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Research Article

Validation of a Three-Item Short Form of the Modified Weight Bias Internalization Scale (WBIS-3) in the German Population

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Social perception · Bias · Overweight · Obesity · Epidemiologic studies · Psychometrics

Abstract
Introduction: Individuals suffering from overweight or obesity frequently experience weight-based stigmatization. The widespread belief that weight is a matter of personal will and self-control results in various weight-based stereotypes (e.g., laziness, lack of self-discipline, or neglect). ***Objective:*** Based on the modified version of the Weight Bias Internalization Scale (WBIS-M), a short form for the economic assessment of weight bias internalization in the general population was compiled and validated. ***Methods:*** A three-item short form (WBIS-3) was derived based on data from a representative sample of the German population (n = 1,092). This new short form was validated in a second representative population sample (n = 2,513). Item characteristics and internal consistency were obtained. Measurement invariance was tested. Construct validity was established via the correlation with theoretically related constructs (depression, anxiety, eating behavior, discrimination, weight status). To establish scale validity, all analyses were performed for the whole sample as well as for the subsample of individuals with overweight. Age- and gender-specific population norms were provided. ***Results:*** The WBIS-3 exhibited excellent psychometric properties. Internal consistency was α = 0.92. Strong measurement invariance was confirmed regarding age, gender, discrimination, and weight status in both the whole sample as well as the overweight subsample. ***Conclu-***

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sions: The WBIS-3 constitutes a valid and economical tool for the assessment of weight bias internalization in epidemiological contexts. Measurement invariance allows for an unbiased comparison of means, correlation coefficients, and path coefficients within structural equation modeling across groups.

Introduction

Individuals suffering from overweight or obesity frequently experience weight-based stigmatization [1–5]. The widespread belief that weight is a matter of personal will and self-control [6] results in various weight-based stereotypes (e.g., laziness, lack of self-discipline or neglect). Weight bias internalization (WBI) is a relatively new concept in health psychology research. It is characterized by adopting a negative bias, that is, negative weight stereotypes and applying them to oneself [7, 8]. Recent reviews [9, 10] highlighted the relationship between WBI and various adverse health consequences such as binge eating, decreased physical activity, psychological distress including depression, weight gain, and obesity.

In light of an increasing prevalence of overweight and obesity and given high WBI rates among individuals with overweight [11, 12], epidemiological research of this phenomenon is warranted. However, most WBI assessment tools (e.g., Weight Bias Internalization Scale [7, 13] or Weight Self-stigma Questionnaire [14]) include the term "overweight" in almost every item, limiting their application to individuals who are either objectively or subjectively overweight [15]. Consequently, the samples used in WBI research are often highly selective and predominantly include female individuals receiving treatment for overweight or related disorders. Results from broader epidemiological surveys could further enrich our understanding of WBI in the general population.

This study addressed the development and validation of WBIS short form for use in epidemiological surveys with the following properties: (i) incorporating a neutral wording for assessment across various body weight categories as recommended by Pearl and Puhl [13] in their modified version of the Weight Bias Internalization Scale (WBIS-M); (ii) a manageable length, minimizing questionnaire burden while maintaining correspondence with the long form and reliability; and (iii) measurement invariance which is relevant given the selectivity of previous samples, especially regarding gender and weight status.

Materials and Methods

The short form development comprised two phases. In phase 1, items were selected based on a representative survey from Hilbert et al. [11]. In phase 2, the short form was validated in a different representative population sample. Both sampling procedures were identical. Sample information for both phases can be obtained from Table 1.

Short Form Development

Items for the short form were selected according to the following criteria: (i) high coefficient alpha, (ii) unidimensionality for a meaningful sum score interpretation, (iii) adequate coverage of the construct, (iv) high correlation with the total scale, and (v) economical number of items. The scale shortening algorithm alphamax [16] was applied to suggest combinations of items with optimal coefficient alpha. In a second step, potential abbreviated item sets were compared using confirmatory factor analyses (CFA). Based on these analyses, a subset consisting of item 3 ("I feel anxious about my weight because of what people might think of me."), 5 ("Whenever I

Table 1. Sample characteristics (phase 1: *n* = 1,092 and phase 2: *n* = 2,513)

	Phase 1		Phase 2			
	Overweight subsample		Full sample		Overweight subsample	
	Women (*n* = 514), *n* (%)	Men (*n* = 578), *n* (%)	Men (*n* = 1,119), *n* (%)	Women (*n* = 1,394), *n* (%)	Men (*n* = 609), *n* (%)	Women (*n* = 622), *n* (%)
Age, years						
≤24	25 (4.9)	32 (5.5)	140 (12.5)	137 (9.8)	42 (6.9)	24 (3.9)
25–34	58 (11.3)	51 (8.8)	159 (14.2)	218 (15.6)	60 (9.9)	80 (12.9)
35–44	61 (11.8)	75 (13.0)	166 (14.8)	208 (14.9)	104 (17.1)	85 (13.7)
45–54	87 (16.9)	113 (19.6)	197 (17.6)	274 (19.7)	120 (19.7)	130 (20.9)
55–64	133 (25.9)	133 (23.0)	216 (19.3)	245 (17.6)	141 (23.2)	132 (21.2)
65–74	99 (19.3)	142 (24.6)	155 (13.9)	192 (13.8)	103 (16.9)	115 (18.5)
≥75	51 (9.9)	32 (5.5)	86 (7.7)	120 (8.6)	39 (6.4)	56 (9.0)
Weight status[a]						
Underweight (<18.5 kg/m^2)	–	–	4 (0.4)	30 (2.2)	–	–
Normal weight (18.5–24.99 kg/m^2)	–	–	506 (45.2)	742 (53.2)	–	–
Overweight (25.0–29.99 kg/m^2)	392 (76.3)	478 (82.7)	466 (41.6)	404 (29.0)	466 (76.5)	404 (65.0)
Obesity (≥30.0 kg/m^2)	122 (23.7)	100 (17.3)	143 (12.8)	218 (15.6)	143 (23.5)	218 (35.0)
Education, years						
<12	464 (90.3)	473 (81.8)	878 (78.5)	1,116 (80.1)	112 (18.4)	81 (13.0)
≥12	50 (9.7)	105 (18.2)	241 (21.5)	278 (19.9)	497 (81.6)	541 (87.0)
Household income						
<1,000 (EUR/month)	51 (10.0)	34 (6.0)	75 (6.9)	142 (10.6)	36 (6.2)	58 (9.6)
≥1,000 (EUR/month)	458 (90.0)	534 (94.0)	1,005 (93.1)	1 197 (89.4)	549 (93.8)	544 (90.4)
Marital status						
Married	269 (52.3)	363 (62.8)	554 (49.6)	604 (43.5)	346 (56.9)	296 (47.7)
Single, divorced, widowed	245 (47.7)	215 (37.2)	562 (50.4)	784 (56.5)	262 (43.4)	325 (52.3)
Nationality						
German	509 (99.0)	566 (97.9)	1,081 (96.6)	1,346 (96.6)	592 (97.2)	604 (97.1)
Other	5 (1.0)	12 (2.1)	38 (3.4)	48 (3.4)	17 (2.8)	18 (2.9)

[a] Weight classification for participants <18 years was based on age- and gender-specific BMI norms for adolescents by Kromeyer-Hauschild et al. [29].

think a lot about my weight, I feel depressed."), and 6 ("I hate myself for my weight.") was deemed appropriate. It showed an excellent internal consistency (α = 0.90) and a very strong correlation with the WBIS total score (r = 0.94; p < 0.001). The original 7-point rating scale was kept.

Sampling

Data were collected as part of a representative survey. Sampling in both phases was conducted in three stages. First, 258 areas in Germany were chosen. In a second step, within the chosen areas the target households were randomly selected, using random route procedures. Finally, the target person within the household was determined with a Kish selection grid. All participants provided written informed consent.

Participants

In the validation sample (phase 2), *n* = 2,513 individuals were assessed (55.5% female), corresponding to a response rate of 51.9% (contacted households: *n* = 4,844). The participants' age ranged from 14 to 94 years (M = 48.79, SD = 18.10) with a body mass index (BMI) derived from self-reported weight and height ranged from 15.55 to 67.06 kg/m^2 (M = 25.81 kg/m^2, SD = 4.99).

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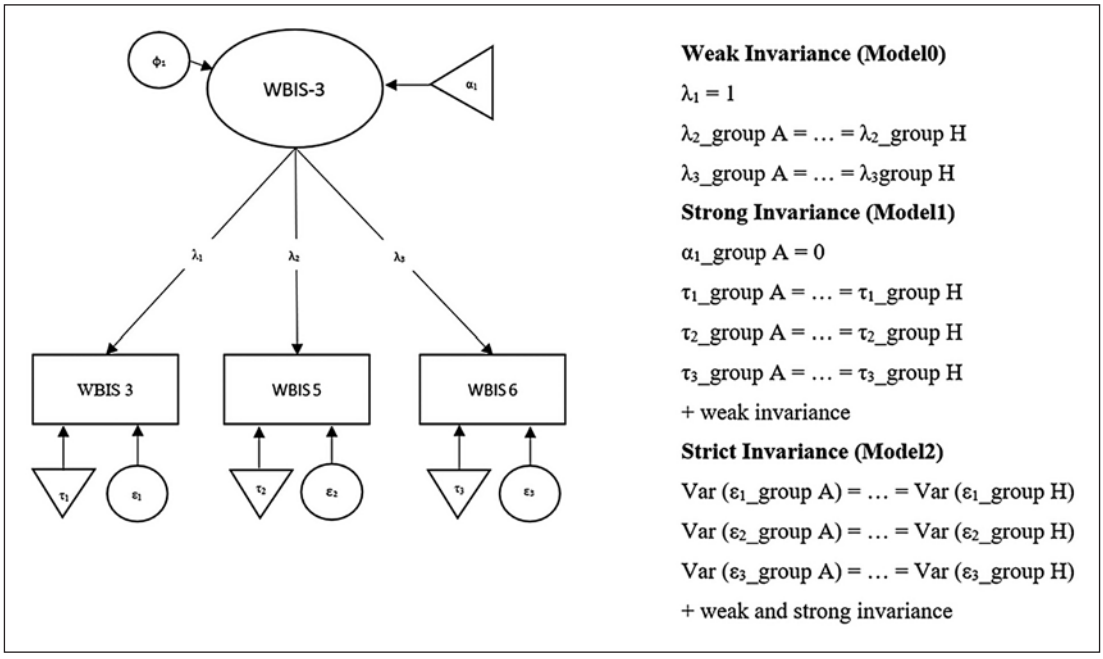

Fig. 1. Explanation of the different models regarding measurement invariance analysis.

Measures for Validation

Major depression was assessed with the Patient Health Questionnaire PHQ-2 [17], German version [18]. This 2-item self-administered version of the PRIME-MD [19] covers both DSM-5 main criteria for major depression. Anxiety was assessed with the Generalized Anxiety Disorder Scale-2 (GAD-2) [20], German version [21]. It covers the presence of the two main symptoms of generalized anxiety disorder 2 weeks prior to assessment. Disturbed eating (restrained eating, external eating, and emotional eating) was assessed with the Dutch Eating Behaviour Questionnaire [22] (DEBQ, German version [23]) comprising 33 items. Weight-related discrimination was assessed using three items capturing the personal encounters with weight bias [24] (e.g., being teased) using a 5-point scale ranging from "never" to "very often". The number of endorsed items (i.e., answers other than "never") was used as an indicator of discrimination.

Statistical Analyses

Missing values (on item-level: 0.1–0.7%) were imputed using the R package mice with chained equation modeling [25] based on gender and age. To avoid non-existing item values, the estimated values ($\hat{y}$) were corrected by predictive mean matching.

Item Analysis

The following item characteristics were evaluated: (1) item mean and standard deviation, (2) item-rest correlation, and (3) item difficulty.

To replicate well-established associations from WBI research, correlation coefficients with depression (PHQ-2), anxiety (GAD-2), and eating behavior (DEBQ) were examined, testing the following hypotheses: (1) higher WBI should be associated with higher depression, anxiety, and discrimination [6, 17, 18]; (2) higher WBI should be associated with higher levels of the DEBQ [26].

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Table 2. Item characteristics of the total sample and the overweight subsample

Item		Total sample (n = 2,513, α = 0.92)				Men (n = 1,119, α = 0.92)				Women (n = 1,394, α = 0.91)				d
		M	SD	p value	r_{it}	M	SD	p value	r_{it}	M	SD	p value	r_{it}	
Item	3	1.73	1.33	12	0.83	1.53	1.1	9	0.84	1.9	1.47	15	0.83	−0.28
	5	1.82	1.45	14	0.87	1.56	1.19	9	0.88	2.03	1.61	17	0.86	−0.33
	6	1.56	1.21	9	0.8	1.39	0.96	7	0.82	1.71	1.36	12	0.79	−0.27
WBIS-3 sum score		5.12	3.7	12	–	4.47	3.03	8	–	5.63	4.1	15	–	−0.32
		Individuals with overweight (n = 1,231, α = 0.91)				Men with overweight (n = 609, α = 0.92)				Women with overweight (n = 622, α = 0.91)				d
Item	3	2.07	1.54	18	0.84	1.72	1.25	12	0.83	2.42	1.7	24	0.82	*−0.47*
	5	2.22	1.69	20	0.87	1.77	1.36	13	0.88	2.66	1.86	28	0.86	−0.55
	6	1.87	1.44	15	0.8	1.55	1.1	9	0.82	2.17	1.64	20	0.77	*−0.44*
WBIS-3 sum score		6.16	4.32	18	–	5.04	3.46	11	–	7.26	4.78	24	–	*−0.53*

p = item difficulty, d = Cohen's d; α = Cronbach's alpha; WBIS-3 = Weight Bias Internalization Scale short form; overweight defined as body mass index ≥25 kg/m^2.

Multi-group confirmatory factor analysis (MGCFA) was conducted to investigate measurement invariance of the WBIS-3 regarding the following grouping variables: (1) gender, (2) age (under 34, 35–64, over 65 years), (3) overweight (yes/no), (4) weight status (underweight, normal weight, overweight, obesity), and (5) discrimination (yes/no). MGCFA was conducted using the R package lavaan [27]. The tested models are specified in Figure 1. As recommended by Chen [28], a change of more than 0.010 in CFI, supplemented by a change of RMSEA larger than 0.015, was interpreted as absence of invariance.

Results

Item Characteristics

Item characteristics of the WBIS-3 are depicted in Table 2. The global mean score of the WBIS-3 in the total sample was 5.12 (SD 3.70). Item difficulty values (p_i) ranged from 9 (item 6) to 14 (item 5). Item-rest correlations exceeded the recommended minimum (range r_{it} = 0.80 [item 6] to r_{it} = 0.87 [item 5]). There were substantial mean differences between men and women (Cohen's d = −0.27 to −0.33). Regarding the overweight subsample, the global mean score of the WBIS-3 was 6.16 (SD 4.32). Item difficulty ranged between 15 (item 6) and 20 (item 5); all item-rest correlation coefficients exceeded the suggested minimum (range r_{it} = 0.80 [item 6] to r_{it} = 0.87 [item 5]). At the item level, there also were considerable mean differences between men and women (Cohen's d = −0.44 to −0.55).

Norms

Tables 3 and 4 provide gender-specific norms (percentiles) for the total sample as well as for the overweight subsample.

Internal Consistency

Cronbach's alpha for the total sample was α = 0.92 and for the overweight subsample α = 0.91.

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Table 3. Norms of the WBIS-3 in the total sample

Age in years, WBIS-3 sum score	Total 14–91 (*n* = 2,513)	Men							Women						
		Total (*n* = 1,119)	14–24 (*n* = 140)	25–34 (*n* = 159)	35–44 (*n* = 166)	45–54 (*n* = 197)	55–64 (*n* = 216)	≥65 (*n* = 241)	Total (*n* = 1,394)	14–24 (*n* = 137)	25–34 (*n* = 218)	35–44 (*n* = 208)	45–54 (*n* = 274)	55–64 (*n* = 245)	≥65 (*n* = 312)
3	62	69	65	74	70	67	69	71	56	53	47	56	52	50	69
4	67	75	71	80	74	74	75	76	61	58	50	59	60	57	74
5	73	81	77	83	78	79	83	82	67	65	58	64	67	64	77
6	79	86	79	87	81	84	89	89	74	69	67	73	73	73	84
7	82	87	83	89	84	86	90	90	77	70	71	77	77	77	87
8	84	89	91	89	87	87	91	90	80	74	74	78	80	80	89
9	87	91	92	89	89	90	94	92	83	80	78	81	83	82	91
10	89	93	94	91	90	92	94	94	85	83	82	83	85	84	93
11	91	94	98	92	91	95	95	95	88	85	85	86	87	87	94
12	94	96	99	95	92	96	97	99	91	88	89	89	91	91	96
13	95	98	>99	96	96	97	97	>99	93	90	91	92	93	93	97
14	96	98	>99	97	97	98	98	>99	95	91	93	94	95	94	98
15	97	99	>99	98	98	98	98	>99	96	93	94	95	97	94	99
16	99	99	>99	99	99	99	>99	>99	97	95	95	95	97	98	>99
17	99	99	>99	99	>99	>99	>99	>99	98	96	97	97	97	98	>99
18	99	99	>99	>99	>99	>99	>99	>99	>99	99	97	97	99	98	>99
19	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	98	98	>99	>99	>99
20	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	99	>99	>99	>99
21	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99

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Table 4. Norms of the WBIS-3 in the overweight subsample

Age in years, WBIS-3 sum score	Total 14–91 (n = 1,231)	Men							Women						
		Total (n = 609)	14–24 (n = 152)	25–34 (n = 180)	35–44 (n = 213)	45–54 (n = 225)	55–64 (n = 177)	≥65 (n = 93)	Total (n = 622)	14–24 (n = 208)	25–34 (n = 202)	35–44 (n = 232)	45–54 (n = 229)	55–64 (n = 204)	≥65 (n = 136)
3	48	59	50	55	58	59	62	63	37	25	24	28	31	32	59
4	54	67	55	68	63	67	69	70	42	29	26	29	37	39	63
5	61	74	62	75	67	73	79	78	48	29	35	37	44	46	68
6	68	80	62	82	72	77	87	85	57	33	44	46	50	57	76
7	72	82	71	85	76	80	87	85	62	38	49	53	58	63	80
8	75	84	74	85	80	82	89	86	67	46	53	57	62	68	84
9	79	87	81	85	83	87	92	89	71	50	58	60	68	72	87
10	82	90	83	88	85	89	93	93	75	54	64	65	72	76	88
11	85	91	86	88	87	93	94	94	79	58	69	71	77	81	90
12	89	94	93	92	89	95	95	99	84	67	78	73	82	86	94
13	92	96	98	93	94	96	96	99	87	75	80	81	86	88	95
14	94	97	98	95	95	97	97	99	90	79	85	86	90	89	98
15	95	98	>99	98	97	98	97	>99	92	79	86	88	95	90	98
16	97	99	>99	>99	98	98	99	>99	94	88	90	88	95	96	99
17	98	>99	>99	>99	99	98	99	>99	96	88	93	93	95	97	99
18	98	>99	>99	>99	>99	98	99	>99	97	>99	93	94	97	97	>99
19	99	>99	>99	>99	>99	99	99	>99	98	>99	95	97	99	99	>99
20	>99	>99	>99	>99	>99	>99	>99	>99	99	>99	99	98	99	99	>99
21	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99	>99

Table 5. Measurement invariance of the WBIS-3 for the total sample

		χ^2_{scaled}	df	CFI	RMSEA	ΔCFI	ΔRMSEA	Measurement invariance test#
Group = gender								
Model 0	Weak invariance	0.570	2	1.000	0.000 (0.000–0.012)	–	–	✓
Model 1	Strong invariance	2.010	4	1.000	0.000 (0.000–0.019)	0.000	0.000	✓
Model 2	Strict invariance	119.878	7	0.902	0.113 (0.103–0.124)	–0.098	0.113	x
Group = overweight status								
Model 0	Weak invariance	0.999	2	1.000	0.000 (0.000–0.024)	–	–	✓
Model 1	Strong invariance	1.608	4	1.000	0.000 (0.000–0.012)	0.000	0.000	✓
Model 2	Strict invariance	112.868	7	0.876	0.110 (0.100–0.120)	–0.124	0.110	x
Group = discrimination								
Model 0	Weak invariance	9.849	2	0.990	0.056 (0.036–0.078)	–	–	✓
Model 1	Strong invariance	15.222	4	0.985	0.047 (0.032–0.064)	–0.05	–0.009	✓
Model 2	Strict invariance	261.533	7	0.668	0.170 (0.162–0.178)	–0.317	0.123	x
Group = age								
Model 0	Weak invariance	10.067	4	0.995	0.043 (0.024–0.062)	–	–	✓
Model 1	Strong invariance	22.047	8	0.989	0.046 (0.030–0.062)	–0.06	0.003	✓
Model 2	Strict invariance	40.909	14	0.979	0.048 (0.038–0.058)	–0.010	0.02	✓
Group = weight category								
Model 0	Weak invariance	11.806	6	0.993	0.039 (0.017–0.060)	–	–	✓
Model 1	Strong invariance	19.873	12	0.990	0.032 (0.011–0.051)	–0.003	–0.007	✓
Model 2	Strict invariance	191.924	21	0.783	0.114 (0.105–0.122)	–0.107	0.078	x

df = degrees of freedom; CFI = comparative fit index; ΔCFI = differences between models (0 and 1, 1 and 2) regarding CFI; RMSEA = root mean square of approximation; ΔRMSEA = differences between models (0 and 1, 1 and 2) regarding RMSEA. # **ΔCFI ≤ −0.010** supplemented by **ΔRMSEA ≥ 0.015** indicates non-invariance; ✓ marks invariance. All fit statistics are robust.

Table 6. Measurement invariance of the WBIS-3 for the overweight subsample

		χ^2_{scaled}	df	CFI	RMSEA	ΔCFI	ΔRMSEA	Measurement invariance test#
Group = gender								
Model 0	Weak invariance	0.270	2	1.000	0.000 (0.000–0.000)	–	–	✓
Model 1	Strong invariance	1.375	4	1.000	0.000 (0.000–0.021)	0.000	0.000	✓
Model 2	Strict invariance	103.539	7	0.898	0.150 (0.0132–0.168)	–0.102	0.150	x
Group = discrimination								
Model 0	Weak invariance	8.198	2	0.987	0.071 (0.042–0.102)	–	–	✓
Model 1	Strong invariance	15.332	4	0.977	0.068 (0.047–0.091)	–0.010	–0.003	✓
Model 2	Strict invariance	199.931	7	0.600	0.212 (0.196–0.227)	–0.377	0.144	x
Group = age								
Model 0	Weak invariance	9.887	4	0.995	0.060 (0.029–0.092)	–	–	✓
Model 1	Strong invariance	19.536	8	0.989	0.059 (0.033–0.086)	–0.006	–0.001	✓
Model 2	Strict invariance	50.372	14	0.966	0.080 (0.063–0.096)	–0.023	0.021	x

df = degrees of freedom; CFI = comparative fit index; ΔCFI = differences between models (0 and 1, 1 and 2) regarding CFI; RMSEA = root mean square of approximation; ΔRMSEA = differences between models (0 and 1, 1 and 2) regarding RMSEA. # ΔCFI ≤ −0.010 supplemented by ΔRMSEA ≥ 0.015 indicates non-invariance; ✓ marks invariance. All fit statistics are robust.

Measurement Invariance

In both, the total sample as well as the overweight subsample, strong measurement invariance was confirmed regarding age, gender, discrimination status, and weight category (see Tables 5 and 6). Apart from one exception (age in the full sample), strict invariance could not be confirmed.

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Table 7. Construct validity

Variable	1	2	3	4	5	6	7	8	9
1. WBIS-3		0.29** (0.25–0.32)	0.26** (0.23–0.30)	0.37** (0.34–0.41)	0.43** (0.40–0.46)	0.59** (0.56–0.61)	0.29** (0.26–0.33)	0.47** (0.44–0.50)	0.28** (0.24–0.31)
2. GAD-2	0.36** (0.31–0.41)	–	0.70** (0.68–0.72)	0.03 (–0.01–0.07)	0.07** (0.03–0.10)	0.20** (0.17–0.24)	0.12** (0.08–0.16)	0.28** (0.24–0.32)	0.12** (0.09–0.16)
3. PHQ-2	0.34** (0.29–0.39)	0.72** (0.70–0.75)	–	0.04 (–0.00–0.08)	0.09** (0.05–0.12)	0.20** (0.16–0.24)	0.07** (0.03–0.11)	0.26** (0.22–0.30)	0.10** (0.06–0.14)
4. Weight status	0.37** (0.32–0.42)	0.14** (0.09–0.20)	0.15** (0.10–0.21)	–	0.86** (0.84–0.87)	0.38** (0.35–0.41)	0.14** (0.11–0.18)	0.22** (0.18–0.26)	0.16** (0.12–0.19)
5. BMI	0.43** (0.39–0.48)	0.17** (0.12–0.23)	0.20** (0.14–0.25)	0.76** (0.73–0.78)	–	0.43** (0.39–0.46)	0.14** (0.10–0.18)	0.27** (0.23–0.30)	0.18** (0.14–0.22)
6. Discrimination	0.61** (0.57–0.64)	0.27** (0.22–0.32)	0.27** (0.22–0.32)	0.38** (0.33–0.42)	0.43** (0.38–0.48)	–	0.21** (0.17–0.25)	0.35** (0.32–0.39)	0.25** (0.21–0.29)
7. DEBQ-RE	0.30** (0.25–0.35)	0.16** (0.10–0.21)	0.09** (0.04–0.15)	0.04 (–0.01–0.10)	0.06* (0.00–0.11)	0.21** (0.15–0.26)	–	0.36** (0.33–0.40)	0.23** (0.19–0.26)
8. DEBQ-EE	0.52** (0.48–0.56)	0.33** (0.28–0.38)	0.31** (0.26–0.36)	0.18** (0.13–0.23)	0.26** (0.21–0.32)	0.39** (0.34–0.44)	0.36** (0.31–0.41)	–	0.57** (0.54–0.59)
9. DEBQ-Ext	0.34** (0.29–0.39)	0.16** (0.10–0.21)	0.13** (0.07–0.18)	0.13** (0.08–0.19)	0.17** (0.12–0.23)	0.29** (0.24–0.35)	0.25** (0.20–0.30)	0.60** (0.56–0.63)	–

Displayed are correlation coefficients. Values above the diagonal pertain to the whole sample, values below the diagonal pertain to the overweight subsample. Values in parentheses indicate the 95% CI for each correlation. ** indicates $p < 0.01$; * indicates $p < 0.05$. WBIS-3 = short form of the modified Weight Bias Internalization Scale; GAD-2 = Generalized Anxiety Disorder Scale; PHQ-2 = depression screen from the PRIME-MD questionnaire; weight status: underweight, normal weight, overweight, obesity; BMI = body mass index; discrimination: dichotomous discrimination status; DEBQ = Dutch Eating Behaviour Questionnaire (Subscales: RE-restrained eating, EE-emotional eating, Ext-external eating).

Construct Validity

Correlations between the WBIS-3 and other self-report questionnaires were significant and in the expected direction for the total sample as well as the overweight subsample (see Table 7).

Discussion

A three-item short form of the modified Weight Bias Internalization Scale [13], the WBIS-3, was constructed based on data from a large German population sample. The newly developed questionnaire was evaluated in a second independent population sample. Based on the latter, population norms were derived. Excellent internal consistency supported reliability. Evidence of strong measurement invariance by gender, age, weight status (i.e., underweight, normal weight, overweight, obese), and discrimination status was found. This allows unbiased comparison of means, correlation coefficients as well as path coefficients within structural equation modeling across groups. Furthermore, the construct validity of the WBIS-3 was confirmed by replicating theoretically derived relationships with depression, anxiety, eating behavior, and discrimination.

Limitations

First, the study relies on self-report. Without external validation it might be possible that general negative self-evaluations are responsible for the observed correlation patterns (i.e., between WBI and discrimination). Second, since the data were obtained in the German general population, comparisons with countries with differing or highly diverse cultural norms regarding weight issues might be limited. Third, as this study solely involved cross-sectional data, it neither addressed predictive validity nor test-retest reliability or longitudinal measurement invariance. Fourth, item selection was conducted based on psychometric properties obtained in a representative overweight sample using the original overweight-related wording. Although it cannot be ruled out that a different subset of items might be more appropriate for a more general purpose, there is no apparent reason to question the suitability of the chosen items.

Conclusion

With excellent psychometric properties, the WBIS-3 is suitable for research in an epidemiological framework. Given the high correlation with the WBIS full-length form, the use of the short form appears appropriate.

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Statement of Ethics

All procedures involving human participants were in accordance with the ethical standards of the institutional and/or national research committee, and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. Written informed

consent was obtained from each individual participating in the study. All procedures were approved by the Ethics Committee of the Medical Faculty of Leipzig University (Az.: 044–15–090322015).

Conflict of Interest Statement

The authors have no conflicts of interest to declare.

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Author Contributions

S.K. and A.K. were responsible for data analysis and interpretation as well as the preparation of the manuscript. A.Hin. and A.K. revised the manuscript. E.B. and A.Hil. conceptualized and designed the study, reviewed and revised the manuscript. All authors had full access to the data, read, and approved the final manuscript.

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