeneous findings as
36 399 they found less support for general antidiscrimination laws with increasing level of
37 400 education, but stronger support for employment specific laws and policies among the
38 401 higher educated German sample. It should, therefore, be discussed whether general
39 402 and employment specific antidiscrimination policies and laws can be viewed as similar
40 403 outcomes or if they display different dimensions of discrimination. Moreover, views on
41 404 who should pay for medical treatment or weight-loss surgery did not reveal significant
42 405 associations [40]. Only one study [40] did not found a significant association between
43 406 educational attainment and discriminating attitudes, nor did it report the direction of the
44 407 insignificant association.

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3 408 With regard to the association between level of income and discriminating attitudes we
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5 409 found overall seven studies in which an association was reported. Five studies [46–48,
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7 410 50, 51] reported positive relationships, i.e., stronger discriminating attitudes with an
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9 411 increasing level of income. Suh et al. [45] found a significant association of stronger
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11 412 support for weight-related laws with decreasing income until they controlled for other
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13 413 sociodemographic variables, such as educational attainment. They reported mixed
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15 414 (insignificant) results concerning the direction of the assumed association. A possible
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17 415 explanation for these insignificant results after controlling for education might be that
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19 416 income can be seen as a proxy variable for education, in the way that the level of
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21 417 income depends on educational attainment. Again, Lund and colleagues [40] who
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23 418 asked Danish citizen by whom medical treatment and weight-loss surgery should be
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25 419 funded, found no significant association, nor did they report a direction of the
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27 420 association.

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29 421 These findings support our assumption that higher socioeconomic status is associated
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31 422 with stronger discriminating attitudes. However, one German study [48] reported
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33 423 contradicting results that might be ascribed at a macro level to Bourdieu's theory about
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35 424 how cultural frameworks determine how specific values and characteristics are
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37 425 perceived. Governmental structures might enforce stigmatizing and discriminating
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39 426 attitudes as an instrument to 'nudge people into desired patterns of behavior' [29]. It
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41 427 can be assumed that cultural frameworks shape governmental systems and are
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43 428 strengthened at the same time through them, especially through the national health
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45 429 and welfare systems. Tyler and Slater [29], for example, outline the political and social
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47 430 function of stigma as a form of power. They discuss macro-level structures, particularly
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49 431 those used actively and passively by governments, as determinants shaping
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51 432 stigmatizing and discriminating attitudes, a level of understanding often left out in social
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53 433 psychology. As explained above, it might be possible that in countries in which obesity
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55 434 is merely perceived as self-inflicted, discriminating attitudes might be stronger - Hence,
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57 435 stigma is not only an instrument used by individuals to enforce personal interests but
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59 436 also one put in place (intended or not) by governments.
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3 437 The different and to some extent inconclusive results might be caused by diverging
4 438 study designs, sample sizes, and instruments assessing weight-related stigmatization
5 439 and discrimination, educational attainment, and level of income: Studies that did not
6 440 show a significant association between weight bias and either educational attainment
7 441 or level of income excluded the overweight portion of the sample [39] or were
8 442 characterized by a small sample (ranging from n=198 to n=396) size [36, 39, 41].
9 443 Furthermore, the association between weight bias with either educational attainment
10 444 or level of income were not seen in instruments such as the Attitudes to Obese People
11 445 scale (ATOP) [36, 37], the Implicit Association Test (IAT) [36] agreement ratings as to
12 446 whether obesity can be classified as a disease [49], and measurement of attitudes
13 447 toward weight-loss surgery and medical treatment [40].
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24 449 However, there are findings diminishing this line of argument: The study of Hilbert et
25 450 al. [48] found less support for general, but stronger support for employment specific
26 451 laws with increasing socioeconomic status. In addition, the German population was
27 452 found to be less supportive of laws and policies that would impede to refuse to hire,
28 453 assign lower wages, and to fire qualified persons because of their body weight,
29 454 compared to an American and Icelandic sample [44]. Moreover, the German
30 455 population was less supportive of including body weight in the civil rights of law
31 456 compared to the American, but not the Icelandic sample.
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39 457 A final point of discussion might be whether the prevalence of obesity has an impact
40 458 on the magnitude of weight bias. When comparing the prevalence and the
41 459 stigmatization of obesity between the USA and Germany, for example, the following
42 460 can be stated: In both countries, the prevalence of obesity increased over time (1995,
43 461 USA 21.9%; GER 14.5%; 2005 USA 29%; GER 18%) [54]. However, not only the
44 462 prevalence of obesity itself increased, but also the (perceived) stigmatization toward
45 463 people with obesity in the US but also in Germany [7, 8, 10, 55].
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3 464 Limitations
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5 465 Just as any overview must contend with heterogeneous samples and instruments, this
6 466 systematic review has likewise attempted to cope with varying data. The studies
7 467 reviewed differed with respect to the instruments used to assess education and
8 468 income. In particular, the measurement of educational attainment was strongly
9 469 influenced by the different organization and structure of the varied local educational
10 470 systems. In addition, the instruments to assess weight bias were also heterogeneous,
11 471 particularly those used to measure stigmatizing attitudes. Some studies used validated
12 472 scales, whereas other studies used single items only. Thus, the manner of gathering
13 473 data and classifying categories can be described as heterogeneous itself – and
14 474 therefore caused the study team to decide against a meta-analysis. However, studies
15 475 that did use the same instrument, such as items weighing support for specific laws and
16 476 policies differed with regard to how they were analyzed (as single items or as an item
17 477 battery). Therefore, the authors had to decide again against a meta-analysis and
18 478 applied a vote-counting approach despite its shortcomings.

19 479 Moreover, the study aimed to investigate socioeconomic determinants of weight bias
20 480 in the general population, as discussed in the inclusion and exclusion section.
21 481 Therefore, we excluded, among other things, studies that focused on overweight
22 482 and/or obese samples only. We assumed that people try to differentiate themselves
23 483 from lower status groups, which might be characterized by varying body sizes, i.e.,
24 484 excess weight or obesity. However, overweight and obese samples were included as
25 485 part of the general population in some studies. Also, these studies did not differentiate
26 486 their results by participants' body sizes. We also excluded studies based on
27 487 homogenous samples, such as health care professionals and students. We considered
28 488 these studies as inadequate since there would have been no possibility to compare
29 489 and thus interpret these results with regard to the research question. Moreover,
30 490 stigmatizing attitudes among some professions, such as dietitians and nutritionists,
31 491 were already investigated systematically.

32 492 In the general population, we assume that people try to differentiate themselves not
33 493 only by socioeconomic status but by other status markers as well, such as excess
34 494 weight. Although we attempted to explain the heterogeneous and inconclusive results
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3 495 by appealing to governmental and cultural differences, there was insufficient (and also
4 496 inconclusive) evidence to conclude the role of cultural and governmental structures on
5 497 weight bias.

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9 498 Since the study team has only sufficient language skills in English and German, the
10 499 current research includes only papers written in English or German

13 500 **Conclusion**

15 501 The literature review aimed to investigate to what extent weight bias can be traced
16 502 back to socioeconomic variables, such as educational attainment and level of income.
17 503 We assumed that a higher level of education or income is associated with greater
18 504 stigmatization and discrimination. Therefore, the current study situation was analyzed
19 505 systematically. Although data of education and income are always collected as
20 506 mandatory sociodemographic information, research is lacking when it comes to
21 507 examining their impact on weight bias. Since this question has not yet been answered
22 508 sufficiently, this review was supposed to address this gap in research and aimed to
23 509 contribute to closing this gap.

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32 511 Our working hypothesis that weight bias increases with higher educational attainment
33 512 or level of income could not be verified. Particularly, we found eight studies that
34 513 supported our hypothesis, two German studies indicating the reverse conclusion, one
35 514 German study reported heterogenous findings and seven studies that did not show a
36 515 significant association at all.

41 516
43 517 The key to identifying effective interventions to battle stigmatization, discrimination,
44 518 and consequences for those affected might lie in exposing the characteristics of
45 519 stigmatizing groups and their motivations. Therefore, future research should pay more
46 520 attention to the link between weight bias and socioeconomic factors and cultural or
47 521 rather governmental structures. Moreover, meta-analysis should be considered as an
48 522 important direction for future research.

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3 **523 Figure legends**

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5 524 Figure 1. Phases of the systematic review
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8 **525 Supplementary Material**

9 526 Supplementary Table 1. Risk of Bias Assessment
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12 **527 Funding Sources**

13
14 528 This study was supported by the Federal Ministry of Education and Research (BMBF),
15 529 Germany, FKZ: 01EO1501. The funding source had no involvement in study design,
16 530 collection, analysis, and interpretation of data. Furthermore, we acknowledge support
17 531 from the German Research Foundation (DFG) and University Leipzig within the
18 532 program of Open Access Publishing.
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24 **533 Disclosure Statement**

25 534 The authors have no conflicts of interest to declare.
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28 **535 Author contributions**

29
30 536 MB, CLS, and SRH outlined and specified the research question. MB and CLS
31 537 conducted the systematic search of the literature. Furthermore, MB, CLS, and TF
32 538 discussed papers in detail in case of disagreement and uncertainty over the eligibility
33 539 of abstracts. MB wrote the first draft of the manuscript. TF, SRH, and CLS revised it
34 540 critically for valuable intellectual content. All authors contributed to and have approved
35 541 the final manuscript.
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43 **543 Data sharing statement**

44 544 No unpublished data is available following this study.
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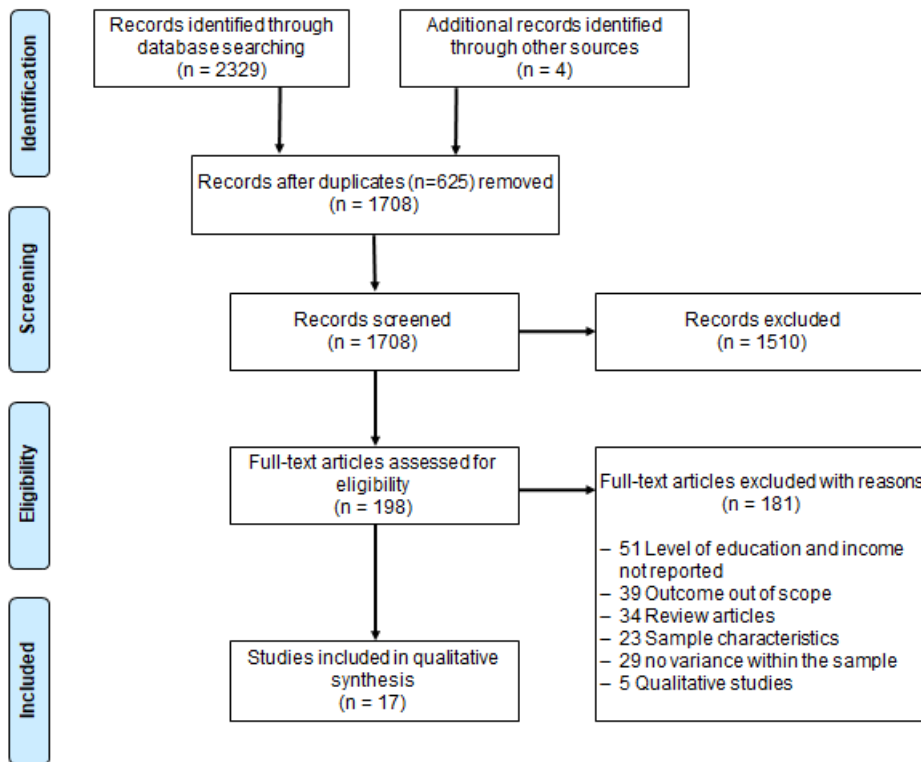


Figure 1 Phases of the systematic review

Peer review only

	Low risk of bias
	Moderate risk of bias
	High risk of bias
	Not reported

Supplementary Material 1. Assessment of Risk of Bias

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
(Brewis and Wutich, 2012)	Low	Low	Not	Low	High	High	Not	Low	Low	Low	Low	Moderate	Not	High	Not	Low	Low	Moderate	Not	Low
(Hansson and Rasmussen, 2014)	Low	Low	Not	Low	Moderate	High	Not	Low	Low	Low	Low	Moderate	Not	High	Moderate	Low	Low	Low	Not	Low
(Hilbert et al., 2017)	Low	Low	Not	Low	Low	Low	Not	Low	Low	Low	Low	Low	Not	High	Moderate	Low	Low	Low	Not	Low
(Jimenez-Cruz et al., 2012)	Low	Low	Not	Low	High	High	Not	Moderate	Low	Low	Moderate	Low	Not	High	Moderate	Moderate	Moderate	Moderate	Not	Low
(Lippa and Sanderson, 2012)	Low	Moderate	Not	Low	Moderate	High	Not	Low	Low	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	Low
(Lund et al., 2015)	Low	Low	Not	Low	Moderate	High	Not	High	High	Low	Moderate	Moderate	Not	High	Low	Low	Low	Low	Not	Low
(Oliver and Lee, 2005)	Low	Low	Not	Low	Low	Low	Not	Not	Not	Low	Low	High	Moderate	High	Low	Low	Low	High	Not	Low
(Puhl et al., 2011)	Low	Low	Not	Low	Low	Low	Not	Low	Low	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	Low
(Puhl et al., 2015)	Low	Low	Not	Low	Low	Low	Not	Low	Low	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	Low
(Puhl and Heuer, 2011)	Low	Low	Not	Low	Low	Low	Not	Low	Low	Low	Low	Low	Not	High	Not	Low	Low	Low	Not	Low
(Puhl et al., 2015)	Low	Low	Not	Low	Low	Low	Not	Low	Low	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	Low
(Puhl and Liu, 2015)	Low	Low	Not	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	Low
(Seo and Torabi, 2006)	Low	Low	Not	Low	Low	Low	Not	Not	Not	Low	Low	Moderate	Not	Low	Not	Low	Low	Low	Not	Low
(Sikorski et al., 2012)	Low	Low	Not	Low	Low	Low	Not	Low	Low	Low	Low	Moderate	Not	High	Low	Low	Low	Low	Not	Low
(Suh et al., 2014)	Low	Low	Not	Low	Moderate	Low	Not	Low	Low	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	Low
(Swami and Monk, 2013)	Low	Low	Not	Low	High	High	Not	Low	Low	Low	Low	Moderate	Not	High	Low	Low	Low	Low	Not	Low

AXIS – Tool to assess the quality of cross-sectional studies (Downes et al., 2016)

1. Were the aims/objectives of the study clear?
2. Was the study design appropriate for the stated aim(s)?
3. Was the sample size justified?
4. Was the target/reference population clearly defined? (Is it clear who the research was about?)
5. Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population under investigation?
6. Was the selection process likely to select subjects/participants that were representative of the target/reference population under investigation?
7. Were measures undertaken to address and categorise non-responders?
8. Were the risk factor and outcome variables measured appropriate to the aims of the study?
9. Were the risk factor and outcome variables measured correctly using instruments/measurements that had been trialled, piloted or published previously?
10. Is it clear what was used to determine statistical significance and/or precision estimates? (eg, p values, CIs)
11. Were the methods (including statistical methods) sufficiently described to enable them to be repeated?
12. Were the basic data adequately described?
13. Does the response rate raise concerns about non-response bias?
14. If appropriate, was information about non-responders described?
15. Were the results internally consistent?
16. Were the results for the analyses described in the methods, presented?
17. Were the authors' discussions and conclusions justified by the results?
18. Were the limitations of the study discussed?
19. Were there any funding sources or conflicts of interest that may affect the authors' interpretation of the results?
20. Was ethical approval or consent of participants attained?



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3-5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	-
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5-7
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5-6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5-7
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6-7
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6-7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6-7
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	14-15
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	No meta-analysis



PRISMA 2009 Checklist

Page 1 of 2

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	5
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	No meta-analysis
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	10-13
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	5
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	11-14
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	No meta-analysis
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	5
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	-
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	15-18
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	20
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	18-20
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	22

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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BMJ Open

Does weight-related stigmatization and discrimination depend on educational attainment and level of income? A systematic review

Journal:	<i>BMJ Open</i>
Manuscript ID	bmjopen-2018-027673.R2
Article Type:	Original research
Date Submitted by the Author:	16-Oct-2019
Complete List of Authors:	Bernard, Marie; Integrated Research and Treatment Center AdiposityDiseases (IFB), University of Leipzig; SRH University of Applied Health Sciences, Fankhänel, Thomas; SRH University of Applied Health Sciences, Riedel-Heller, Steffi; University of Leipzig, Institute of Social Medicine, Occupational Health and Public Health (ISAP), Medical Faculty Luck-Sikorski, Claudia; Integrated Research and Treatment Center AdiposityDiseases (IFB), University of Leipzig; SRH University of Applied Health Sciences
Primary Subject Heading:	Sociology
Secondary Subject Heading:	Sociology, Public health
Keywords:	obesity, stigma, discrimination, education, income

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10 4 **Bernard, Marie** ^{a,b,*}, **Fankhänel, Thomas** ^b, **Riedel-Heller, Steffi G.** ^c, **Luck-Sikorski, Claudia** ^{a,b}

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Word count 5,327

26 **Abstract**

27 **Objectives:** Obesity is considered a global health issue, not only because of its health-
28 related consequences but also because of its impact on social status as a result of stigma.
29 This study aims to review the quantitative state of research regarding socioeconomic
30 characteristics' influence on weight-related stigmatization and discrimination. Based on
31 Bourdieu's Theory of Class and his concept of "habitus," it is assumed that people with a
32 higher level of education and income show stronger negative attitudes toward people with
33 obesity.

34 **Method:** A narrative systematic literature review was conducted in 2017 using PubMed,
35 PsychINFO, Web of Science, and the Cochrane Library. Seventeen studies that measured
36 weight bias and either educational attainment or level of income were included in the
37 analysis.

38 **Results:** The results of the studies included were inconsistent: six of these studies were
39 found to support the hypothesis, whereas two of the studies contradicted it. The remaining
40 seven studies did not show any significant correlation between weight bias and either
41 education or income.

42 **Conclusion:** In light of the inconsistent and heterogeneous results of the studies that report
43 a significant association between weight bias and socioeconomic variables, the findings must
44 be discussed concerning their cultural context, i.e., cultural and governmental differences.
45 Furthermore, educational attainment seems to be more likely to predict weight bias than
46 income. The review revealed a lack of research when it came to examining the impact of
47 socioeconomic capital on weight bias.

48 **Keywords:** obesity, stigma, discrimination, education, income

49 **Strength and limitations of this study**

- 50 ▪ A systematic review following the PRISMA guidelines was conducted to investigate
51 the relationship between weight bias and the socioeconomic status of studies
52 published in English or German.
- 53 ▪ Study selection was performed by two independent reviewers to minimize subjectivity
54 and random errors.
- 55 ▪ This study is limited since no meta-analysis could be performed due to divergent
56 study designs, instruments used, or different ways items were operationalized for
57 statistical analysis

58 Introduction

59 According to the World Health Organization (WHO), the worldwide prevalence of
60 obesity, defined by a body mass index (BMI) of over 30 kg/m², nearly tripled between
61 1975 and 2016 [1]. To give but two examples, current data reveal an obesity rate of
62 over 21% in Germany and 37.7% in the US [2, 3]. With its escalating rate, obesity
63 can be classified as a global health issue, primarily because it is associated with
64 numerous comorbid diseases, such as diabetes mellitus, cardiovascular diseases,
65 and certain forms of cancer [4].

66
67 Not only health-related consequences are connected to obesity, but also
68 psychological implications that affect those concerned on a social level [5]. In
69 particular, obesity is classified as a stigmatized condition. Therefore, being obese is a
70 characteristic that sets those affected apart from people with normal weight. Since
71 obesity is mislabeled as a self-inflicted situation, numerous negative stereotypes,
72 such as laziness, lack of willpower, unhealthy lifestyle, and being unintelligent are
73 associated with the condition [6, 7]. Stigmatization leads to discriminating behavior
74 toward people with obesity in the form of mistreatment in several areas of life, such
75 as labor market, healthcare, and educational system [6, 7].

76 The systematic review of Spahlholz [8] revealed increased perceived discrimination
77 toward people with obesity in comparison to people with normal weight, especially
78 toward people with more extreme obesity (BMI >35 kg/m²) as well as toward women.
79 Moreover, the prevalence of weight-related discrimination accelerated over time. In
80 the US, the prevalence of weight-related discrimination was nine times higher (66%)
81 in 2005 than in 1995 (7.3%) [7, 8] and is thus similar to the rate of racial
82 discrimination, particularly against women [9]. Understanding the origin of stigma,
83 which can be seen as the catalyst for structural discrimination, is necessary to
84 prevent discriminating behavior. Although weight-related stigmatization and
85 discrimination are closely linked, they need to be considered as two divergent
86 concepts. However, in the following, we will refer to weight-related stigmatization and
87 discrimination as “weight bias”, but will differentiate between both concepts whenever
88 needed.

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3 89 Some people are more prone to display weight bias than other: There is some
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5 90 evidence that older age is associated with stigmatizing attitudes [10–12] and stronger
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7 91 evidence that men show stronger weight bias than women [13–16]. When looking at
8
9 92 the body and beauty perception of people, the cultural framework also needs to be
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11 93 considered as a determinant of stigma. According to Bourdieu, the predominant
12
13 94 cultural context determines which values and characteristics can be seen either as
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15 95 desirable or traits to be stigmatized [17]. Depending on regional characteristics,
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17 96 weight is perceived as a sign of class distinction: In undeveloped countries,
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19 97 overweight was associated positively with well-being and wealth, while in developed
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21 98 countries a negative view of being overweight was widespread. Thus, in developed
22
23 99 countries, thinness has been viewed as a sign of beauty, success, and an overall
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25 100 high (socioeconomic) status [18]. Although in the last decades the perception of
26
27 101 obesity or rather slim-body ideals developing countries might have changed [19, 20],
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29 102 results indicate that educational attainment and level of income seem to be relevant
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31 103 regarding weight bias.

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34 105 Although socioeconomic variables and obesity correlate closely, the impact of
35
36 106 educational attainment and level of income on weight bias remain ambiguous.
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38 107 Several studies have shown the negative impact of being overweight on the labor
39
40 108 market, especially for women [21, 22] as well as in the education system [23]. In
41
42 109 addition, a lower level of education and income is associated with obesogenic
43
44 110 behavior such as a poor diet and a lack of exercise caused by factors such as stress
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46 111 [24]. Moreover, Bourdieu [25] sees the most decisive determinant of a healthy
47
48 112 lifestyle in socioeconomic class. While people that belong to the working class
49
50 113 preferred tasty and nutritious food, people from the upper-middle class preferred food
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52 114 that can be described as light, healthy, and low in calories, according to his study.
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54 115 Subsequently, people with a higher level of education and income might choose a
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56 116 healthier lifestyle to distance themselves from people with obesity [26].

57 117 As a superior framework to generate missing hypotheses, Bourdieu's Theory of
58
59 118 Class can be applied [25]. Following his concept of "habitus," a person's general
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119 attitude, lifestyle, and even body shape can be seen as a metaphor for social status
120 [18]. Furthermore, Bourdieu considers stigma as a form of symbolic power and a tool

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3 121 to serve the interests of the powerful [27]. Phelan and colleagues [28] continue with
4
5 122 his line thought and presented three motives of stigma, namely *keeping people in,*
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7 123 *away, or down.* Particularly, *keeping people down* applies to the review's theoretical
8
9 124 framework. Link and Phelan [17] discuss stigma as an instrument of a dominant
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11 125 group to keep another group down to attain or maintain high social status, wealth,
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13 126 and power. However, a person's educational attainment and level of income are
14
15 127 mainly invisible characteristics; thus, there are other attributes that more readily show
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17 128 social status. Assuming that obesity is perceived as a metaphor for lower social
18
19 129 status, groups with higher social status might be aware of this link and keep people
20
21 130 with obesity down to empower themselves. In this review, it is therefore assumed that
22
23 131 people with a higher level of education and income display negative attitudes toward
24
25 132 people with obesity in comparison to people with lower educational attainment and
26
27 133 income. The impact of educational attainment and level of income on weight bias will
28
29 134 be examined and compared.

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30
31 136 Based on a sociological perspective, this systematic literature review attempts to
32
33 137 outline the current state of research and reveal the relationship between weight bias
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35 138 and the level of education and income. Tyler and Slater [29] criticized inter alia "*that*
36
37 139 *one of the major limitations of existing understandings of stigma is the ways in which*
38
39 140 *they have 'bracketed off' key questions, such as where stigmatizing attitudes come*
40
41 141 *from, how and by whom is stigma crafted, mediated, produced and why [...].*" The
42
43 142 general aim of this review is thus to identify social and economic groups that
44
45 143 stigmatize and discriminate against those who are obese. In the future, this
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47 144 information could help researchers to develop and implement interventions in a more
48
49 145 targeted manner.

146 **Methods**

147 Search Strategy

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51 148 A systematic review of published studies reporting weight-related attitudes held by
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53 149 differing socioeconomic status groups was conducted by using the relevant scientific
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55 150 electronic databases: PubMed, PsychINFO, Web of Science, and the Cochrane
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57 151 Library. The review followed the Prisma Guidelines [30].
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3 152 The systematic review of literature was performed independently by two reviewers
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5 153 using the following keywords: stigma*, discrimination, "weight bias", or prejudice;
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7 154 education*, income, salary, wage, status, socio-economic, socioeconomic*, SES,
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9 155 sociodemographic, or socio-demographics; and obes*, overweight, or fat. Giving a
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11 156 very high number of results, the literature search was limited to the publications' titles
12
13 157 and abstracts. Only published studies written in English or German were included.
14
15 158 There was no restriction regarding the year of publication. The stages of the
16
17 159 systematic literature search are provided in Fig. 1. The literature review was
18
19 160 conducted for all studies that have been published until June 2019.

19 161 Data extraction

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21 162 The systematic search of the literature revealed 2,331 studies, whereby 1,708
22
23 163 studies remained after removing duplicates. Furthermore, 1,510 studies were
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25 164 excluded because screening their titles and abstracts for eligibility showed no
26
27 165 association with the research question. Disagreement and uncertainty between the
28
29 166 two reviewers over the eligibility were resolved by reinspecting the papers in detail
30
31 167 and discussing disparate perspectives. For the remaining 198 studies, full articles
32
33 168 were screened in detail to assess their eligibility. For data extraction we used an
34
35 169 adjusted PICO scheme [31]: Studies that collected data of an adult sample (P) which
36
37 170 assessed stigmatizing and discriminating attitudes (I) depending on socioeconomic
38
39 171 variables (C) to investigate if weight bias is associated with socioeconomic status
40
41 172 (O). The detailed inclusion and exclusion criteria are presented in the following.

41 173 Inclusion criteria

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43 174 Studies that report associations between weight bias and either educational
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45 175 attainment or level of income were included. Weight bias was operationalized to
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47 176 reflect stigmatizing and discriminating attitudes. Therefore, studies that measured
48
49 177 stigmatizing attitudes by applying explicit and implicit instruments will be included, but
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51 178 also studies that assessed causal beliefs about obesity, which can be considered as
52
53 179 proxy variable as previously done before [32]. Studies that assessed discriminating
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55 180 attitudes, for example, by measuring the support for weight-related antidiscrimination
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57 181 policies and law, or considering obesity as a financial burden are considered for
58
59 182 inclusion. According to Woolford et al. [33], who found less support to cover obesity-

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3 183 related costs by public health insurances, the public's opinion can be seen as a
4 184 potential guideline for insurance funds [33]. In other words, based on the public's
5 185 view, discrimination might occur in the field of health insurance policies. This
6 186 assumption might be of particular importance when considering the increased
7 187 obesity-related healthcare cost [34].

12 188 Exclusion criteria

14 189 The following exclusion criteria were used to eliminate studies that were not
15 190 applicable: (a) studies with a sample of health care professionals, dietitians,
16 191 psychologists, and physical educators; (b) studies that investigated stigmatizing
17 192 attitudes of children and/or adolescents; (c) studies that investigated stigma toward
18 193 childhood obesity; (d) studies with an overweight and/or obese sample that
19 194 investigated perceived stigmatization; (e) studies with a homogenous sample in
20 195 regard to educational attainment (e.g., students) or level of income; (f) studies that
21 196 investigated weight bias toward extended stigma groups (e.g., obese and binge
22 197 eating); and (g) reviews or qualitative studies. The flowchart (Figure 1) displays how
23 198 many studies were excluded in accordance with the exclusion criteria. In summary,
24 199 50 studies were excluded because they did not report the participants' educational
25 200 attainment or income. In addition, 29 studies did assess data of a sample with no
26 201 variance concerning socioeconomic characteristics, and 23 studies were excluded
27 202 because of the samples' characteristics (overweight/obese or children/adolescents
28 203 sample). Five studies were excluded because they followed a qualitative approach,
29 204 and 34 studies were excluded because they could be categorized as reviews. Thirty-
30 205 nine studies were found that did not meet the criteria for the aimed outcome of weight
31 206 bias. Two studies were neither published in English nor German.

32 207 Moreover, one paper had to be excluded because of its lack of academic
33 208 background. After excluding the studies that did not meet our criteria, 17 studies
34 209 were identified as relevant for in-depth investigation (Figure 1). Therefore, sampling
35 210 characteristics, study design, assessment of weight bias, and measurement of
36 211 educational attainment and income were systematically examined.

212 Risk of Bias

213 We assessed the risk of bias of all studies included using the Appraisal tool for
214 Cross-Sectional Studies (AXIS) developed by Downes and colleagues [35]. The
215 studies were therefore examined regarding potential causes that might induce a
216 specific risk of bias.

217 Patient and Public Involvement

218 Within this study, no patient data were collected. We conducted a systematic review
219 and analyzed data that had already been collected. Thus, patients were not involved
220 in this study.

221 **Results**

222 The 17 studies included were tabulated according to the following characteristics: the
223 origin of the sample, sample size (N), sample characteristics, study design,
224 instruments to assess weight bias, educational attainment or income, and a summary
225 of results. Studies reviewed in detail are tabulated by either educational attainment
226 (Table 1) or by the level of income (Table 2).

227 Study characteristics

228 All relevant study characteristics are summarized in Table 1 and Table 2,
229 respectively. Seven out of seventeen studies are based entirely on an American
230 sample [36–42]. Two other studies are based on an American and an Icelandic
231 sample [43, 44]. These two studies also provided data based on a Canadian sample
232 of health care professionals and American, Australian, and Icelandic student samples
233 that did not meet the inclusion criteria and therefore all four samples had to be
234 excluded. Three studies were based on a German sample [10, 45, 46] and five
235 studies based on one sample, from Paraguay [47], Mexico [48], Sweden [49],
236 Denmark [50], and Great Britain [51] respectively. The study by Brewis and Wutich
237 [47], based on a Paraguayan sample also provided data of a comparison group of
238 US-undergraduate students that were not considered in the analysis because of the
239 homogenous study sample in terms of educational attainment. The seventeen
240 studies included showed a wide variety of sample sizes ranging from 198 [51] to
241 3,502 participants [37].

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3 242 Since the aim of the study was to outline the impact that socioeconomic status in the
4 243 form of educational attainment and level of income have on weight bias, attention
5 244 was paid to a variation in these variables within the samples. The studies included
6 245 therefore focused either on a population-based sample [10, 38, 39, 45, 46, 49] or an
7 246 convenience sample [37, 40, 41, 43, 44, 50]. Although Jiminez-Cruz and colleagues
8 247 [48] investigated stigmatizing attitudes of an entirely low-income sample, they divided
9 248 the socioeconomic factors (level of education and income) into five and four
10 249 categories respectively; thus, variation within the sample could be ensured.
11 250 Moreover, an investigation of weight bias in different gradations of lower status
12 251 groups could provide further insight into the topic. In one study [36], the general
13 252 population was included, whereby the overweight participants received an alternative
14 253 questionnaire assessing the perceived stigmatization and not their stigmatizing
15 254 attitudes toward obesity. Therefore, only the normal weight sample could be
16 255 included.

17 256 The distribution of women and men was equally considered in the majority of studies,
18 257 even though more women than men were included. However, two studies posed an
19 258 exception. The study of Brewis et al. [47] and the study of Jiminez-Cruz [48]
20 259 investigated only the stigmatizing attitudes of female participants.

21 260 We also assessed the risk of bias among all studies that fulfilled the inclusion criteria.
22 261 None of these studies justified the sample size; however, despite a risk of bias
23 262 regarding the non-responders (i.e., no categorization, description, and ratio between
24 263 the response and non-response rate) the majority of the studies included showed a
25 264 low risk of bias. Only a few studies were detected to be at moderate risk of bias
26 265 based on the sampling procedure [36–41]. The summarized risk of bias assessment
27 266 of all studies included is provided as a supplementary table (Supplementary Material
28 267 1)

268 Table 1 Summary of Selected Studies: Weight Bias Depending on Educational Attainment

Study	N	Sample Discription	Instruments Weight bias	Educational attainment	Association's Direction ¹	Magnitude of Association
Form of weight bias: stigmatizing attitudes						
[46]; GER	3003	population based (ø age: 51.7 years; 52.8% female)	Short-FPS[1]	4 subgroups: - No degree - 9 th grade degree - 10 th grade degree - 12 th grade degree	Negative	Multivariate Regression: - No degree = reference category - 9th grade: $\beta = -0.278$, $p < 0.01$, (std. error 0.0852) - 10th grade: $\beta = -0.251$, $p < 0.01$ (std. error 0.0838) - Upper secondary school: $\beta = -0.214$, $p < 0.05$, (std. error 0.0835)
[10]; GER	960	US adults (ø age: 43.8 years; 50.2% female)	WCB [2];	2 subgroups: - Low; <13 years of education - High; ≥ 13 years of education)	Negative	Multiple linear regression - $\beta = -0.16$, $p < 0.001$ Zero-order association - $r = -0.18$, $p < 0.0001$
[48]; MEX	1,100	Women aged 18-40 of low SES (ø age: 37.5 years)	Beliefs about the causes of obesity	5 subgroups: - None - some elementary - elementary - middle - high school	Positive	Logistic regression - "Having an unhealthy lifestyle": unadjusted OR=2.56, $p < 0.001$, Confidence Interval 1.88-3.49
[43]; USA and ISL	899	US adults (ø age: 40.9 years; 46.1% female)	Short-FPS [1]; UMB-FAT [3]	3 subgroups: - High school or less - Some college/technical or vocation degree - College graduate or higher	FPS: Mixed	Linear regression: - High school or less = reference category - Vocational training/some college ($\beta = 0.202$, $p < 0.05$) - College ($\beta = 0.141$, $p > 0.1$) - Postgraduate ($\beta = -0.017$, $p > 0.1$)
					UMB-Fat: Positive	Linear regression: - High school or less = reference category - Vocational training/some college: $\beta = 0.102$, $p > 0.1$ - College: $\beta = 0.189$, $p < 0.05$ - Postgraduate: $\beta = 0.034$, $p > 0.1$
	659	ISL adults (ø age: 45.9 years; 55.1% female)		2 subgroups: - High school or less - College	FPS: Positive	Linear regression: - High school or less = reference category - College: $\beta = 0.068$, $p > 0.1$
					UMB-Fat: Positive	Linear regression: - High school or less = reference category - College: $\beta = 0.160$, $p < 0.05$

[49]; SWE	2,436	Representative Swedish population aged 25-64 (ø age: 47.8 years; 63% female)	ATOP [4]	3 subgroups: - Low - Medium - High	Negative	Spearman zero-order correlations: - $r = -0.023$, $p = 0.260$
[40]; USA	1,118	US adults (ø age: 43.8 years; 50.2% female)	Opinions about obesity as a disease [5]	3 subgroups: - High school or less - Some college/ Technical or vocation degree - College graduate or higher	Mixed	Linear regression - High school or less = reference category Agreement with statements in support of classification - Some college/ technical degree: $\beta = -0.036$, $p > 0.1$ - College graduate or higher: $\beta = 0.035$, $p > 0.1$ Agreement with statements in support of classification - Some college/ technical degree: $\beta = -0.03$, $p > 0.1$ - College graduate or higher: $\beta = 0.095$, $p < 0.1$ but > 0.05
[51]; GB	198	Community-based (ø age: 32.58 year; 50.5% female)	PFRS [6]	5 subgroups - General Certification of Secondary Education - Advanced Level - Undergraduate degree - Postgraduate degree - other qualification	/	Univariate analysis of variance (ANOVA): - $F(1, 197) = 0.47$, $p = .705$, $\eta^2 < 0.01$
[36]; USA	396	General, not overweight population (ø age: 42.7 years; 43.7% female)	Short-FPS[1]	3 subgroups: - High school or less - Some college/associate degree - Bachelor's degree or higher	/	Adjusted model of correlates: - $F(2) = 0.026$, $p = 0.974$
[47]; PRY	200	Women (ø age: 38.9 years)	ATOP [4]; IAT [7]	Metric measurement: years of formal education	/	/
Form of weight bias: both, stigmatizing and discriminating attitudes						
[39]; USA	981	US representative sample (62% female)	Beliefs about obesity as a financial burden for society	4 subgroups: - Less than some high school - High-school graduate - Some college - Higher than a college degree	Positive	Logistic regression - \leq some HS: adjusted OR= 0.25, $p < 0.05$ - Some College: adjusted OR= 1.61, $p < 0.05$ - \geq College: adjusted OR= 1.97, $p < 0.01$
			Beliefs about the controllability of obesity		Mixed	Logistic regression - \leq some HS: adjusted OR= 0.99, $p > 0.05$ - Some College: adjusted OR= 0.90, $p > 0.05$ - \geq College: adjusted OR= 1.68, $p > 0.05$

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Form of weight bias: discriminating attitudes						
[41]; USA	1,114	Adults (ø age: 44.87 years; 48% female)	6 Statements assessing support of general and employment-specific antidiscrimination laws or policies	3 subgroups: - High school or GED completed - 2-Year vocational/technical degree or some college - College graduate	Positive	Ordinal logistic regression, for all 6 statements - High school/GED = reference category - College: OR 0.28-0.49, p<0.05)
[37]; USA	3,502	Adults (age 21-65; 61.9% female)	3 statements assessing support of legal protection and employment-specific antidiscrimination laws or policies	3 Subgroups: - High school or less - some college/ technical or vocation degree - College graduate or higher	Positive	Multiple logistic regression - High school or less = reference category - Some college/Technical or vocation degree ▪ Law 1: adjusted OR=0.7, p>0.01 ▪ Law 2: adjusted OR=0.9, p>0.05 ▪ Law 3: adjusted OR=1.2, p>0.05 - College graduate or higher ▪ Law 1: adjusted OR=0.7, p>0.01 ▪ Law 2: adjusted OR=0.8, p<0.05 ▪ Law 3: adjusted OR=0.3, p=0.05
[44]; USA and ISL	893	US adults (ø age:40.9 years; 46.1% female)	13 statements assessing support for employment-specific and broader antidiscrimination laws or policies	3 Subgroups - High school or less - some college/technical or vocation degree - College graduate or higher	Positive	Tobit Regression - High school or less = reference category Broad laws and policies - Vocational training/some college: Coeff= -0.135, p>0.05 - College: Coeff = -0.223, p>0.05 - Postgraduate: Coeff = -0.040, p>0.05 Employment-specific laws and policies - Vocational training/some college: Coeff= -0.115, p>0.05 - College: Coeff= -0.220, p>0.05 - Postgraduate: Coeff.= -0.087, p>0.05
	658	ISL adults (ø age:45.9 years; 46.1% female)				2 subgroups - High school or less - College
[38]; USA	1,001	Population-based sample (ø age:43.8 years; 51% female)	6 statements assessing support for general, employment-specific and broader policies/ antidiscrimination laws or policies	3 subgroups - High school - college degree - Postgraduate degree	Positive	Logistic regression, five of six statements - High school = reference category - Higher degree: OR= 0.56-0.72, p<0.05

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[42]; USA	909	US adults	2 statements assessing support for antidiscrimination policies	Only 2 subgroups reported: - less than High school - College degree	Positive	Probit Model - Less than High school = reference category "Government should do more to protect obese" - College degree: $\beta = -0.100$, $p < 0.05$ "Overweight should get same protections as disabled" - College degree: $\beta = -0.136$, $p < 0.01$
[45]; GER	2,531	Population-based sample (ø age: 48.79 years; 55.5% female)	6 Statements assessing support of general and employment-specific antidiscrimination laws or policies	2 subgroups: - Low (<12 years of education) - High (≥ 12 years of education)	General laws Positive Employment-specific laws: Negative	Logistic regression - Education ≥ 12 years: OR= 0.60, $p = 0.005$ Logistic regression - Education ≥ 12 years: OR= 1.25, $p = 0.016$
[50]; DNK	1,003	Citizens aged 18-65	Attitudes toward weight-loss surgery & medical treatment of obesity	No details reported	/	/

271 Note: ¹ Bold characters display significant association, Positive = demonstrates greater anti-fat attitudes with increasing educational attainment; Negative = demonstrate greater anti-fat
 272 attitudes with decreasing educational attainment; N = sample size; FPS = Fat Phobia Scale; UMB = Universal Measure of Bias; WCB = Weight Control/Blame of the Anti-Fat Attitudes Test;
 273 ATOP = Attitudes to Obese People; IAT = Implicit Association Test; PFRS = Photographic Figure Rating Scale; SES = Socioeconomic status

274 **Table 2 Summary of Selected Studies: Weight Bias Depending on Level of Income**

Study	N	Sample Discription	Instruments Weight bias	Level of income	Direction of Correlation ¹	Magnitude of Association
Form of weight bias: stigmatizing attitudes						
[48]; MEX	1,100	Women aged 18-40 of low SES (ø age: 37.5 years)	Beliefs about the causes of obesity	Weekly income, 4 subgroups: - USD < 1,200 - USD 1,200-2,000 - USD 2,000-4,000 - USD ≥ 4,000	Negative	Logistic regression - "Having an unhealthy lifestyle: unadjusted OR= 1.13, p>0.05, Confidence Interval 0.78-1.62
[10]; GER	960	Population based sample (ø age: 45.9 years; 56.9% female)	WCB [2]	Monthly Income, 2 subgroups: - EUR < 2,000 - EUR ≥ 2,000	Negative	Zero-order association - r= -0.02, p>0.01
[49]; SWE	2,436	Representative Swedish population aged 25-64 (ø age: 47.8 years; 63% female)	ATOP [4]	Annual household income; no subgroups reported	Positive	Pearson and Spearman zero-order correlations: - r=0.018, p= .382
[40]; USA	1,118	US adults (ø age:43.8 years; 50.2% female)	Opinions about obesity as a disease [5]	Annual household income, 5 subgroups - USD < 25,000 - USD 25,000-49,999 - USD 50,000-74,999 - USD 75,000-99,999 - USD > 100,000	Mixed	Linear regression - Less than \$25,000 = reference category Agreement with statements in support of classification - USD 25,000 - 49,999: β= 0.045, p>0.1 - USD 50,000 - 74,999: β= 0.113, p<0.1 - USD 75,000 - 99,999: β= 0.084, p>0.1 - > USD 100,000: β= -0.026, p>0.1 Agreement with statements in opposition of classification - USD 25,000 - 49,999: β=0.06, p>0.1 - USD 50,000 - 74,999: β=-0.019, p>0.1 - USD 75,000 - 99,999: β=0.041, p>0.1 - > USD 100,000: β=0.061, p>0.1
[46]; GER	3003	population based (ø age:51.7 years; 52.8% female)	Short-FPS [1]	Monthly household income, 4 subgroups: - EUR < 999 - EUR 1,000-1,999 - EUR 2,000-2,999 - EUR > 3,000	/	/

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[36]; USA	396	General, not overweight population (ø age: 42.7 years; 43.7% female)	Short-FPS [1]	Annual household income,5 subgroups: - USD < 20,000 - USD 20,000-39,000 - USD 40,000-59,000 - USD 60,000-79,000 - USD > 80,000	/	Correlation: - Unadjusted, correlation coefficient not reported, p= 0.305
Form of weight bias: Both, stigmatizing and discriminating attitudes						
[39]; USA	981	US representative sample (62% female)	Beliefs about obesity as a financial burden for society Beliefs about the controllability of obesity	Annual household income, 4 subgroups: - USD < 25,000 - USD 25,000 < 50,000 - USD 50,000 < 75,000 - USD ≥ 75,000	Positive	Logistic regression - USD < 25,000 = reference category - USD 25,000 < 50,000: adjusted OR= 1.02, p>0.05 - USD 50,000 < 75,000: adjusted OR= 1.57, p>0.05 - USD ≥ 75,000: adjusted OR= 3.18, p<0.001
					Negative	Logistic regression - USD < 25,000 = reference category - USD 25,000 < 50,000: adjusted OR= 0.82, p>0.05 - USD 50,000 < 75,000: adjusted OR= 0.96, p>0.05 - USD ≥ 75,000: adjusted OR= 0.51, p>0.05
Form of weight bias: discriminating attitudes						
[42]; USA	710	US adults (aged 18 – 65)	2 statements assessing support for civil protections for the obese	Annual household income - USD < 15,000 - USD > 100,000	Positive	Probit Model - USD < 15,000 = reference category "Government should do more to protect obese" - USD > 100,000: β= -0.098, p<0.01 Overweight should get same protections as disabled" - USD > 100,000: β= -0.077, p<0.01
[45]; GER	2,531	Population-based sample (ø age: 48.79 years; 55.5% female)	6 Statements assessing support of general and employment-specific antidiscrimination laws or policies	Monthly Income, 2 subgroups: - EUR < 2,000 - EUR ≥ 2,000	Positive	Logistic regression General laws or policies - EUR < 2,000 = reference category - EUR ≥ 2,000: OR=0.67, p=0.002 Logistic regression Employment-specific laws or policies - EUR < 2,000 = reference category - EUR ≥ 2,000: OR=0.91, p=0.376
[38]; USA	1,001	Population based sample (ø age: 43.8 years; 51% female)	6 statements assessing support for general, employment-specific and broader policies/ antidiscrimination laws or policies	Annual household income, 5 subgroups - USD 15,000-25,000 - USD 25,000-49,999 - USD 50,000-74,999 - USD 75,000-99,999 - USD > 100,000	Positive	Logistic regression, five of six statements - USD 15,000-25,000 = reference category - Adjusted OR= 0.52-0.64, p<0.05

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[41]; USA	1,114	Adults (ø age: 44.87 years; 48% female)	6 Statements assessing support of general and employment-specific antidiscrimination laws or policies	Annual household income, 5 subgroups: - USD < 25,000 - USD 25,000-49,999 - USD 50,000-74,999 - USD 75,000-99,999 - USD > 100,000	Positive	Ordinal logistic regression - USD < 25,000 = reference category - Significant results among women but not men “Obesity should be considered a disability under the ADA to protect obese people from weight discrimination in the workplace” - USD 75,000-99,999: OR= 0.52, p<0.05 “Congress should pass the WDEA to protect overweight Americans from discrimination in the workplace” - USD 75,000-99,999: OR= 0.49, p<0.05
[37]; USA	3,502	Adults (age 21-65; 61.9% female)	3 statements assessing support of legal protection and employment-specific antidiscrimination laws or policies	Annual household income, 5 subgroups - USD < 25,000 - USD 25,000-49,999 - USD 50,000-74,999 - USD 75,000-99,999 - USD > 100,000	Mixed	Logistic Regression Model - USD 15,000-25,000 = reference category - USD 25,000-49,999 - Law 1: OR=1.0, p>0.05) - Law 2: OR=1.2, p>0.05) - Law 3: OR=1.0, p>0.05) - USD 50,000-74,999 - Law 1: OR=1.0, p>0.05) - Law 2: OR=1.2, p>0.05) - Law 3: OR=1.0, p>0.05) - USD 75,000-99,999 - Law 1: OR=1.2, p>0.05) - Law 2: OR=1.3, p>0.05) - Law 3: OR=0.9, p>0.05) - USD > 100,000 - Law 1: OR=0.8, p>0.05) - Law 2: OR=1.0, p>0.05) - Law 3: OR=0.9, p>0.05)
[50]; DNK	1,003	Citizens (age 18-65)	Attitudes toward weight-loss surgery & medical treatment of obesity	No details reported	/ /	

Note: ¹ Bold characters display significant association, Positive = demonstrates greater weight bias with increasing level of income; Negative = show greater weight bias with decreasing level of income; N = sample size

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3 279 Instruments
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5 280 The studies included were found to be heterogeneous with regard to the instruments
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7 281 used (Table 3 and 4). Therefore, the study team has decided against a meta-analysis
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9 282 and for a systematic narrative literature review.

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11 283 Educational attainment and level of income
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13 284 Seventeen studies were found that assessed attitudes toward obesity in association
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15 285 with participants' educational attainment and/or level of income. All of these
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17 286 seventeen studies reported the participants' educational attainment [10, 36–51].
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19 287 Depending on the origin of the sample and the analogous countries' educational
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21 288 system, categories were formed or years of educational attainment were gathered.
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23 289 From seventeen studies, thirteen assessed participants' level of income [10, 36–42,
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25 290 45, 46, 48–50]; therefore, income was either assessed by the annual, weekly,
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27 291 household, or individual income.

27 292 Weight Bias in Form of Stigmatizing Attitudes
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29 293 Studies that examined either participants' stigmatizing attitudes or participants'
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31 294 beliefs about the causes of obesity [10, 36, 39, 40, 43, 46–49, 51] were included.
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33 295 Stigmatizing attitudes were thereby measured with instruments such as the Fat
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35 296 Phobia Scale (FPS), the Universal Measure of Bias (UMB), the Weight Control/Blame
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37 297 of the Antifat Attitude Test (WCB), the Attitudes to Obese People (ATOP), the Implicit
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39 298 Association Test (IAT), or the Photographic Figure Rating Scale (PFRS). As
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41 299 described before, beliefs about the causes of obesity in the form of evaluating obesity
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43 300 as a controllable condition – which is supposedly preventable by a greater extent of
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45 301 self-discipline – can consequently be seen as one decisive factor in determining
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47 302 stigmatizing attitudes [52] and was therefore included. The instruments used are
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49 303 presented in Table 3.
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304 **Table 3 Overview of the instruments used to measure stigmatizing attitudes**

Instruments measuring Stigmatizing attitudes	Studies that apply the instrument
<i>Explicit Stigma</i>	
- Fat Phobia Scale (FPS)	[36, 43, 46]
- Universal Measure of Bias (UMB)	[43]
- Attitudes to Obese People (ATOP)	[47, 49]
- Opinions about obesity as a disease	[40]
- Photographic Figure Rating Scale (PFRS)	[51]
<i>Implicit Stigma</i>	
- Implicit Association Test (IAT)	[47]
<i>Causal Attribution</i>	
- Weight Control/Blame of the Anti-Fat-Attitudes (WCB)	[10]
- Potential causes of obesity	[48]
- Individuals responsibility ("Obese people can do something about their weight")	[39]

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306 Weight Bias in the form of Discriminating Attitudes

307 We found eight studies that investigated participants' discriminating attitudes toward
308 people with obesity [37–39, 41, 42, 44, 45, 50]. All instruments used to measure
309 discriminating attitudes are listed in Table 4. Discrimination was measured for
310 example, by examining policy and law support, but also the ratings on the statement
311 "Obesity is a major burden to society in terms of healthcare costs" as well as attitudes
312 toward weight-loss surgery and medical treatment. We found some studies [37, 38,
313 41, 42, 44, 45] that investigated support for the same or almost identical laws or
314 policies (Law/policy a-i). However, these items were analyzed in such heterogeneous
315 way, for example, by merging different items into one, that a meta-analysis could not
316 be conducted.

317 **Table 4 Overview of the instruments used to measure discriminating attitudes**

Instrument measuring discriminating attitudes	Studies that apply the instrument
<i>Attitudes toward weight-loss surgery & medical treatment</i>	[50]
<i>Beliefs about obesity as a financial burden for society</i>	[39]
<i>Statements measuring support/rejection of weight-related laws or policies</i>	
a My country/state should include body weight in our civil rights law in order to protect people from discrimination based on their body weight	[37, 38, 41, 44, 45]
b It should be illegal for an employer to refuse to hire a qualified person because of his or her body weight.	[37, 38, 41, 44, 45]
c It should be illegal for an employer to terminate or fire a qualified employee because of his or her body weight.	[37, 38, 41, 44, 45]
d Fat/overweight persons should be subject to the same legal protections and benefits offered to people with physical disabilities.	[37, 38, 41, 42, 44, 45]
e It should be illegal for an employer to deny a promotion or appropriate compensation to a qualified employee because of his or her body weight.	[37, 38, 41, 44]
f Obesity should be considered a disability (under the ADA) so that people will be protected from weight discrimination in the workplace	[38, 41, 44, 45]
g Congress/Government should pass the Weight Discrimination in Employment Act (WDEA) to protect overweight Americans from discrimination in the workplace/employees from discrimination in the workplace based on their body-weight.	[38, 41, 44]
h The government should play a more active role in protecting overweight people from discrimination.	[38, 41, 42]
i It should be illegal for an employer to assign lower wages to a qualified employee because of his or her body weight.	[44, 45]
j The government should have specific laws in place to protect people from weight discrimination.	[44]
k The government should penalize (or fine) those who discriminate against persons because of their weight.	[44]
l Individual companies should have the right to determine whom to hire based on an employee's personal body weight.	[44]
m Employers should be allowed to assign different salaries to employees based on their body weight.	[44]
n My country should pass a Healthy Workplace Law to address workplace bullying	[44]

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319 **Findings**

320 The studies included showed a very heterogeneous picture regarding their results.

321 Eleven out of the seventeen studies significantly associated educational attainment
 322 (Table 5) and/or level of income (Table 6) with stigmatizing and/or discriminatory
 323 attitudes toward people with obesity [10, 37–39, 41–46, 48].

324 Associations between educational attainment and weight-related stigmatization

325 We found ten studies that reported an association between educational attainment
326 and stigmatizing attitudes, whereas only two of them [43, 48] showed a positive
327 association between higher educational attainment and weight-related stigmatization.
328 In addition, the study of Puhl and colleagues [43, 44] found a significant association
329 in the Icelandic (Beta=0.160, $p<0.05$), but not in the American sample. However, two
330 German studies [10, 46] showed an inverse correlation. Both of these studies found
331 evidence that higher education is associated with lower stigma [46] and less belief in
332 individual responsibility [10] for an obese condition. The remaining studies did not
333 report significant associations.

334 Associations between educational attainment and weight-related discrimination

335 Six studies [37–39, 41, 42, 44] reported increased discriminating attitudes with higher
336 education. The study of Puhl and colleagues found no significant association
337 between weight bias and educational attainment in the US sample, but did find an
338 association in the Icelandic sample (Beta = -0.221, $p<0.01$). The study of Hilbert and
339 colleagues [45] revealed inconsistent findings: Higher education is associated with
340 less support for general but more support for employment specific weight-related
341 antidiscrimination laws or policies.

342 Associations between the level of income and weight-related stigmatization

343 We found no study that reported a significant association between the level of
344 income and weight-related stigmatization. Associations between the level of income
345 and weight-related discrimination

346 Four American [38, 39, 41, 42] revealed stronger weight-related discrimination with
347 increasing income. One German study [45] found less support for general, but not for
348 employment specific policies and laws among more affluent people. Although the
349 study of Suh et al. [37] found a significant positive association between level of
350 income and support for two laws and policies (law a: $\chi^2=6.06$, $p=0.01$; law d: $\chi^2=3.81$,
351 $p=0.05$), these results could not be validated by logistic regression analysis.
352 Moreover, the assumption that discrimination, in the form of views on the funding for
353 medical or weight-loss surgery, is somehow associated with income was not found
354 [50].

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355 Table 5. Studies That Show Significant Associations Between Education Attainment and Weight-Related Stigmatization and Discrimination

Study	Direction of correlation	Form of Weight Bias	Instrument Weight Bias	Result	Adjusted for
[46]	Negative	Stigmatization	Short-FPS	Higher educational attainment is associated with lower stigmatizing attitudes	Gender, age, income, residence, emigrational background
[10]	Negative	Stigmatization	WCB	Higher educational attainment is associated with less stigmatizing attitudes (P<0.001)	Causal attributions to behavior, Labeling obesity as an illness, Age, Causal attributions to heredity
[43]	Positive	Stigmatization	UMB-Fat	Higher educational attainment is associated with higher stigmatizing attitudes (ISL sample; P<0.05)	Gender, race/ethnicity, BMI, perceived causes of obesity, weight-related attributions
[48]	Positive	Stigmatization	Beliefs about the causes of obesity	Higher educational attainment is associated with greater belief in individual responsibility (P<0.001)	Unadjusted
[39]	Positive	Discrimination	Belief in obesity as a financial burden for society	Higher educational attainment is associated with greater belief in the statement "Obesity is a major burden to society in terms of healthcare costs" (P<0.01)	Race/ethnicity, sex, income, employment, age group, marital status, BMI, smoking status
[37]	Positive	Discrimination	Support for weight-related laws or policies	Higher educational attainment is associated with lower support for weight-related laws or policies (P<0.01)	Other socio-demographic variables
[44]	Positive	Discrimination	Support for weight-related laws or policies	Higher educational attainment is associated with less support for weight-related laws or policies (P<0.01)	Sex, age, race/ethnicity, BMI
[38]	Positive	Discrimination	Support for weight-related laws or policies	Higher educational attainment is associated with lower support for weight-related laws or policies	Sex, body weight, age, income, race, political affiliation, history of weight-based victimization
[42]	Positive	Discrimination	Support for civil protections for the obese	Higher educational attainment is associated with lower support for civil protection of the obese	Sex, age, BMI, race/ethnicity, income, political orientation, perceived causes for obesity
[41]	Positive	Discrimination	Support for general and employment specific antidiscrimination laws or policies	Higher educational attainment is associated with less support for weight-related laws or policies	Body weight, age, race, political affiliation, income, history of weight-based discrimination, divergent vignettes describing obesity and obesity-related (workplace) discriminations
[45]	Positive	Discrimination	Support for general antidiscrimination laws or policies	Higher educational attainment is associated with less support for general antidiscrimination laws or policies	Sex, age, weights status, income, residence, church membership, readiness to vote in following week, weight-based victimization, weight bias internalization
	Negative		Support for employment-specific antidiscrimination laws or policies	Higher educational attainment is associated with stronger support for employment specific antidiscrimination laws or policies	

Positive = demonstrates greater weight bias with increasing educational attainment; Negative = show greater weight bias with decreasing educational attainment

356 Table 6 Studies That Show Significant Associations Between Level of Income and Weight-Related Stigmatization and Discrimination

Study	Direction of correlation	Form of Weight Bias	Instrument Weight Bias	Result	Adjusted for
[39]	Positive	Discrimination	Belief in obesity as a burden for society	Yes; A higher income level is associated with greater belief in statement "Obesity is a major burden to society in terms of healthcare costs" (P<0.05)	Race/ethnicity, sex, education, employment, age group, marital status, BMI, smoking status
[38]	Positive	Discrimination	Support for weight-related laws or policies	Higher income is associated with lower support for weight-related laws or policies	Sex, body weight, age, education, income, race, political affiliation, history of weight-based victimization
[42]	Positive	Discrimination	Support for civil protections for the obese	Higher income is associated with lower support for civil protection of the obese	Sex, age, BMI, race/ethnicity, education, political orientation, perceived causes for obesity
[41]	Positive	Discrimination	Support for general and employment specific antidiscrimination laws or policies	Higher income is associated with less support for weight-related laws or policies	Body weight, age, race, political affiliation, education, history of weight-based discrimination, divergent vignettes describing obesity and obesity-related (workplace) discriminations
[45]	Positive	Discrimination	Support for general antidiscrimination laws or policies	Higher income is associated with less support for general antidiscrimination laws or policies	Sex, age, weights status, education, residence, church membership, readiness to vote in following week, weight-based victimization, weight bias internalization

Positive = demonstrates greater weight bias with increasing level of income; Negative = show greater weight bias with decreasing level of income

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358 Discussion

359 This systematic literature review aimed to summarize the current state of research on
360 socioeconomic status and its impact on weight-related stigmatization and
361 discrimination. As it was outlined earlier, the association between socioeconomic
362 factors and weight bias has not been investigated sufficiently [41]. This review aimed
363 therefore to address this gap. Although many studies were found that investigated
364 various forms of weight bias and assessed socioeconomic data, an association was
365 only reported in 17 studies. The underlying reason why an association was not
366 reported might be a different research focus, but also insignificant findings. Overall,
367 eleven out of the seventeen studies showed that weight bias is significantly
368 associated with either educational attainment or level of income. In the following the
369 results are discussed separated by education and income, as well as weight-related
370 stigmatization and discrimination.

371 Educational Attainment, Level of Income, and Stigmatizing Attitudes

372 Overall, ten studies reported an association between educational attainment and
373 stigmatizing attitudes. However, we found no systematic pattern in which way
374 educational attainment and stigmatizing attitudes are associated: Two studies [43,
375 48] supported the hypothesis that stigmatizing attitudes are more likely in people with
376 higher educational attainment, whereas two German studies [10, 46] contradict this.
377 Moreover, six studies [36, 39, 40, 47, 49, 51] did not show any significant association,
378 nor a clear direction of the assumed association. In light of divergent results of
379 studies that report a significant association between socioeconomic variables and
380 stigmatizing attitudes, the findings must be discussed with regard to their cultural
381 context: American, Mexican, and Icelandic studies were found to support the working
382 hypothesis, whereas two German studies [10, 46] revealed findings to the contrary.
383 These differences might be explained when considering cultural distinctions. In
384 cultures, in which individual responsibility is considered as one of the leading causes
385 of self-fulfillment, health, and wealth, obesity might be perceived as a self-inflicted
386 condition. Highly educated people might attempt to keep people down to maintain
387 their high(er) social status. In contrast, in cultures in which individuals' situations are
388 principally considered as a result of various circumstances, obesity might

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3 389 consequently not only be seen as self-inflicted. In these cultures, especially highly
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5 390 educated people might be aware of social barriers as determinants for self-fulfillment,
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7 391 wealth, and health, i.e., body weight. In conclusion, the direction of the relationship
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9 392 between weight bias and socioeconomic status might depend on divergent socio-
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11 393 cultural perspectives. Hence, future research should consider expansion and
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13 394 reorientation of stigma's theoretical framework by focusing on the meso and macro
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15 395 socio-cultural structures, as Bonnington and Rose [53] suggest.
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17 397 Overall, we found eight studies that investigated (or rather reported) the association
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19 398 between level of income and stigmatizing attitudes. None of these studies showed a
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21 399 significant relationship. However, the direction of the (insignificant) associations did
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23 400 not show any pattern. We found three studies reporting an (insignificant) positive
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25 401 association [10, 39, 48], and one study each reporting an (insignificant) positive [49]
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27 402 or mixed associations [40].

28 403 Educational Attainment, Level of Income, and Discriminating Attitudes

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30 404 Of the seventeen studies included, eight studies were found that reported an
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32 405 association between educational attainment and discriminating attitudes. Five of
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34 406 these studies reported a positive relationship, i.e., stronger discriminating attitudes (in
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36 407 the form of law and policy support) with increasing education. Another study [44] that
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38 408 applied the same instruments for an American and an Icelandic sample found only
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40 409 indications for our assumption (i.e., higher education is associated with stronger
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42 410 discriminating attitudes) in the Icelandic, but not in the American sample. This study
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44 411 [44] was also replicated by Hilbert et al. [45], who report heterogeneous findings as
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46 412 they found less support for general antidiscrimination laws with increasing level of
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48 413 education, but stronger support for employment specific laws and policies among the
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50 414 higher educated German sample. It should, therefore, be discussed whether general
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52 415 and employment specific antidiscrimination policies and laws can be viewed as
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54 416 similar outcomes or if they display different dimensions of discrimination. Moreover,
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56 417 views on who should pay for medical treatment or weight-loss surgery did not reveal
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58 418 significant associations [50]. Only one study [50] did not find a significant
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60 419 association between educational attainment and discriminating attitudes, nor did it
420 report the direction of the insignificant association.

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3 421 With regard to the association between level of income and discriminating attitudes
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5 422 we found overall seven studies in which an association was reported. Five studies
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7 423 [38, 39, 41, 42, 45] reported positive relationships, i.e., stronger discriminating
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9 424 attitudes with an increasing level of income. Suh et al. [37] found a significant
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11 425 association of stronger support for weight-related laws with decreasing income until
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13 426 they controlled for other sociodemographic variables, such as educational attainment.
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15 427 They reported mixed (insignificant) results concerning the direction of the assumed
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17 428 association. A possible explanation for these insignificant results after controlling for
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19 429 education might be that income can be seen as a proxy variable for education, in the
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21 430 way that the level of income depends on educational attainment. Again, Lund and
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23 431 colleagues [50] who asked Danish citizen by whom medical treatment and weight-
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25 432 loss surgery should be funded, found no significant association, nor did they report a
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27 433 direction of the association.

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29 434 These findings support our assumption that higher socioeconomic status is
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31 435 associated with stronger discriminating attitudes. However, one German study [45]
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33 436 reported contradicting results that might be ascribed at a macro level to Bourdieu's
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35 437 theory about how cultural frameworks determine how specific values and
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37 438 characteristics are perceived. Governmental structures might enforce stigmatizing
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39 439 and discriminating attitudes as an instrument to 'nudge people into desired patterns
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41 440 of behavior' [29]. It can be assumed that cultural frameworks shape governmental
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43 441 systems and are strengthened at the same time through them, especially through the
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45 442 national health and welfare systems. Tyler and Slater [29], for example, outline the
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47 443 political and social function of stigma as a form of power. They discuss macro-level
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49 444 structures, particularly those used actively and passively by governments, as
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51 445 determinants shaping stigmatizing and discriminating attitudes, a level of
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53 446 understanding often left out in social psychology. As explained above, it might be
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55 447 possible that in countries in which obesity is merely perceived as self-inflicted,
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57 448 discriminating attitudes might be stronger - Hence, stigma is not only an instrument
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59 449 used by individuals to enforce personal interests but also one put in place (intended
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61 450 or not) by governments.

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3 451 The different and to some extent inconclusive results might be caused by diverging
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5 452 study designs, sample sizes, and instruments assessing weight-related stigmatization
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7 453 and discrimination, educational attainment, and level of income: Studies that did not
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9 454 show a significant association between weight bias and either educational attainment
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11 455 or level of income excluded the overweight portion of the sample [36] or were
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13 456 characterized by a small sample (ranging from n=198 to n=396) size [36, 47, 51].
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15 457 Furthermore, the association between weight bias with either educational attainment
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17 458 or level of income were not seen in instruments such as the Attitudes to Obese
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19 459 People scale (ATOP) [47, 49], the Implicit Association Test (IAT) [47] agreement
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21 460 ratings as to whether obesity can be classified as a disease [40], and measurement
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23 461 of attitudes toward weight-loss surgery and medical treatment [50].
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26 463 However, there are findings diminishing this line of argument: The study of Hilbert et
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28 464 al. [45] found less support for general, but stronger support for employment specific
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30 465 laws with increasing socioeconomic status. In addition, the German population was
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32 466 found to be less supportive of laws and policies that would impede to refuse to hire,
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34 467 assign lower wages, and to fire qualified persons because of their body weight,
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36 468 compared to an American and Icelandic sample [44]. Moreover, the German
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38 469 population was less supportive of including body weight in the civil rights of law
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40 470 compared to the American, but not the Icelandic sample.

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42 471 A final point of discussion might be whether the prevalence of obesity has an impact
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44 472 on the magnitude of weight bias. When comparing the prevalence and the
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46 473 stigmatization of obesity between the USA and Germany, for example, the following
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48 474 can be stated: In both countries, the prevalence of obesity increased over time (1995,
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50 475 USA 21.9%; GER 14.5%; 2005 USA 29%; GER 18%) [54]. However, not only the
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52 476 prevalence of obesity itself increased, but also the (perceived) stigmatization toward
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54 477 people with obesity in the US but also in Germany [7, 8, 10, 55].
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3 478 Limitations
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5 479 Just as any overview must contend with heterogeneous samples and instruments,
6 480 this systematic review has likewise attempted to cope with varying data. The studies
7 481 reviewed differed with respect to the instruments used to assess education and
8 482 income. In particular, the measurement of educational attainment was strongly
9 483 influenced by the different organization and structure of the varied local educational
10 484 systems. In addition, the instruments to assess weight bias were also heterogeneous,
11 485 particularly those used to measure stigmatizing attitudes. Some studies used
12 486 validated scales, whereas other studies used single items only. Thus, the manner of
13 487 gathering data and classifying categories can be described as heterogeneous itself –
14 488 and therefore caused the study team to decide against a meta-analysis. However,
15 489 studies that did use the same instrument, such as items weighing support for specific
16 490 laws and policies differed with regard to how they were analyzed (as single items or
17 491 as an item battery). Therefore, the authors had to decide again against a meta-
18 492 analysis and applied a vote-counting approach despite its shortcomings.

19 493 Moreover, the study aimed to investigate socioeconomic determinants of weight bias
20 494 in the general population, as discussed in the inclusion and exclusion section.
21 495 Therefore, we excluded, among other things, studies that focused on overweight
22 496 and/or obese samples only. We assumed that people try to differentiate themselves
23 497 from lower status groups, which might be characterized by varying body sizes, i.e.,
24 498 excess weight or obesity. However, overweight and obese samples were included as
25 499 part of the general population in some studies. Also, these studies did not
26 500 differentiate their results by participants' body sizes. We also excluded studies based
27 501 on homogenous samples, such as health care professionals and students. We
28 502 considered these studies as inadequate since there would have been no possibility to
29 503 compare and thus interpret these results with regard to the research question.
30 504 Moreover, stigmatizing attitudes among some professions, such as dietitians and
31 505 nutritionists, were already investigated systematically.

32 506 In the general population, we assume that people try to differentiate themselves not
33 507 only by socioeconomic status but by other status markers as well, such as excess
34 508 weight. Although we attempted to explain the heterogeneous and inconclusive results
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3 509 by appealing to governmental and cultural differences, there was insufficient (and
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5 510 also inconclusive) evidence to conclude the role of cultural and governmental
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7 511 structures on weight bias.

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9 512 Since the study team has only sufficient language skills in English and German, the
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11 513 current research includes only papers written in English or German

12 13 514 **Conclusion**

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15 515 The literature review aimed to investigate to what extent weight bias can be traced
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17 516 back to socioeconomic variables, such as educational attainment and level of
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19 517 income. We assumed that a higher level of education or income is associated with
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21 518 greater stigmatization and discrimination. Therefore, the current study situation was
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23 519 analyzed systematically. Although data of education and income are always collected
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25 520 as mandatory sociodemographic information, research is lacking when it comes to
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27 521 examining their impact on weight bias. Since this question has not yet been
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29 522 answered sufficiently, this review was supposed to address this gap in research and
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31 523 aimed to contribute to closing this gap.

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33 524
34 525 Our working hypothesis that weight bias increases with higher educational attainment
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36 526 or level of income could not be verified. Particularly, we found eight studies that
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38 527 supported our hypothesis, two German studies indicating the reverse conclusion, one
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40 528 German study reported heterogenous findings and seven studies that did not show a
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42 529 significant association at all.

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45 531 The key to identifying effective interventions to battle stigmatization, discrimination,
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47 532 and consequences for those affected might lie in exposing the characteristics of
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49 533 stigmatizing groups and their motivations. Therefore, future research should pay
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51 534 more attention to the link between weight bias and socioeconomic factors and
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53 535 cultural or rather governmental structures. Moreover, meta-analysis should be
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55 536 considered as an important direction for future research.

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3 **537 Figure legends**

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5 538 Figure 1. Phases of the systematic review

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8 **539 Supplementary Material**

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10 540 Supplementary Material 1. Risk of Bias Assessment

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12 **541 Funding Sources**

13
14 542 This study was supported by the Federal Ministry of Education and Research
15 543 (BMBF), Germany, FKZ: 01EO1501. The funding source had no involvement in study
16 544 design, collection, analysis, and interpretation of data. Furthermore, we acknowledge
17 545 support from the German Research Foundation (DFG) and University Leipzig within
18 546 the program of Open Access Publishing.

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21 **547 Disclosure Statement**

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24 548 The authors have no conflicts of interest to declare.

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27 **549 Author contributions**

28
29 550 MB, CLS, and SRH outlined and specified the research question. MB and CLS
30 551 conducted the systematic search of the literature. Furthermore, MB, CLS, and TF
31 552 discussed papers in detail in case of disagreement and uncertainty over the eligibility
32 553 of abstracts. MB wrote the first draft of the manuscript. TF, SRH, and CLS revised it
33 554 critically for valuable intellectual content. All authors contributed to and have
34 555 approved the final manuscript.

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43 **557 Data sharing statement**

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45 558 No unpublished data is available following this study.
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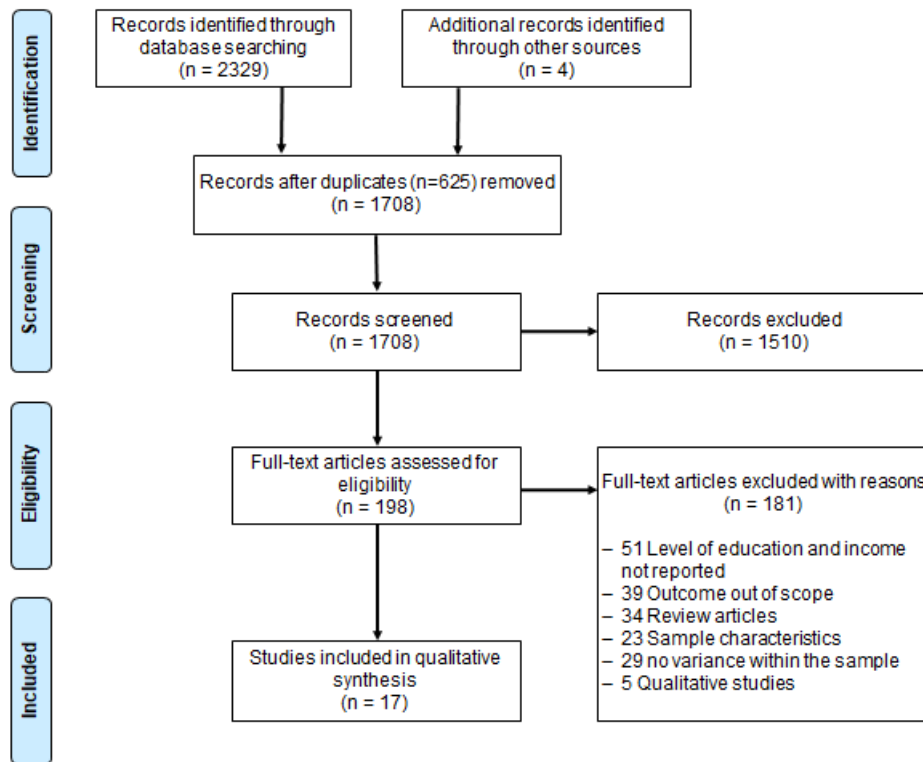


Figure 1 Phases of the systematic review

Peer review only

	Low risk of bias
	Moderate risk of bias
	High risk of bias
	Not reported

Supplementary Material 1. Assessment of Risk of Bias

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
(Brewis and Wutich, 2012)	Low	Low	Not	Low	High	High	Not	Low	Low	Low	Low	Moderate	Not	High	Not	Low	Low	Moderate	Not	Low
(Hansson and Rasmussen, 2014)	Low	Low	Not	Low	Moderate	High	Not	Low	Low	Low	Low	Moderate	Not	High	Moderate	Low	Low	Low	Not	Low
(Hilbert et al., 2017)	Low	Low	Not	Low	Low	Low	Not	Low	Low	Low	Low	Low	Not	High	Moderate	Low	Low	Low	Not	Low
(Jimenez-Cruz et al., 2012)	Low	Low	Not	Low	High	High	Not	Moderate	Low	Low	Moderate	Low	Not	High	Moderate	Moderate	Moderate	Moderate	Not	Low
(Lippa and Sanderson, 2012)	Low	Moderate	Not	Low	Moderate	High	Not	Low	Low	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	Low
(Lund et al., 2015)	Low	Low	Not	Low	Moderate	High	Not	High	High	Low	Moderate	Moderate	Not	High	Low	Low	Low	Low	Not	Low
(Oliver and Lee, 2005)	Low	Low	Not	Low	Low	Low	Not	Not	Not	Low	Low	High	Moderate	High	Low	Low	Low	High	Not	Low
(Puhl et al., 2011)	Low	Low	Not	Low	Low	Low	Not	Low	Low	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	Low
(Puhl et al., 2015)	Low	Low	Not	Low	Low	Low	Not	Low	Low	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	Low
(Puhl and Heuer, 2011)	Low	Low	Not	Low	Low	Low	Not	Low	Low	Low	Low	Low	Not	High	Not	Low	Low	Low	Not	Low
(Puhl et al., 2015)	Low	Low	Not	Low	Low	Low	Not	Low	Low	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	Low
(Puhl and Liu, 2015)	Low	Low	Not	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	Low
(Seo and Torabi, 2006)	Low	Low	Not	Low	Low	Low	Not	Not	Not	Low	Low	Moderate	Not	Low	Not	Low	Low	Low	Not	Low
(Sikorski et al., 2012)	Low	Low	Not	Low	Low	Low	Not	Low	Low	Low	Low	Moderate	Not	High	Low	Low	Low	Low	Not	Low
(Suh et al., 2014)	Low	Low	Not	Low	Moderate	Low	Not	Low	Low	Low	Low	Low	Not	High	Low	Low	Low	Low	Not	Low
(Swami and Monk, 2013)	Low	Low	Not	Low	High	High	Not	Low	Low	Low	Low	Moderate	Not	High	Low	Low	Low	Low	Not	Low

AXIS – Tool to assess the quality of cross-sectional studies (Downes et al., 2016)

1. Were the aims/objectives of the study clear?
2. Was the study design appropriate for the stated aim(s)?
3. Was the sample size justified?
4. Was the target/reference population clearly defined? (Is it clear who the research was about?)
5. Was the sample frame taken from an appropriate population base so that it closely represented the target/reference population under investigation?
6. Was the selection process likely to select subjects/participants that were representative of the target/reference population under investigation?
7. Were measures undertaken to address and categorise non-responders?
8. Were the risk factor and outcome variables measured appropriate to the aims of the study?
9. Were the risk factor and outcome variables measured correctly using instruments/measurements that had been trialled, piloted or published previously?
10. Is it clear what was used to determine statistical significance and/or precision estimates? (eg, p values, CIs)
11. Were the methods (including statistical methods) sufficiently described to enable them to be repeated?
12. Were the basic data adequately described?
13. Does the response rate raise concerns about non-response bias?
14. If appropriate, was information about non-responders described?
15. Were the results internally consistent?
16. Were the results for the analyses described in the methods, presented?
17. Were the authors' discussions and conclusions justified by the results?
18. Were the limitations of the study discussed?
19. Were there any funding sources or conflicts of interest that may affect the authors' interpretation of the results?
20. Was ethical approval or consent of participants attained?



PRISMA 2009 Checklist

Section/topic	#	Checklist item	Reported on page #
TITLE			
Title	1	Identify the report as a systematic review, meta-analysis, or both.	1
ABSTRACT			
Structured summary	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings; systematic review registration number.	2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of what is already known.	3-5
Objectives	4	Provide an explicit statement of questions being addressed with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	5
METHODS			
Protocol and registration	5	Indicate if a review protocol exists, if and where it can be accessed (e.g., Web address), and, if available, provide registration information including registration number.	-
Eligibility criteria	6	Specify study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	5-7
Information sources	7	Describe all information sources (e.g., databases with dates of coverage, contact with study authors to identify additional studies) in the search and date last searched.	5-6
Search	8	Present full electronic search strategy for at least one database, including any limits used, such that it could be repeated.	5-7
Study selection	9	State the process for selecting studies (i.e., screening, eligibility, included in systematic review, and, if applicable, included in the meta-analysis).	6-7
Data collection process	10	Describe method of data extraction from reports (e.g., piloted forms, independently, in duplicate) and any processes for obtaining and confirming data from investigators.	6-7
Data items	11	List and define all variables for which data were sought (e.g., PICOS, funding sources) and any assumptions and simplifications made.	6
Risk of bias in individual studies	12	Describe methods used for assessing risk of bias of individual studies (including specification of whether this was done at the study or outcome level), and how this information is to be used in any data synthesis.	6-7
Summary measures	13	State the principal summary measures (e.g., risk ratio, difference in means).	14-15
Synthesis of results	14	Describe the methods of handling data and combining results of studies, if done, including measures of consistency (e.g., I^2) for each meta-analysis.	No meta-analysis



PRISMA 2009 Checklist

Page 1 of 2

Section/topic	#	Checklist item	Reported on page #
Risk of bias across studies	15	Specify any assessment of risk of bias that may affect the cumulative evidence (e.g., publication bias, selective reporting within studies).	5
Additional analyses	16	Describe methods of additional analyses (e.g., sensitivity or subgroup analyses, meta-regression), if done, indicating which were pre-specified.	No meta-analysis
RESULTS			
Study selection	17	Give numbers of studies screened, assessed for eligibility, and included in the review, with reasons for exclusions at each stage, ideally with a flow diagram.	6
Study characteristics	18	For each study, present characteristics for which data were extracted (e.g., study size, PICOS, follow-up period) and provide the citations.	10-13
Risk of bias within studies	19	Present data on risk of bias of each study and, if available, any outcome level assessment (see item 12).	5
Results of individual studies	20	For all outcomes considered (benefits or harms), present, for each study: (a) simple summary data for each intervention group (b) effect estimates and confidence intervals, ideally with a forest plot.	11-14
Synthesis of results	21	Present results of each meta-analysis done, including confidence intervals and measures of consistency.	No meta-analysis
Risk of bias across studies	22	Present results of any assessment of risk of bias across studies (see Item 15).	5
Additional analysis	23	Give results of additional analyses, if done (e.g., sensitivity or subgroup analyses, meta-regression [see Item 16]).	-
DISCUSSION			
Summary of evidence	24	Summarize the main findings including the strength of evidence for each main outcome; consider their relevance to key groups (e.g., healthcare providers, users, and policy makers).	15-18
Limitations	25	Discuss limitations at study and outcome level (e.g., risk of bias), and at review-level (e.g., incomplete retrieval of identified research, reporting bias).	20
Conclusions	26	Provide a general interpretation of the results in the context of other evidence, and implications for future research.	18-20
FUNDING			
Funding	27	Describe sources of funding for the systematic review and other support (e.g., supply of data); role of funders for the systematic review.	22

From: Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group (2009). Preferred Reporting Items for Systematic Reviews and Meta-Analyses: The PRISMA Statement. PLoS Med 6(7): e1000097. doi:10.1371/journal.pmed1000097

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