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„Pre-registered Psychometric Evaluation and Validation of the German Functionality Appreciation Scale FAS and Body Appreciation Scale 2 BAS-2"

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Abstract

Positive body image has been a growing field of research since the 2000s. The Body Appreciation Scale 2 (BAS-2) and Functionality Appreciation Scale (FAS) are important measures of positive body image; body appreciation means having a favorable opinion of one's body, irrespective of physical appearance; functionality appreciation means appreciating what the body can do. In this study, the BAS-2 and FAS were translated into German. Linguistic quality was evaluated in a pre-sample ($N = 64$). Subsequently, the BAS-2's and FAS' psychometric quality was validated in the main sample ($N = 426$). Besides the German BAS-2 and FAS, participants filled out demographics, self-reported body mass index and measures of appearance evaluation, body areas satisfaction, subjective happiness, drive for masculinity, current-ideal weight discrepancy as well as impression management and self-deceptive enhancement. The German BAS-2 showed excellent internal consistency, unidimensional factor structure and scalar sex invariance. The German FAS showed good-to-excellent internal consistency, unidimensional factor structure and scalar sex invariance. Both questionnaires were positively correlated with each other as well as with appearance evaluation and body areas satisfaction. Both the BAS-2 and FAS showed moderately negative correlations with current-ideal weight discrepancy in women and drive for masculinity in men as well as small-to-none negative correlations with self-reported body mass index, indicating good convergent and discriminant validity. Hierarchical regression analysis was used to investigate incremental validity for both questionnaires; In summary, these results are indicative of the German BAS-2's and FAS' linguistic and psychometric quality.

Zusammenfassung

Positives Körperbild ist seit den Zweitausendern ein wachsendes Forschungsfeld. Die „Body Appreciation Scale 2" (BAS) und die "Functionality Appreciation Scale" (FAS) sind bedeutende Maße positiven Körperbilds; „Body Appreciation" heißt eine, vom Aussehen unabhängige, positive Meinung gegenüber dem eigenen Körper zu haben; „Functionality Appreciation" bedeutet den eigenen Körper dafür zu schätzen, was er zu tun in der Lage ist. In dieser Studie wurden der BAS-2 und der FAS auf Deutsch übersetzt. Zunächst wurde die sprachliche Qualität in einer Voruntersuchung evaluiert (N = 64). Anschließend wurde die psychometrische Qualität des übersetzten BAS-2 und FAS in der Hauptstichprobe validiert (N = 426). Neben dem deutschen BAS-2 und FAS wurden demographische Angaben, selbstberichteter Body-Mass-Index sowie Fragebögen zu anderen Konstrukten (MBSRQ, SHS, DMS, PFRS, BIDR-6) von den Teilnehmer*innen ausgefüllt, wobei Frauen der PFRS, Männern der DMS vorgelegt wurde. Der deutsche BAS-2 zeigte exzellente innere Konsistenz, eindimensionale Faktorenstruktur und skalare Messinvarianz zwischen Männern und Frauen. Der deutsche FAS zeigte gute bis exzellente innere Konsistenz, sowie ebenfalls Eindimensionalität und skalare Messinvarianz. Beide Fragebögen korrelierten sowohl positiv miteinander als auch mit der Bewertung des äußeren Erscheinungsbildes (MBSRQ). Bei Frauen korrelierten der BAS-2 und der FAS negativ mit der aktuellen Idealgewichtsdiskrepanz (PFRS); bei Männern waren die Fragebögen negativ mit dem Streben nach Maskulinität (DMS) korreliert. Es lag eine schwach-negative Korrelation des BAS-2 und FAS mit selbstberichtetem Body-Mass-Index für Frauen, aber nicht für Männer vor. Inkrementelle Validität wurde mittels hierarchischer Regression untersucht. Zusammengenommen kann von guter psychometrischer Qualität des deutschen BAS-2 und FAS ausgegangen werden.

Contents

1   Introduction

Body image originally meant the perception of one's physical appearance. The construct since expanded to also include size perception accuracy, appearance evaluation and body dissatisfaction, among others. Nowadays, body image can be defined as perceptions, thoughts, and feelings about one's body. (Grogan, 2017)

With turn of the millennium, early research's deficit orientation was paradigmatically complemented by positive psychology. Positive body image showed to be independent of negative body image i.e., they are not simply opposites on one scale (Tylka & Wood-Barcalow, 2015b). Hence, body image is thought to be a multidimensional construct (Cash & Grasso, 2005). Positive body image is sometimes used synonymously with body appreciation and means having a favorable opinion of one's body, irrespective of physical appearance, weight or imperfections, responding to one's bodies needs and rejecting ideals popularized in the media (Grogan, 2017).

1.1   Body Appreciation

The first psychometrically sound measure of body appreciation, the Body Appreciation Scale (BAS), was created by Avalos et al. (2005). It was reviewed in 2015, resulting in a modernized and sex invariant version, the BAS-2 (Tylka & Wood-Barcalow, 2015a). The original publication was based on three US community and student samples (N = 1587). There, the BAS-2 showed good internal consistency (α = .95) and three-week test-retest reliability (ICC = .90) as well as one-dimensional factor structure and metric measurement invariance i.e., equal item factor loadings between women and men. A recent meta-analysis revealed a small sex difference: Men showed slightly higher body appreciation than women. This gap was more pronounced in youths, which may be explained by the non-simultaneous onset of puberty (He et al., 2020).

The BAS-2 has since been translated to Greek (Argyrides, 2020), Persian (Atari, 2016), Hebrew (Geller et al., 2020), Brazilian Portuguese (Junqueira et al., 2019), French (Kertechian & Swami, 2017), Polish (Razmus & Razmus, 2017), Spanish (Swami, García, et al., 2017), Chinese (Swami et al., 2016), Malay (Swami, Nor, et al., 2019), Icelandic (Karlsdóttir & Pálmarsdóttir, 2016), Romanian (Swami, Tudorel, et al., 2017) and Arabic (Vally et al., 2019). Cross-cultural research in Iran, Japan, Poland,

Serbia, and the US showed partial metric invariance in nine out of ten of the BAS-2 items (Razmus et al., 2020). Partial scalar invariance was shown between the UK and Malaysia for all BAS-2 items, except Items 6 and 8 (Todd & Swami, 2020).

Overall, researchers reported good reliability, consistently unidimensional factor structure and metric-or-above sex invariance (see Appendix, Table A1). The BAS-2 scores are not affected by priming (Dignard & Jarry, 2019). Convergent validity was reported using appearance satisfaction (Argyrides, 2020), appearance evaluation (Karlsdóttir & Pálmarsdóttir, 2016; Swami, García, et al., 2017), body areas satisfaction (Swami, García, et al., 2017) and body esteem (Escoto Ponce de León et al., 2020). The BAS-2 showed divergent validity in respect of appearance- and weight-related anxiety (Argyrides, 2020), appearance dissatisfaction (Junqueira et al., 2019) and social physique anxiety (Alcaraz-Ibáñez et al., 2017) as well as drive for thinness in women (Escoto Ponce de León et al., 2020; Góngora et al., 2020; Junqueira et al., 2019), actual-ideal weight discrepancy in women (Junqueira et al., 2019; Swami et al., 2016; Swami, Nor, et al., 2019) and drive for masculinity in men (Swami, Nor, et al., 2019).

Concerning construct relevance, the BAS-2 was also found to positively correlate with life satisfaction (Alcaraz-Ibáñez et al., 2017; Atari, 2016; Geller et al., 2020; Junqueira et al., 2019; Swami et al., 2016; Swami, García, et al., 2017; Swami, Nor, et al., 2019; Swami, Tudorel, et al., 2017), psychological well-being (Karlsdóttir & Pálmarsdóttir, 2016; Lemoine et al., 2018), positive affect (Razmus & Razmus, 2017), subjective happiness (Swami, Nor, et al., 2019; Swami, Tudorel, et al., 2017), self-esteem (Argyrides, 2020; Atari, 2016; Geller et al., 2020; Junqueira et al., 2019; Karlsdóttir & Pálmarsdóttir, 2016; Lemoine et al., 2018; Meneses et al., 2019; Razmus & Razmus, 2017; Swami, Tudorel, et al., 2017; Swami et al., 2016; Swami, García, et al., 2017) and intuitive eating (Lemoine et al., 2018).

Negative correlations were found between the BAS-2 and disordered eating (Lemoine et al., 2018) as well as shame and guilt (Razmus & Razmus, 2017). Generally, correlations between the BAS-2 and body mass index (BMI) were found to be small and negative. While some studies found small, negative correlations with BMI (Alcaraz-Ibáñez et al., 2017; Argyrides, 2020; Atari, 2016; Escoto Ponce de León et al., 2020; Góngora et al., 2020; Razmus & Razmus, 2017; Swami, García, et al., 2017;

Swami, Tudorel, et al., 2017), others reported negative correlations in women only (Junqueira et al., 2019; Swami et al., 2016; Swami, Nor, et al., 2019) or no correlation at all (Lemoine et al., 2018; Meneses et al., 2019; Vally et al., 2019).

1.2 Functionality Appreciation

With the body of research growing, one consistent limitation of positive body image publications was pointed out by Smolak and Cash (2011): Researchers were focusing on appearance aspects of positive body image, neglecting body functionality. The same pattern was found in positive body image interventions (Alleva et al., 2015). In respect of these considerations, functionality appreciation emerged as a new construct. Functionality appreciation can be defined as appreciating what the body can do or is capable of doing (Alleva et al., 2017).

The Functionality Appreciation Scale (FAS) was developed by Alleva et al. (2017) to measure functionality appreciation. It was validated in a US community sample *(n =* 1042*)*, showing good internal consistency *(.86 < α < .91)*, test-retest reliability *(ICC = .77)*, unidimensional factor structure and scalar sex invariance i.e., equal factor structure, item loadings and intercepts, allowing for group mean comparisons. The authors found no sex difference. Convergent validity was assessed concerning body appreciation, body image flexibility, appearance evaluation and appearance orientation. As is consistent with the idea of functionality appreciation not focusing on appearance, functionality appreciation yielded lower correlations with appearance evaluation than body appreciation did. Furthermore, the FAS correlated negatively with body surveillance and self-objectification in women. (Alleva et al., 2017)

The FAS was translated into Malay, again yielding good reliability, unidimensional factor structure, scalar sex invariance as well as convergent, discriminant and incremental validity (Swami, Todd, et al., 2019). Partial scalar invariance was shown between the UK and Malaysia for all FAS items but Item 4 (Todd & Swami, 2020).

Functionality appreciation shows strongly positive correlations with body appreciation (Alleva et al., 2017; Swami, Todd, et al., 2019) and gratitude (Alleva et al., 2017), strongly negative correlations with anxiety and depression (Alleva et al.,

2017) as well as moderately positive correlations with self-esteem (Alleva et al., 2017; Swami, Todd, et al., 2019).

1.3 Aim of This Study

The aim was to translate, and subsequently validate, a German version of the BAS-2 and FAS. Internal consistency, factor structure, and sex invariance as well as convergent, discriminant, and incremental validity of the BAS-2 and FAS were evaluated. The analytic strategy and desired sample size were pre-registered on aspredicted.org prior to recruitment of the main sample. The pre-registration is publicly available at https://aspredicted.org/sw7ki.pdf .

2 Methods

2.1 Participants

Participants were recruited via university affiliated newsgroups and participant recruitment platforms e.g., "SurveyCycle" and pertinent "Facebook" groups. Due to conceptual reasons, other sexes were excluded. The pre-sample ($N = 64$, $M_{age} = 26.0$, $SD_{age} = 11.2$) was recruited in April 2020 (after the first Austrian lockdown due to SARS-CoV-2); it contained 52 women and 12 men. The lowest level of education was Matura (corresponding to US high school graduation).

The main sample ($N = 426$, $M_{age} = 29.6$, $SD_{age} = 11.3$) was opportunistically recruited between July and August 2020 (before the second Austrian lockdown due to SARS-CoV-2) and consisted of 310 women and 113 men. Again, levels of education were high: 35.4% Matura and 57.6% bachelor's or master's degree.

2.2 Measures

2.2.1 Body Appreciation Scale 2 (BAS-2)

The BAS-2 is a unidimensional scale, measuring respect for and positive attitude towards one's body. Agreement with the BAS-2's ten items is rated on a five-point Likert scale. It has since been translated multiple times, results indicating intercultural validation of its unidimensionality, with mixed results concerning measurement invariance between men and women as well as between nations. The authors generally report adequate reliability and validity (see appendix, Table A1). Exemplary item: "I appreciate the different and unique characteristics of my body."

2.2.2 Functionality Appreciation Scale (FAS)

In response to critique concerning BAS-2's focus on physical appearance, the FAS was developed to measure body functionality related aspects of positive body image (Alleva et al., 2017). The FAS has seven items; agreement is rated on a scale from one to five. Its good psychometric properties could be replicated in a Malaysian translation, showcasing good reliability ($\omega = .92$), validity, unidimensionality, and sex invariance (Swami, Todd, et al., 2019). Exemplary Item: "I am grateful that my body enables me to engage in activities that I enjoy or find important."

2.2.3 Multidimensional Body-Self Relations Questionnaire's Appearance Scales (MBSRQ-AS)

The MBSRQ-AS consists of four subscales, two of which were used in the present survey: Body Areas Satisfaction and Appearance Evaluation; the former measuring satisfaction with eight different body parts, the latter measuring positive and negative appraisals of one's appearance (Cash, 2000). Vossbeck-Elsebusch et al. (2014) validated the MBSRQ's German translation, confirming its factor structure and good reliability; for Appearance Evaluation, Cronbach's α was .90 and 6-week test-retest reliability was .75, Body Areas Satisfaction scoring $\alpha = .85$ and $r_{tt} = .79$.

2.2.4 Drive for Masculinity Scale (DMS)

The DMS measures the desire to be more muscular. It consists of 15 items, which are rated on a scale from one to six (McCreary & Sasse, 2000). The DMS was found to be suitable for diagnosing eating disorders in men, providing an alternative to typical constructs e.g., pursuit of thinness (McCreary & Sasse, 2000). The German translation of Waldorf and et al. (2014) showed good internal consistency ($\alpha = .90$) and test-retest reliability ($r_{tt} = .95$) as well as convergent and discriminant validity. Like the original, the German version loads onto two factors, a cognitive and a behavioral component.

2.2.5 Photographic Figure Rating Scale (PFRS)

The PFRS assesses current-ideal weight discrepancy using ten standardized photographs of women representing different weight categories. It is thought to be more valid than rating scales with drawings (Swami et al., 2008). Its good 5-week test-retest reliability ($ICC = .89$) and convergent validity were replicated in 2012 by Swami et al..

2.2.6 Subjective Happiness Scale (SHS)

The SHS measures overall life satisfaction and well-being; it consists of four items rated on a seven-point-scale (Lyubomirsky & Lepper, 1999). Its German translation has an unidimensional structure, good internal consistency ($\alpha = .87$) as well as adequate convergent and discriminant validity (Swami et al., 2009).

2.2.7 Balanced Inventory of Desirable Responding (BIDR-6)

The BIDR-6 consists of two subscales, self-deceptive enhancement (SDE) and impression management (IM), which assess one's respective tendency to lie to oneself or others. The BIDR-6 uses differently poled items to combat response bias. Each of the ten-item subscales are rated on a seven-point Likert scale. A German version was validated by Musch et al. (2002), yielding acceptable internal consistency (α_{SDE} = .64, α_{IM} = .67) and convergent validity.

2.3 Translation Procedure

First, the BAS-2 and FAS were translated from English into German by two independent translators of certified Cambridge C2 standard. Translational differences were discussed until obtaining consensus (see appendix, Table A2 and A3 for item translations).

Subsequently, both questionnaires' linguistic quality was surveyed in a community sample. Understandability was rated on a scale from 1 (= *do not understand*) to 5 (= *completely understand*). Fourteen subjects did not provide ratings of at least one item, resulting in 7.7% missing values. Both translation's understandability was rated 4.7 on average, the lowest average item rating being 4.4 for both the German FAS and German BAS-2 respectively. An investigation of open comments on each item revealed no understanding problems.

2.4 Analytic Strategy

As stated in the pre-registration, we sought to obtain data of at least 400 participants. If we had reached a sample size of 600 or more, an EFA-CFA (Exploratory-Confirmatory Factor Analysis) approach would have been performed with random split-halves of the sample instead of using ESEM (exploratory structural equation modelling) with the whole sample. Since over 400 but under 600 participants completed the survey, ESEM was used to assess the scales' structural properties; a bigger sample would have allowed for cross-validation (Algina & Keselman, 2000). Polychoric item correlation matrices and the WLSMV estimator were used in structural analyses, an approach which is suited to ordered-categorical item response format (Sass, 2011; Sass et al., 2014).

Reliability was reported using 95% confidence intervals of Revelle's omega total, which is superior to Cronbach's alpha (Dunn et al., 2014; McNeish, 2018). Convergent and discriminant validity were assessed using standard Pearson correlation coefficients of the respective measures described above. Incremental validity was assessed using hierarchical regression analysis with subjective happiness as criterion variable; in addition to the German FAS and BAS-2, body areas satisfaction, drive for masculinity, current-ideal weight discrepancy and age were used as predictors of subjective happiness. Drive for masculinity in men and current-ideal weight discrepancy in women were previously used to assess incremental validity of the BAS-2 and FAS Malay translations by Swami et al. (2019; 2019). Body areas satisfaction represents measures emphasizing appearance, which positive body image should have above-and-beyond predictive capability over. Appearance evaluation was not used due to concerns of multicollinearity; it is expected to behave similarly to body areas satisfaction. All statistical procedures were conducted in R (R core team, 2020).

3   Results

3.1   Preliminary Analysis

There was a total of 31 missing values, which made up 0.001% of the data. Since only few values were missing, simple medians were imputed using the Hmisc-package (Harrell et. al, 2020).

Sampling adequacy for factor analysis was evaluated for the BAS-2 and FAS, and both men and women, respectively. The overall measure of sampling adequacy, the Kaiser-Meyer-Olkin criterion, was adequate ($BAS\text{-}2_{male}$ = .89, $BAS\text{-}2_{female}$ = .84, FAS_{male} = .89, FAS_{female} = .89), with no single item falling below .79.

3.2   Dimensionality

A parallel analysis of polychoric principal component analysis was conducted with weighted least squares estimation using the Psych-package (Revelle, 2019). After 1000 replications, both the FAS and BAS-2 clearly showed to be unidimensional (Figure 1).

Figure 1

Scree Plots of the FAS (left) and BAS (right)
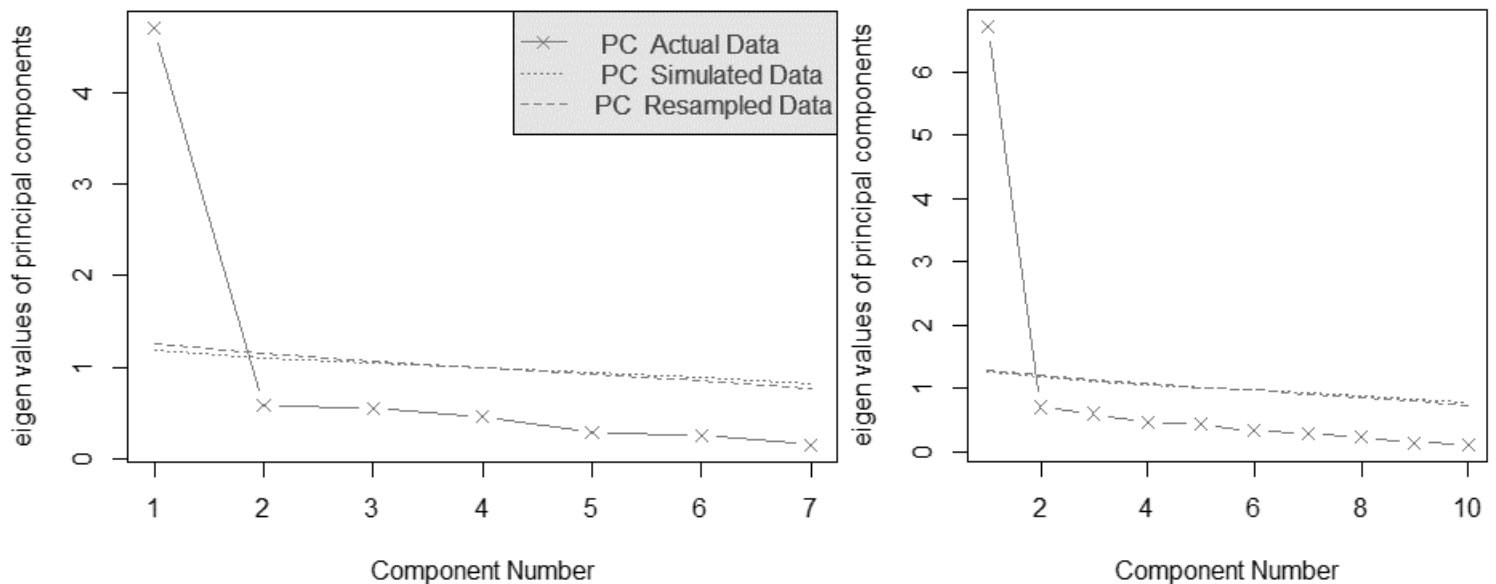
3.3 Measurement Invariance

Measurement invariance could not be modelled as planned. Polychoric item matrices could not be calculated, because the lowest response category (= *do not agree*) was never checked by male participants in some items. To visualize potential ceiling effects, histograms of all items were plotted. Concerning the BAS-2, response category frequencies between items tended toward the middle of the scale, still showing few data points at the lowest category (see Appendix, Figure A1). Concerning the FAS, this revealed a tendency towards the upper end (= *fully agree*) and few answers at the lower end of the scale. The pattern was consistent in all seven items (Figure 2).

Figure 2

FAS Response Frequencies by Item and Sex
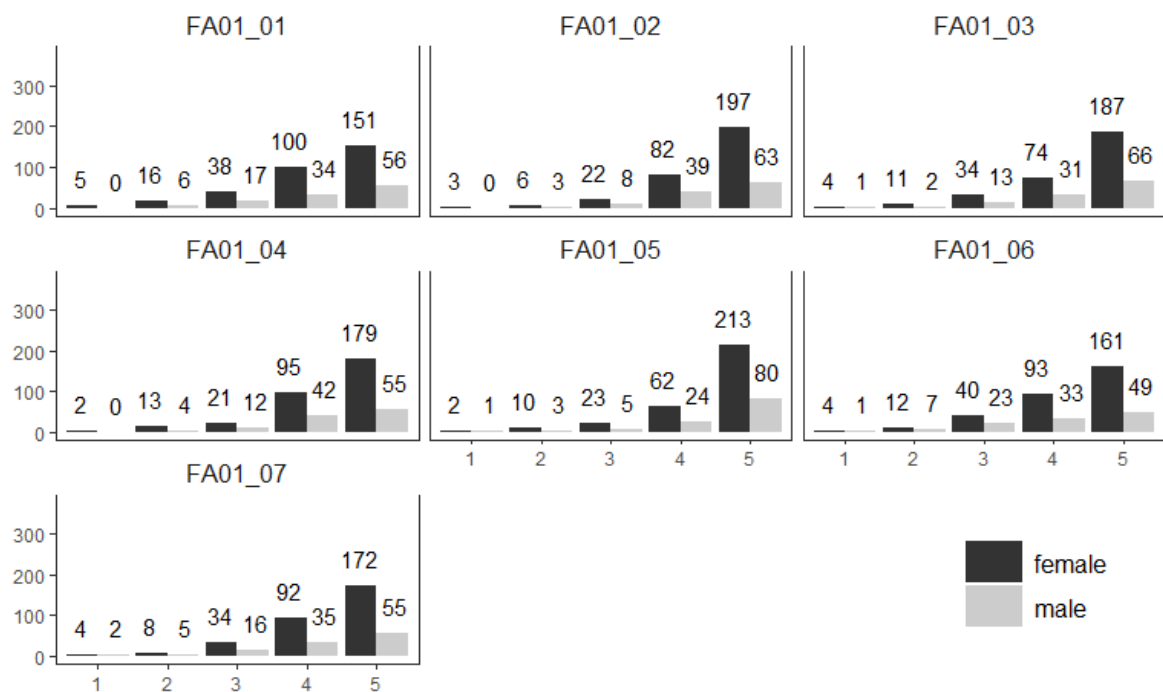
Thus, the last two item categories were merged. Then, the analysis was performed with polychoric item matrices and four response categories instead of five using the Lavaan-package (Rosseel, 2012). Factor loadings per group are reported in the appendix, Table A4. Both questionnaires reached scalar sex invariance. Table 1 summarizes fit indices and model comparisons. Exploratorily, respective sex differences within the BAS-2 and FAS were analyzed by comparing scalar sex invariance models to scalar models with group means set to zero; this revealed an

absence of latent group mean differences (see Table 1). For comparability, sex differences were also calculated with Welch t-tests for the BAS-2 ($t = -0.248$, $df = 221.17$, $p = .805$) and FAS ($t = 0.810$, $df = 213.4$, $p = 0.419$), respectively.

Table 1
Modelling Sex Invariance Ordered-Categorically with Merged Response Categories

Model	χ^2	df	CFI	TLI	Comparison	$\Delta\chi^{2**}$	Δdf	ΔCFI	ΔTLI	p
BAS-2										
Configural	123.89	70	0.997	0.997						
Metric	166.56*	79	0.996	0.995	Con vs. Met	15.79	9	.001	.002	.072
Scalar	158.92	98	0.997	0.997	Met vs. Sca	1.12	19	.001	.002	.999
Means	160.08	99	0.997	0.997	Sca vs. M	0.37	1	.000	.000	.541
FAS										
Configural	32.16	28	0.999	0.999						
Metric	38.86	34	0.999	0.999	Con vs. Met	5.03	6	.000	.000	.540
Scalar	43.42	40	0.999	0.999	Met vs. Sca	7.53	6	.000	.000	.275
Means	48.88	41	0.999	0.998	Sca vs. M	1.65	1	.000	.001	.200

Note. CFI = comparative fit index, TLI = Tucker–Lewis index, Means = scalar model with factor means set to zero.
* χ^2 being smaller in more restricted models is a technicality possible in WLSMV-estimation
**$\Delta\chi^2$ is scaled (Satorra & Bentler, 2010)
CFI / TLI > 0.95 indicate good model fit (Hu & Bentler, 1999)

As an alternative, the analysis was repeated using standard Pearson correlation matrices and maximum likelihood estimation with the original five response categories. The model fit was not acceptable (Hu & Bentler, 1999), nevertheless results are reported in the appendix (Table A5).

3.4 Reliability

Revelle's omega total was calculated using Mbess (Kelley, 2020). The BAS-2 yielded excellent reliability ($\omega_{BAS} = .93$, 95%-CI [.92, .94]), the FAS yielded good-to-excellent reliability ($\omega_{FAS} = .88$, CI [.86, .90]*)*. Cronbach's alpha is provided for comparability: $\alpha_{BAS} = .93$, CI [.92, .94] and $\alpha_{FAS} = .88$, CI [.86, .89].

3.5 Validity

Convergent and discriminant validity were assessed using standard Pearson correlation coefficients. Table 2 displays the correlation matrix. Body Appreciation

(BAS-2) was positively correlated with functionality appreciation (FAS), appearance evaluation (MBSRQ-AE), body areas satisfaction (MBSRQ-BES) and subjective happiness (SHS) in both women and men. Body appreciation was negatively correlated with drive for masculinity (DMS) in men and current-ideal weight discrepancy (PFRS) in women. Self-deceptive enhancement (BIDR-6-SDE) and impression management (BIDR-6-IM) were positively correlated with body appreciation in both men and women. Body mass index was negatively correlated with body appreciation in women, but not in men.

Functionality appreciation was positively correlated with body appreciation, appearance evaluation, body areas satisfaction and subjective happiness in both sexes, correlations with appearance evaluation and body areas satisfaction being lower than their respective correlations with body appreciation. Functionality appreciation was negatively correlated with drive for masculinity in men and current-ideal weight discrepancy in women. Self-deceptive enhancement was positively correlated with functionality appreciation in both men and women. Impression management was positively correlated with functionality appreciation only in men.

Table 2

Pearson Correlation Matrix of Questionnaires and BMI

	[1]	[2]	[3]	[4]	[5]	[6]	[7]	[8]	[9]	[10]
[1] BAS-2	-	.59*	.84*	.79*	-	-.34*	.34*	.12*	-.17*	.52*
[2] FAS	.65*	-	.45*	.45*	-	-.16*	.26*	.09	-.07	.46*
[3] Appearance Evaluation	.81*	.50*	-	.84*	-	-.34*	.32*	.09	-.27*	.41*
[4] Body Areas Satisfaction	.80*	.60*	.85*	-	-	-.34*	.32*	.09	-.23*	.41*
[5] Drive for Masculinity	-.21*	-.39*	-.24*	-.27*	-	-	-	-	-	-
[6] Actual-Ideal Weight Discrepancy	-	-	-	-	-	-	-.04	-.10	.59*	.01
[7] Self-deceptive Enhancement	.45*	.30*	.33*	.33*	-.36*	-	-	.19*	.01	.40*
[8] Impression Management	.24*	.25*	.24*	.26*	-.19*	-	.22*	-	.07	.18*
[9] BMI	.09	.01	.08	.01	-.12	-	.04	.00	-	.10
[10] Subjective Happiness	.53*	.47*	.44*	.48*	-.19*	-	.32*	.16	.01	-

Note. Lower diagonal matrix displays the male, upper diagonal matrix the female sample. Women did not complete the DMS and men did not complete the PFRS. Significant results ($p < .05$)* are marked with an asterisk.

Incremental validity was assessed with hierarchical linear regression analysis using subjective happiness as a criterion variable. The base model (M0, step zero) contained body area satisfaction (BES) and age as well as current-ideal weight discrepancy (PFRS) in women and drive for masculinity (DMS) in men as predictors; body appreciation (BAS-2) was introduced in a first step (M1b) and functionality appreciation in a second step (M2). The first step was also performed for functionality appreciation only (M1f), where functionality appreciation (FAS) was added to M0.

Linearity, homoscedasticity and normality of residuals were checked graphically for each model. Variance inflation factors (VIF) were smaller than 1.8 for all models and parameters, except for models containing both body areas satisfaction and body appreciation, where variance inflation factors of BES and BAS-2 were higher ($2.7 < VIF < 3.4$). In summary, VIFs indicate the absence of problematic multicollinearity. For women, all predictors except age were significant in step zero. All

predictors minus age stayed significant in step one, except for body area satisfaction, which no longer predicted subjective happiness when body appreciation entered the model. The results are summarized in Table 3.

Table 3

Hierarchical Regression Results for Subjective Happiness in Women

Variable	*B*	*SE*	*β*	*R²* adj	*ΔR²*
Step 0 (M0)				.19***	
Intercept	2.328***	0.237			
BES	0.490***	0.060	0.449***		
Age	0.007	0.003	0.102		
PFRS	0.075**	0.025	0.162**		
Step 1 (M1b)				.33***	.14***
Intercept	2.170***	0.217			
BES	-0.029	0.085	-0.026		
Age	0.005	0.003	0.076		
PFRS	0.106***	0.024	0.227***		
BAS-2	0.550***	0.069	0.626***		
Step 1 (M1f)				.29***	.10***
Intercept	1.257***	0.277			
BES	0.325***	0.062	0.298***		
Age	0.005	0.003	0.085		
PFRS	0.078**	0.024	0.168**		
FAS	0.386***	0.059	0.348***		
Step 2 (M2)				.35***	M1b: .2***
					M1f: .6***
Intercept	1.598***	0.271			
BES	-0.006	0.084	-0.005		
Age	0.005	0.003	0.073		
PFRS	0.100***	0.023	0.215***		
BAS-2	0.427***	0.077	0.486***		
FAS	0.219***	0.064	0.198***		

Note. BES = body area satisfaction, PFRS = current-ideal weight discrepancy, BAS-2 = body appreciation, FAS = functionality appreciation
*p < .05. **p < .01. ***p < .001.

For men, all predictors except drive for masculinity were significant in step zero. In step one, age was no longer significant. Again, when entering body appreciation, body area satisfaction was no longer significant. In step two, no predictor was significant and the model itself (M2) did not fit the data significantly better than M1b. The results are summarized in Table 4.

Table 4

Hierarchical Regression Results for Subjective Happiness in Men

Variable	*B*	*SE*	*B*	*R²* adj	*ΔR²*
Step 0 (M0)				.24***	
Intercept	1.938***	0.526			
BES	0.584***	0.104	0.482***		
Age	0.011*	0.005	0.187*		
DMS	-0.026	0.087	-0.026		
Step 1 (M1b)				.28***	.04*
Intercept	2.040***	0.516			
BES	0.250	0.169	0.206		
Age	0.008	0.005	0.137		
DMS	-0.041	0.085	-0.041		
BAS-2	0.337*	0.136	0.338*		
Step 1 (M1f)				.27***	.03*
Intercept	1.153	0.610			
BES	0.417***	0.112	0.345***		
Age	0.010	0.005	0.157		
DMS	0.030	0.088	0.030		
FAS	0.308*	0.059	0.254*		
Step 2 (M2)				.29***	M1b: .1 M1f: .2
Intercept	1.461*	0.271			
BES	0.225	0.169	0.186		
Age	0.008	0.005	0.129		
DMS	0.003	0.089	0.003		
BAS-2	0.244	0.148	0.245		
FAS	0.216	0.139	0.178		

Note. BES = body area satisfaction, DMS = drive for masculinity, BAS-2 = body appreciation, FAS = functionality appreciation
*p < .05. **p < .01. ***p < .001.

Using backwards elimination i.e., step-by-step removal of the least significant predictor until only significant predictors are left, M2 in women retained body appreciation, functionality appreciation and current-ideal weight discrepancy. Backwards elimination of M2 in men retained body appreciation and functionality appreciation as predictors of subjective happiness.

4 Discussion

The aim of this study was the German translation and psychometric evaluation of the BAS-2 and FAS questionnaires. In a pre-sample, the German BAS-2 and FAS were quantitatively rated as well understandable, with no indication of understanding problems in open comments. The main sample yielded a unidimensional factor structure in both questionnaires. The German BAS-2 and FAS showed excellent and good-to-excellent internal consistency, respectively.

Sex invariance was supposed to be evaluated with WLSMV-estimation, however, the procedure proved inapplicable due to participant's tendency to not check the lowest response category (= *do not agree*). Hence, two alternative approaches were implemented: Merging the lowest two response categories, and using standard Pearson correlation matrices. The first approach indicated scalar sex invariance i.e., equal factor structure and item loadings and intercepts between sexes. The second approach revealed genuinely poor model fit and was therefore discarded. In conclusion, scalar sex invariance of the German BAS-2 and FAS can be assumed, allowing for meaningful group mean comparisons. There were no latent sex differences.

The German BAS-2 was strongly correlated with appearance evaluation and body areas satisfaction. These results are comparable to those found in the Icelandic and Spanish translations (Karlsdóttir & Pálmarsdóttir, 2016; Swami, García, et al., 2017). Furthermore, the findings are consistent with BAS-2 items often being interpreted in respect of physical appearance, especially in white women (Dignard & Jarry, 2019). The German BAS-2 was also strongly correlated with functionality appreciation, yielding an effect size similar to the English and Malay versions (Alleva et al., 2017; Swami, Todd, et al., 2019). In women, actual-ideal weight discrepancy showed a moderately negative correlation with the German BAS-2, which was also found in the Brazilian Portuguese, Standard Chinese and Malay versions (Junqueira et al., 2019; Swami et al., 2016; Swami, Nor, et al., 2019). In men, drive for masculinity showed a small, negative correlation with the German BAS-2, similar to the Brazilian Portuguese version but dissimilar to the non-significant results found in Malaysian men (Swami, Nor, et al., 2019). Small-to-moderate correlations could be observed between the BIDR-6 subscales and the German BAS-2. There was a small, negative correlation

with body mass index in women but not in men. In conclusion, the German BAS-2 shows good convergent and discriminant validity.

The German FAS showed moderate-to-strong correlations with appearance evaluation and body areas satisfaction, which were lower than the respective correlations of the German BAS-2 with appearance evaluation and body areas satisfaction. This in itself indicated construct validity, as functionality appreciation is supposed to be less related to physical appearance than body appreciation is. These findings are similar to the original publication (Alleva et al., 2017). The German FAS correlated moderately positive with self-deceptive enhancement and weakly positive with impression management in men, but not in women. Moderately negative correlations with actual-ideal weight discrepancy in women and drive for masculinity in men were found. There was no correlation with body mass index. Taken together, these results uphold convergent and discriminant validity of the German FAS.

To assess incremental validity, subjective happiness was used as a criterion variable. The German BAS-2 showed a strongly positive correlation with subjective happiness, which exceeded previously reported, moderate correlations in Malaysian and Romanian samples (Swami, Nor, et al., 2019; Swami, Tudorel, et al., 2017). In a step-two model, body appreciation and functionality appreciation still were significant predictors in women, but not in men. This might be the result of low statistical power in the male subsample due to lower sample size. In most models (e.g., backwards elimination, M2 women), the German BAS-2 was the strongest, the German FAS the second strongest predictor of subjective happiness. In summary, the German BAS-2 and FAS predicted subjective happiness beyond body areas satisfaction, age, current-ideal-weight discrepancy in women and drive for masculinity in men.

4.1 Strengths and Limitations

Strengths of the present study are practicing open science by pre-registering desired sample size and analytical strategy, and using adequate statistical procedures e.g., confidence intervals of Revelle's omega coefficient instead of point estimates of Cronbach's alpha (Dunn et al., 2014; McNeish, 2018), polychoric item matrices and the WLSMV estimator for structural analysis (Sass, 2011; Sass et al.,

2014). The translation was accomplished in a multistep process and evaluated in respect of its understandability before launching the psychometric evaluation.

Limitations are using an opportunistic sampling strategy, which produced three times as many women as men; furthermore, recruiting via university-affiliated newsgroups may have caused the unrepresentatively high levels of education. This could be due to self-selective bias, as people interested in social sciences may be more likely to complete a scientific online survey; women and more educated people have been shown to be more likely to participate in surveys in general (e.g., Goyder, Warriner, & Miller, 2002; Singer, van Hoewyk, & Maher, 2000; Curtin, Presser, and Singer, 2000). Another limitation is not reaching a high enough sample size to allow for cross validation instead of exploratory structural equations modelling (see Algina & Keselman, 2000). Lastly, high FAS item means are indicative of a ceiling effect, as has been pointed out before in the literature (Alleva et al., 2017; Swami, Todd, et al., 2019).

4.2 Conclusion

Both the German BAS-2 and FAS were rated well understandable and showed to be unidimensional and internally consistent. Convergent and discriminant validity were assessed by correlating both questionnaires and eight other measures. Both questionnaires predicted subjective happiness above-and-beyond other measures. In summary, the German BAS-2's and FAS' psychometric quality meets required standards.

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6   Appendix

Table A1

Summary of BAS-2's Psychometric Properties Found in Other Publications

Publication	Sample	N	Reliability	#dim-ension	Sex In-variance*
(Tylka & Wood-Barcalow, 2015a)**	US community & students	1587	ICC = .90 α = .95	1	M
(Alcaraz-Ibáñez et al., 2017)	Brazilian adolescents	840	ρ =.93	1	M
(Argyrides, 2020)	Greek female students	193	α =.92, ICC =.91	1	-
(Atari, 2016)	Iranian students	1093	α =.88	1	-
(Escoto Ponce de León et al., 2020)	Mexican adolescents	1127	ω =.90	1	M
(Geller et al., 2020)	Israeli adults	613	ω CI-95% [.93 .95]	1	S
(Góngora et al., 2020)	Latin-American adolescents	3845	α =.93	1	S
(Junqueira et al., 2019)	Brazilian adults	990	ω CI [.89 .93] ICC = .81	1	S
(Karlsdóttir & Pálmarsdóttir, 2016)	Icelandic community sample	905	α =.79	1	-
(Kertechian & Swami, 2017)	French students	652	α = .92	1	M
(Lemoine et al., 2018)	Danish, Portuguese, Swedish	1012	α = .93	1	M
(Meneses et al., 2019)	Portuguese elderly	202	ω =.88	1	S
(Namatame et al., 2020)	Japanese children***	243	α = .87 ICC = .73	1	S
(Pereira, 2020)	Portuguese children***	328	ω = .72	1	S
(Razmus et al., 2020)	Iran, Japan, Poland, Serbia, US	2944	α =.93	1	-
(Swami, Nor, et al., 2019)	Malay & Chinese community	781	ω CI [.86 .91]	1	S
(Vally et al., 2019)	Arabic	256	α =.91	1	-

*N = none, C = configural, M = metric (equal loadings), S = scalar (equal intercepts), only reporting full invariance

**original publication ***BAS-2C, BAS-2 version for children

Table A2

Functionality Appreciation Scale Item Translations

I appreciate my body for what it is capable of doing	Ich schätze meinen Körper für was er zu tun in der Lage ist
I am grateful for the health of my body, even if it isn't always as healthy as I would like it to be	Ich bin dankbar für meine körperliche Gesundheit, selbst wenn ich nicht immer so gesund bin, wie ich gerne wäre
I appreciate that my body allows me to communicate and interact with others	Ich weiß zu schätzen, dass mein Körper es mir ermöglicht mit anderen zu kommunizieren und zu interagieren
I acknowledge and appreciate when my body feels good and/or relaxed	Ich erkenne und schätze es, wenn mein Körper sich gut und/oder entspannt anfühlt
I am grateful that my body enables me to engage in activities that I enjoy or find important	Ich bin dankbar, dass mein Körper mir ermöglicht Aktivitäten nachzugehen, die mir Spaß machen oder die mir wichtig sind
I feel that my body does so much for me	Es kommt mir vor als würde mein Körper viel für mich leisten
I respect my body for the functions it performs	Ich respektiere meinen Körper für die Aufgaben, die er erfüllt

Table A3

Body Appreciation Scale Item Translations

I respect my body	Ich respektiere meinen Körper
I feel good about my body	Ich bin zufrieden mit meinem Körper
I feel that my body has at least some good qualities	Ich denke, dass mein Körper zumindest einige gute Eigenschaften hat
I take a positive attitude towards my body	Ich habe eine positive Einstellung zu meinem Körper
I am attentive to my body's needs	Ich achte auf die Bedürfnisse meines Körpers
I feel love for my body	Ich empfinde Liebe für meinen Körper
I appreciate the different and unique characteristics of my body	Ich schätze die verschiedenen und einzigartigen Eigenschaften meines Körpers
My behaviour reveals my positive attitude toward my body; for example, I hold my head high and smile	Mein Verhalten zeigt meine positive Einstellung zu meinem Körper; zum Beispiel gehe ich aufrecht und lächle
I am comfortable in my body	Ich fühle mich wohl in meinem Körper
I feel like I am beautiful even if I am different from media images of attractive people (e.g., models, actresses/actors)	Ich fühle mich schön, selbst wenn ich anders aussehe als in den Medien gezeigte Ideale (z.B. Models, Schauspieler*innen)

Figure A1

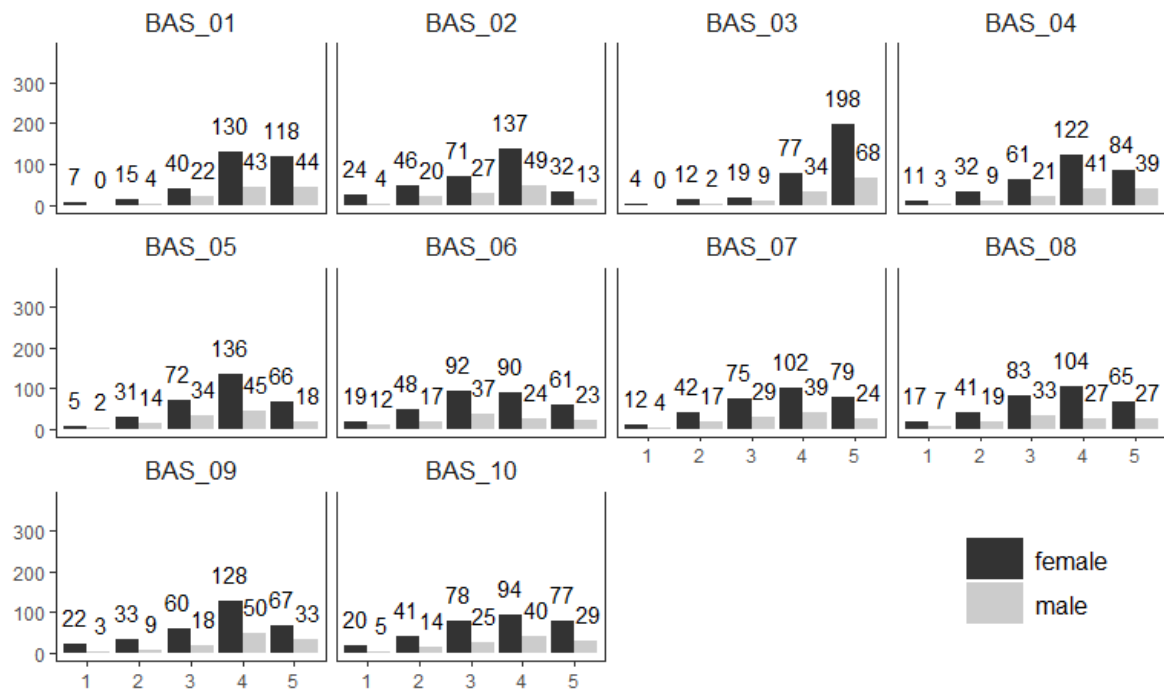*BAS-2 Response Frequencies by Sex and Item*

Table A4

Factor Loadings of the BAS-2 and FAS in a Scalar Sex Invariance Model

	BAS-2		FAS	
	Women	Men	Women	Men
Item 01	.742	.660	.829	.832
Item 02	.864	.917	.761	.703
Item 03	.794	.674	.765	.648
Item 04	.935	.914	.639	.607
Item 05	.645	.542	.796	.833
Item 06	.825	.802	.846	.819
Item 07	.819	.774	.932	.887
Item 08	.753	.645		
Item 09	.909	.913		
Item 10	.795	.837		

Table A5

Modelling Sex Invariance with ML and Pearson correlations

Model	χ^2	df	CFI	TLI	Model Comparison	$\Delta\chi^2$	Δdf	ΔCFI	ΔTLI	p
BAS										
Configural	236.64	70	0.937	0.919						
Metric	245.22	79	0.937	0.928	Con vs. Met	8.57	9	.000	.009	.478
Scalar	276.06	88	0.929	0.927	Met. vs. Sca	30.84	9	.006	.001	<.001
FAS										
Configural	102.90	28	0.948	0.922						
Metric	111.40	34	0.946	0.933	Con vs. Met	7.20	6	.002	.011	.204
Scalar	123.88	40	0.941	0.939	Met. vs. Sca	10.85	13	.005	.006	.052

Note. CFI = comparative fit index, TLI = Tucker–Lewis index, CFI / TLI > 0.95 indicate good model fit (Hu & Bentler, 1999)