Original Article

# Examining the Psychometric Properties of the Czech Versions of Anti-Fat Attitudes Questionnaire (AFA) and Beliefs About Obese Persons Scale (BAOP)

## Weight Stigma Among Adolescents

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**Abstract:** *Purpose:* The study aimed to evaluate anti-fat attitudes and beliefs among Czech adolescents and develop a Czech version of the Anti-Fat Attitudes Questionnaire (AFA) and Beliefs About Obese Persons Scale (BAOP). *Methods and Participants:* A total of 3,345 Czech adolescents aged 11–19 years completed sociodemographics, AFA, and BAOP. *Results:* The confirmatory factor analysis confirmed a three-factor solution and adequate factor validity for AFA. For BAOP, our data did not support the one-factor solution. The bifactor solution that accounted for the negatively formulated items fit, however, the data well. We also found both questionnaires to be invariant by sex. Age was inversely associated with BAOP and AFA Fear of Fat; higher ages were associated with higher AFA Dislike subscale scores. Girls scored higher on AFA Fear of Fat and boys on Dislike and Willpower. *Limitations:* Only Czech adolescents were included as participants, which could limit the applicability of the results to other age groups or cultural contexts. Furthermore, the use of self-report measurements introduces the potential for response biases. *Conclusion:* The Czech versions of both questionnaires demonstrated acceptable psychometric properties, but further research is needed to explore the wording effect for BAOP.

**Keywords:** adolescence, obesity, stigma, psychometrics, anti-fat attitudes


Weight stigma refers to the social rejection and devaluation of people with higher weights (Tomiyama et al., 2018), which stem from anti-fat biases, stereotypes, and attitudes (Crandall, 1994; Robinson et al., 1993; Vartanian & Porter, 2016). Stigmatization of high-weight individuals leads to various negative psychosocial consequences, including lower quality of life, depressive symptoms, disturbed body image, and low self-esteem (Friedman et al., 2005). Furthermore, experiencing stigma is consistently associated with worse physical and health behaviors (Hunger et al., 2015). While people of all body sizes can experience weight stigma and weight bias internalization, those in the largest bodies are most susceptible (Puhl & Himmelstein, 2018). Accordingly, the burden of weight stigma is likely to increase as the proportion of the population that is considered a high weight grows (Bentham et al., 2017).

Weight stigma is observed across many domains, including employment, health care, education, and the media (Puhl & Brownell, 2006; Puhl & Heuer, 2009). The media perpetuates anti-fat attitudes by depicting, for example, high-weight people with negative characteristics (Greenberg et al., 2003) and promoting thin body ideals (Guillen & Barr, 1994; Herbozo et al., 2004). Family and peers are common source of weight stigma (Puhl & Brownell, 2006). Among high-weight adolescents, Neumark-Sztainer et al. (2002) found that 47% of girls and

34% of boys had experienced mocking from family members, and 63% girls and 58% boys had experienced mocking from their peers. High-weight students are frequently the targets of bullying (Puhl et al., 2011) and have lower levels of peer acceptance (Zeller et al., 2008). Anti-fat attitudes among youth are likely key drivers of bullying and social ostracism and have been shown to be common among students in the United States. Neumark-Sztainer et al. (2002) demonstrated, for example, that 63% of all high school students had negative attitudes toward high-weight people, 32% of students had a neutral attitude, and only 6% had a positive attitude (Neumark-Sztainer et al., 2002).

Understanding weight bias helps in comprehending its impact on the development, maintenance, and treatment of eating disorders (Durso & Latner, 2008; Puhl & Brownell, 2006). In a recent study (Macho et al., 2022), individuals with a higher education exhibited more negative attitudes toward obesity. To extend this research, we aim to investigate the influence of parental education level and other sociodemographic characteristics. No previous study has investigated anti-fat attitudes among Czech students; thus, our primary goal is to examine these attitudes among Czech adolescents. To properly investigate anti-fat attitudes and related phenomena, precise and reliable instruments are needed. Therefore, the aim of this study is to present the validation of the Czech versions of the two questionnaires: Anti-Fat Attitudes Questionnaire (AFA) and Beliefs About Obese People Scale (BAOP). The AFA and BAOP address different but related areas regarding views on obesity. The AFA mainly concentrates on the emotional and prejudiced aspects, whereas the BAOP is more focused on cognitive beliefs about the causes and controllability of obesity.

The study aims to examine the psychometric properties of scales, focusing on factor structure and measurement invariance. Jayawickrama et al. (2023) conclude that AFA and BAOP are both measures suitable for assessing explicit weight bias not only in the general population, but also among health care providers.

The AFA scale was designed to measure attitudes toward overweight or obese individuals. It assesses anti-fat attitudes, which are essentially negative attitudes, biases, and stigmatizing beliefs about people who are overweight or obese (Crandall, 1994). The AFA includes three subscales. The first facet is Willpower which measures the belief that weight control is entirely under an individual's control, attributable to personal choices, discipline, and willpower. High scores indicate a strong belief that overweight individuals lack self-discipline or willpower. The second facet is Fear of Fat which assesses the degree of personal anxiety or fear about becoming overweight oneself. It reflects concerns about weight gain and the extent to which individuals internalize societal ideals about thinness. The third one is Dislike which evaluates the degree of negative emotional reactions or aversion toward overweight individuals. It includes elements of discomfort, disgust, or active dislike. Each subscale focuses on different dimensions of how people perceive and judge those who are overweight (Crandall, 1994). Ambwani et al. (2015) found AFA applicable in a cross-national study, indicating its potential for another language adaptation.

Early validation of the AFA scale often indicated an acceptable internal consistency for its subscales. Crandall (1994) demonstrated, for example, satisfactory reliability in his development of the scale, with Cronbach's α coefficients usually well above .70 for its subscales.

Subsequent studies have questioned the factor structure. Brien et al. (2007) raised concerns, for example, about the replicability of the original factor structure in different populations, suggesting that cultural and demographic factors might influence how the scale's items are interpreted.

The Beliefs About Obese People Scale (BAOP) is used to evaluate individuals' beliefs about the causes and controllability of obesity and assess attitudes and beliefs about overweight individuals, including weight-related biases, stereotypes, and discrimination. This scale focuses on the cognitive aspects of attitudes toward obesity, specifically focusing on the perceived causes. It distinguishes between beliefs that obesity is a result of controllable factors such as personal behavior and those that view it as a consequence of uncontrollable factors, such as genetics or medical conditions (Allison et al., 1991).

The BAOP scale by Allison et al. (1991) initially showed good construct validity and internal consistency and demonstrated a relatively clear factor structure. A study by Puhl et al. (2013) suggested, for example, that the factor structure might not be as straightforward as initially thought, with some items clearly not loading onto the expected one factor in different cultural contexts. A study by Tsai et al. (2019) using BAOP has also raised questions about its dimensionality, as they did not find the expected factor structure in BAOP when studying Taiwanese adolescents and negative wording effects were taken into account to address this issue. Further research indicated variability in the BAOP's performance across different populations, suggesting that cultural factors may play a significant role in how beliefs about obesity are formed and expressed (Puhl & Heuer, 2009).

Confirmatory factor analyses by Jayawickrama et al. (2023) confirmed the originally proposed factor structures of the BAOP (one factor) and AFA (three factors) and supported a relatively good model fit.

While some studies (Argyrides et al., 2023; Speirs et al., 2022) explored measurement invariance across cultures,

the present study will investigate measurement invariance in our representative sample, including considerations of sex. Since concepts as attitudes toward body size are known to be different between genders (e.g., Aruguete et al., 2006), studying the measurements in relation to this variable is crucial to ensure that the results are not biased toward one sex, whether they can be generalized and to understand whether the theoretical concept is stable across sexes or whether modifications are needed to accommodate differences.

Based on previous research and lack of research connecting BMI, education, age, gender, and anti-fat attitudes, we formulated the following hypotheses:

*Hypothesis 1 (H1):* We hypothesize that women manifest higher anti-fat attitudes than men, influenced by stricter societal body image standards.

*Hypothesis 2 (H2):* It is hypothesized that lower BMI and lower personal and parental education levels in adolescents are significantly associated with stronger anti-fat attitudes.

*Hypothesis 3 (H3):* This study hypothesizes change in anti-fat attitudes with increasing age in adolescents, suggesting that older adolescents exhibit higher levels of these attitudes due to more prominent body image concerns.

# Methods

## Participants and Procedure

Participants were Czech adolescents aged 11–19 years who attended school in one of the 14 administrative regions. To fulfill regional representativeness, schools were selected by a random number generator from a list of schools from throughout the country. At least one primary school (Grades 6–9, also known as a basic school), one grammar school (also known as gymnasium) with maturita exam, and one secondary school with a leaving examination (also known as maturita) or one secondary school without that leaving examination were chosen from every region. We contacted schools via post with all the documents describing the research and its purpose. Informed consent was obtained from the parents or legal guardians of the participants. The data were collected by a trained researcher who administrated the self-report, pen-and-paper questionnaires to participants during one school class (45 min). The participation was voluntary and anonymous. The sample originally contained 4,318 adolescents. After removing incomplete data, 3,345 (77.5% of the original sample) were included in the analysis. We also analyzed those missing complete data and found that the respondents who did not fill out the questionnaires completely were more frequently men ($\chi^2 = 51.596$, $df = 2$, $p < .001$, Cramer's $V = 0.12$), were seemed to be older (on average 0.4 years, Welch $t$ test, $t = -5.43$, $df = 496.12$, $p < .001$, Cohen's $d = -0.45$), and were more frequently attending secondary schools without maturita/in comparison with other school types ($\chi^2$ test, $\chi^2 = 335.94$, $df = 3$, $p < .001$, Cramer's $V = 0.34$).

## Assessments and Measures

Anti-fat attitudes and beliefs about high-weight people were assessed using the AFA and the BAOP. The AFA includes three factors: Dislike (7 items), which represents negative feelings toward high-weight people; Fear of Fat (3 items), which represents the individual's concern about weight gain; and finally, Willpower (3 items), which reflects one's belief about the controllability of weight and fat (Crandall, 1994). The questions are answered on a 0–9 Likert scale (0 = *very strongly disagree*; 9 = *very strongly agree*). The BAOP was published by Allison et al. (1991). The scale consists of eight items. The response options are on a scale from −3 (*I strongly disagree*) to +3 (*I strongly agree*), without a neutral option. Items 1, 3, 4, 5, 6, and 8 are reverse coded. The higher score indicates a stronger belief that obese people cannot control their obesity. An official Czech translation was unavailable; therefore, we translated the methods into the Czech language, as part of the study. First, the consent of the authors was gained. Five independent translators consequently translated the questionnaire, researchers conducted content analysis, and a professional English translator proofread the final version of the scales. Pilot testing was then conducted, and the final version of the set of questionnaires was created and printed.

With the consent of the authors, both scales in the original and the Czech version are in the supplementary material (https://osf.io/pghse/).

Student characteristics, such as sex, age, and education of parents, family history of high weight, and other sociodemographic characteristics, were obtained using multiple-choice questions:

1. Sex: What is your sex? (response options: male, female)
2. Age: What is your age? (write the number)
3. Education of parents: What is your mother's/father's highest level of education? (response options: primary school, secondary school without a leaving

examination, grammar school/secondary school with a leaving examination, university, I don't know).
4. Family history of high weight: Is anyone in your family obese or overweight? (response options: mother, father, sibling)

Participants were also asked to report weight and height. The calculated BMI values allowed us to assign every participant into weight groups according to the WHO averages for each age adolescence group, as described in the WHO guidelines, which we used as a proxy for body size. We divided our sample into four categories of body size based on *SD* (<−2 *SD*; −2 *SD*–<+1 *SD*; +1 *SD*–<+2 *SD*; ≥+2 *SD*), not based on the criteria normally used for adult samples (World Health Organization, 2007). In the statistical models, BMI was used as a continuous variable.

## Data Analysis

All data analyses were conducted using R version 4.0.5 (R Core Team, 2022). For both the AFA and BAOP scales, we first performed confirmatory factor analysis (CFA) using *lavaan* package 0.6-8 (Rosseel, 2012) with the diagonal weighted least squares estimation technique using polychoric correlations to assess factor validity. The adequacy of the model fit was evaluated using dynamic fit indices from a package *dynamic* for categorical models (McNeish, 2023; Wolf & McNeish, 2023). This approach uses simulation to obtain model-specific goodness-of-fit indices with hypothetical misspecification. Following CFA, we assessed measurement invariance for gender using a multigroup CFA. We considered four levels of invariance: configural (same factor structure), metric (equal item loadings), scalar (equal item thresholds), and residual (equal residuals). Scales are considered noninvariant if they do not fit data significantly differently than a previous restriction (except configural invariance). Since the traditional $\chi^2$ test of fit difference can be too strict with large samples, Chen's (2007) cutoffs are considered, where a change by .010 in CFI, .015 in RMSEA, or .030 in SRMR for metric invariance for scalar and a strict difference of .010 in CFI, .015 in RMSEA, or .010 in SRMR would indicate a significant noninvariance. As the next step, reliability coefficients were estimated. For both scales and their subscales, we did not expect τ equivalence of items. Therefore, reliability was investigated using coefficient omega categorical (Flora, 2020). R library *semTools* 0.5-5 (Jorgensen et al., 2021) was used for the calculation. As the last step in the psychometric evaluation, we analyzed differential item functioning (DIF) by gender using the iterative ordinal logistic regression approach, where the latent trait is estimated with the IRT framework using the Graded Response Model. The DIF was analyzed with package *lordif 0.3.-3* (Choi et al., 2011). An item would be flagged as having a DIF if a man and woman with the same amount of latent trait would respond significantly differently to the same item assessing the trait. We used a 1% change in $R^2$ and 1% change in β as a cutoff for a significant DIF (Crane et al., 2006). In general, there are two types of DIF: uniform, where the difference between groups is consistent across trait levels, and nonuniform, where the difference between groups varies by trait level (i.e., Trait × Group interaction). Both were examined visually by comparing three nested models, in which additional parameters were added (Model 1: trait level; Model 2: trait level, group; Model 3: trait level, group, interaction of Trait level × Group). Fits of these models are compared using the likelihood ratio $\chi^2$ tests. Finally, we developed a linear model for each raw score as a dependent variable and several sociodemographic variables as independent variables to evaluate relationships with these characteristics. The clean version of the data and analysis scripts are available at https://osf.io/pghse/.

# Results

## Demographic Characteristics

The participants in the current study were 3,345 adolescents from the Czech Republic, of whom 1,470 (47.5%) were boys and 1,875 (53.4%) were girls. The mean age was 16.6 years with an *SD* of 1.32. The boys and girls in our sample do not differ in mean age, $t(3{,}035.53) = 0.59$, $p > .05$, Cohen's $d = 0.02$, and the difference in the distribution is negligible, $d = 0.02$, $p = .8$, as tested with the Kolmogorov–Smirnov test. Demographic information is presented in Table 1.

## Item Analysis

A summary of item *M*, *SD*, skewness, kurtosis, and corrected item-total correlations (i.e., the specific item is subtracted from the sum score) can be found in Supplementary Table 1 (available at OSF). The AFA mean responses ranged from 5.21 (Item 2) to 0.96 (Item 4), with *SD* from 3.51 (Item 9) to 1.88 (Item 5), and corrected item-total correlation ranged from .69 (Item 6) to .24 (Item 2) for the Dislike subscale, from .83 (Item 10) to .76 (Item 9) for Fear of Fat, and from .53 (Item 12) to .35 (Item 11) for Willpower. The mean responses for BAOP ranged from 1.70 (Item 8) to −0.33 (Item 7), with *SD* from 1.76 (Item 1) to 1.47 (Item 6), and the corrected item-total correlation ranged from .67 (Item 6) to .09 (Item 7).

**Table 1.** Demographic information of research sample

| Characteristics | Categories | Frequency/*M* ± *SD* | % |
|---|---|---|---|
| Gender | Total | 3,345 | 100 |
| | Boys | 1,470 | 44 |
| | Girls | 1,875 | 56 |
| Age | Total | 16.61 ± 1.32 | |
| | Boys | 16.63 ± 1.37 | |
| | Girls | 16.6 ± 1.27 | |
| School | Elementary school | 260 | 7.8 |
| | High school without a leaving examination | 285 | 8.5 |
| | High school with a leaving examination | 878 | 26.2 |
| | Grammar school | 1,922 | 57.5 |
| Place of living | Town | 2,098 | 63.2 |
| | Village | 1,221 | 36.8 |
| Nationality | Czech | 2,994 | 89.7 |
| | Czech–Slovak | 129 | 3.9 |
| | Other | 222 | 6.5 |
| Highest education of a mother | Elementary school | 70 | 2.1 |
| | High school without a leaving examination | 696 | 20.8 |
| | Grammar school/high school with a leaving examination | 1,471 | 44.0 |
| | University | 977 | 29.2 |
| | I don't know | 131 | 3.9 |
| Highest education of a father | Elementary school | 51 | 1.5 |
| | High school without a leaving examination | 1,031 | 30.8 |
| | Grammar school/high school with a leaving examination | 1,058 | 31.7 |
| | University | 951 | 28.4 |
| | I don't know | 254 | 7.6 |
| BMI raw score | Total | 21.99 ± 3.45 | |
| | Male | 22.54 ± 3.61 | |
| | Female | 21.57 ± 3.26 | |
| Body size | <−2*SD* | 61 | 1.9 |
| | −2*SD* − <+1*SD* | 2,526 | 77.8 |
| | +1*SD* − <+2*SD* | 513 | 15.8 |
| | ≥+2*SD* | 146 | 4.5 |
| Family history of high weight | Mother | 476 | 14.4 |
| | Father | 601 | 18.2 |
| | Sibling | 262 | 7.9 |
| | Both parents and a sibling | 51 | 1.5 |

*Note. SD* = standard deviation.

## Factor Structure and Reliability

Several factor models were developed. In the first step, we evaluated the theoretically hypothesized three-factor model for the AFA questionnaire. The CFA was tested on data with 3,325 complete participants. Dynamic fit cutoffs with magnitude of misspecification = .326 (level 1) were SRMR = .047, RMEA = .063, and CFI = .978. The model fits the data adequately: $\chi^2$ = 590.457, *df* = 62, *p*-value of $\chi^2$= <.001, RMSEA = .051 (90% CI: .047, .054), CFI = .994, TLI = .993, and SRMR = .043. Factor loadings ranged from .94, with $R^2$ = .88 (Item 10) to .39 with $R^2$ = .15 (Item 2). The factors were allowed to correlate with the following correlation estimates: Dislike and Fear of Fat *r* = .15, Dislike and Willpower *r* = .49, and finally, Willpower with Fear of Fat *r* = .12. All correlations were significant *p* <

.001. Next, a hypothesized single-factor solution for BAOP was developed and evaluated using dynamic cutoff metrics: SRMR = .043, RMSEA = .071, and CFI = .971. The empirical fit measures are $\chi^2 = 616.580$, $df = 20$, $p$-value of $\chi^2 = <.001$, RMSEA = .097 (90% CI: .091, .104), CFI = .973, TLI = .962, and SRMR = .061. The model was calculated with 3,144 complete data points. Factor loadings ranged from .86, with $R^2 = .73$ (Item 6) to .07 with $R^2 < .01$ (Item 7). The model did not fit the data adequately. We investigated another solution to improve model fit, where all negatively worded items were loaded by the negativity factor in addition to the BAOP main factor, which was evaluated based on a previous study by Tsai et al. (2019) which found the BAOP to have been affected by negative wording (six of eight items are negatively worded). The fit measures for this solution were $\chi^2 = 130.263$, $df = 14$, $p$-value of $\chi^2 = <.001$, RMSEA = .051 (90% CI: .044, .060), CFI = .995, TLI = .989, and SRMR = .027. This significantly improved the fit, $\chi_{diff}^2 = 486.32$, $df_{diff} = 6$, $p < .001$. All factor loadings can be found in Supplementary Table 2 (available at OSF).

With our data, the AFA subscales Dislike and Fear of Fat demonstrate good internal consistency estimates, $\omega_{cat} = .84$, $\alpha = .81$, and .90, .90, respectively. The Willpower subscale has, however, a lower reliability estimate $\omega_{cat} = .66, .64$. The reliability estimate for BAOP is $\omega_{cat} = .76$, $\alpha = .76$.

## Measurement Invariance

To assess the role of gender (0 = *boys*, 1 = *girls*) in measurement, we used the multigroup CFAs. Table 2 summarizes models estimated for each level of invariance for both scales. For AFA, the change in fit measures did not meet the criteria by Chen (2007) until the residual invariance (equal error variances), where ΔRMSEA = .067; therefore, residuals of AFA are noninvariant across gender. Turning now to BAOP with negative wording, using the criteria by Chen (2007), the model did not change significantly by adding restrictions and demonstrating metric, scalar, and residual invariance.

Logistic regression-based DIF analysis for all AFA items found a significant uniform difference regarding the $R^2$ cutoff for three items: 8, 9, 10 (between 4% and 5% of variance) and eight items with the β change cutoff: 2, 6, 8, 9, 10, 11, 12, and 13 (all .3–.5). Nonuniform DIF was not found. The largest impact of DIF was present for Items 8, 9, and 10, which all belong to the Fear of Fat subscale. We did not find a significant DIF for BAOP for the $R^2$ criterion, and only Item 7 (value) was flagged as DIF in the β change cutoff point, corresponding with previous results for Items 7 and 6. DIF values for all items can be found in Supplementary Table 2.

## The Relationship Between AFA and BOAP Scores and Other Variables

Pearson's correlation coefficients are presented in Table 3, and all values are statistically significant at $p < .001$.

To investigate the relationships of raw total scores with demographics, five linear regression analyses were performed. The results for BAOP total scores are presented in Table 4, and the results for AFA subscales are presented in Table 5. The values of explained variance $R^2$ are also presented. Students who did not report their parents' education level by answering "I don't know" were removed due to unclear interpretation of results ($n = 309$). In H1, we assumed that women would manifest higher anti-fat attitudes than men, and the results only confirmed this for one of the three subscales. Boys had higher Willpower [$\beta = -0.18$, $t(2,903) = -9.59$, $p < .001$] and Dislike AFA

**Table 2.** Test results for measurement invariance by gender

| Model | $\chi^2(df)$ | CFI | RMSEA | SRMR | Model comp | $\Delta\chi^2$ ($\Delta df$) | ΔCFI | ΔRMSEA | ΔSRMR |
|---|---|---|---|---|---|---|---|---|---|
| AFA | | | | | | | | | |
| M1: Configural | 724.408 (124) | .992 | .054 | .047 | | — | — | — | — |
| M2: Metric | 779.845 (134) | .992 | .054 | .049 | M1 | 55.437* (10) | −.001 | −.001 | .002 |
| M3: Scalar | 1,152.153 (235) | .988 | .048 | .049 | M2 | 372.31* (101) | −.003 | −.005 | 0 |
| M4: Residual | 1,261.754 (248) | .987 | .050 | .049 | M3 | 109.6* (13) | −.001 | .067* | 0 |
| BAOP | | | | | | | | | |
| M1: Configural | 143.553 (28) | .995 | .051 | .028 | | — | — | — | — |
| M2: Metric | 179.684 (40) | .994 | .047 | .032 | M1 | 36.131 (12)* | −.001 | −.004 | .004 |
| M3: Scalar | 246.120 (70) | .992 | .040 | .033 | M2 | 66.436 (30)* | −.002 | −.007 | .001 |
| M4: Residual | 268.177 (78) | .991 | .039 | .033 | M3 | 22.058 (8)* | −.001 | −.001 | 0 |

*Note.* BAOP: $N = 3,144$, $n$ girls = 1,771, $n$ boys = 1,373, AFA: $N = 3,325$, $n$ girls = 1,865, $n$ boys = 1,460; * for $\Delta\chi^2$ represents $p < .05$; * for CFI, RMSEA, and SRMR represents a change in fit greater than Chen's (2007) criteria (CFI = .010, RMSEA = .015, SRMR = .30 for Metric and CFI = .010 RMSEA = .015,.SRMR = .010 for scalar and residual).

**Table 3.** Pearson's correlation coefficients for BAOP and AFA

| Factor | | Mean | *SD* | 1 | 2 | 3 |
|---|---|---|---|---|---|---|
| 1 | BAOP | 16.83 | 6.62 | — | | |
| 2 | Dislike (AFA subscale) | 13.19 | 10.47 | –.19*** | — | |
| 3 | Fear of fat (AFA subscale) | 10.46 | 9.22 | –.12*** | .11*** | — |
| 4 | Willpower (AFA subscale) | 14.1 | 6.33 | –.4*** | .33*** | .06*** |

*Note. SD* = standard deviation.
***$p$ < .001.

**Table 4.** Results from linear regression models with sum scores of BAOP as dependent variables

| | BAOP total score | | |
|---|---|---|---|
| Regressor | Parameter | β | *SE* |
| Intercept | 23.76*** | 0 | 2.01 |
| Gender (boys, ref) | — | — | — |
| Gender (girls) | 0.3 | 0.02 | 0.26 |
| Age | −0.31* | −0.06 | 0.13 |
| Upper grades of elementary school (ref) | — | — | — |
| Secondary school without maturita | 2.48** | 0.09 | 0.84 |
| Secondary school with maturita | −0.21 | −0.01 | 0.7 |
| Grammar school with maturita | −1.25 | −0.09 | 0.67 |
| BMI | −0.05 | −0.03 | 0.04 |
| No high-weight family members (ref) | — | — | — |
| High-weight – father | −0.11 | −0.01 | 0.33 |
| High-weight – mother | 0.03 | 0 | 0.38 |
| High-weight – sibling | 0.5 | 0.02 | 0.48 |
| Mother education – elementary school (ref) | — | — | — |
| Education mother – secondary school without maturita | 0.41 | 0.02 | 1 |
| Education mother – secondary school with maturita | −0.14 | −0.01 | 0.99 |
| Education mother – university | 0.45 | 0.03 | 1.01 |
| Father education – elementary school (ref) | — | — | — |
| Education father – secondary school without maturita | 3.88* | 0.16 | 1.54 |
| Education father – secondary school with maturita | 4.34** | 0.18 | 1.55 |
| Education father – university | 3.52* | 0.19 | 1.58 |
| $R^2$ | 3% | | |

*Note*. Parameter = unstandardized standardized regression coefficients. β = standardized regression coefficients. *SE* = standard error.
*$p$ < .05. **$p$ < .01. ***$p$ < .001.

[β = −0.12, $t(2,903)$ = −6.343, $p$ < .001] subscales. However, girls scored higher on Fear of Fat [β = 0.43, $t(2,903)$ = 26.28, $p$ < .001, $t(2,903)$ = 26.28, $p$ < .001]. In BAOP, gender results were not statistically significant [β = 0.02, $t(2,756)$ = 1.18, $p$ = .239].

H2 expected that adolescents' lower BMI and lower personal and parental education levels are significantly associated with stronger anti-fat attitudes. The effect of BMI is statistically significant for Dislike [β = −0.10, $t(2,903)$ = −4.91, $p$ < .001], Willpower [β = −0.06, $t(2,903)$ = −3.08, $p$ = .002], Fear of Fat [β = 0.27, $t(2,903)$ = 15.95, $p$ < .001, but not for BAOP β = −0.03, $t(2,756)$ = −1.31, $p$ = .191].

There was no significant effect of personal education or the mother's education on Dislike, only for the father's education (higher education having higher Dislike). A similar pattern was present for Fear of Fat. No effect of education was found on Willpower and for the BAOP total score.

In H3, we proposed a change in anti-fat attitudes with increasing age. In accordance with the hypothesis, the results showed that age is a significant regressor for Dislike [β = 0.06, $t(2,903)$ = 2.45, $p$ = .014], Fear of Fat [β = −0.04, $t(2,903)$ = −2.18, $p$ = .030], and BAOP [β = −0.06, $t(2,756)$ = −2.42, $p$ = .016], but not for Willpower [β = 0.02, $t(2,903)$ = 0.89, $p$ = .376]. Only the Dislike score

**Table 5.** Results from linear regression models with sum AFA subscale scores as dependent variables

| | Dislike | | | Willpower | | | Fear of fat | | |
|---|---|---|---|---|---|---|---|---|---|
| Regressor | Parameter | β | *SE* | Parameter | β | *SE* | Parameter | β | *SE* |
| Intercept | 13.25*** | 0 | 3.06 | 14.72*** | 0 | 1.84 | −5.27* | 0 | 2.37 |
| Gender (boys, ref) | — | — | — | — | — | — | — | — | — |
| Gender (girls) | −2.51*** | −0.12 | 0.4 | −2.27*** | −0.18 | 0.24 | 8.03*** | 0.43 | 0.31 |
| Age | 0.49* | 0.06 | 0.2 | 0.11 | 0.02 | 0.12 | −0.34* | −0.04 | 0.15 |
| Upper grades of elementary school (ref) | — | — | — | — | — | — | — | — | — |
| Secondary school without maturita | −1.2 | −0.03 | 1.25 | −1.27 | −0.05 | 0.75 | −0.43 | −0.01 | 0.97 |
| Secondary school with maturita | −0.32 | −0.01 | 1.05 | 1.56* | 0.11 | 0.63 | 1.32 | 0.06 | 0.81 |
| Grammar school with maturita | −0.3 | −0.01 | 1.01 | 1.75** | 0.13 | 0.61 | 0.3 | 0.02 | 0.78 |
| BMI | −0.29*** | −0.1 | 0.06 | −0.11** | −0.06 | 0.04 | 0.74*** | 0.27 | 0.05 |
| No high-weight family members (ref) | — | — | — | — | — | — | — | — | — |
| High-weight – father | −0.53 | −0.02 | 0.51 | −0.27 | −0.02 | 0.31 | 0.95* | 0.04 | 0.4 |
| High-weight – mother | −0.46 | −0.02 | 0.58 | −0.13 | −0.01 | 0.35 | 0.74 | 0.03 | 0.45 |
| High-weight – sibling | 0.9 | 0.02 | 0.73 | 0.3 | 0.01 | 0.44 | 1.39* | 0.04 | 0.57 |
| Mother education – elementary school (ref) | — | — | — | — | — | — | — | — | — |
| Education – mother without maturity exam | 0.3 | 0.01 | 1.51 | −0.09 | −0.01 | 0.9 | −0.36 | −0.02 | 1.16 |
| Education – mother with maturity exam | −0.18 | −0.01 | 1.49 | −0.01 | 0 | 0.89 | −0.5 | −0.03 | 1.15 |
| Education – mother university | 0.48 | 0.02 | 1.53 | 0.17 | 0.01 | 0.92 | −0.67 | −0.03 | 1.18 |
| Father education – elementary school (ref) | — | — | — | — | — | — | — | — | — |
| Education – father without maturity exam | 3.52* | 0.16 | 1.54 | 0.17 | 0.01 | 0.92 | 2.85* | 0.15 | 1.19 |
| Education – father with maturity exam | 3.88* | 0.18 | 1.55 | −0.09 | −0.01 | 0.93 | 2.63* | 0.14 | 1.2 |
| Education father – university | 4.34** | 0.19 | 1.58 | 0.17 | 0.01 | 0.95 | 2.77* | 0.14 | 1.22 |
| $R^2$ | 0.03 | | | 0.05 | | | 0.25 | | |

*Note*. Parameter = unstandardized standardized regression coefficients. β = standardized regression coefficients. *SE* = standard error.
*$p$ < .05. **$p$ < .01. ***$p$ < .001.

consequently increases with age, whereas younger students score higher for Fear of Fat or BAOP. This pattern, where Dislike scores rise with age while younger students have higher Fear of Fat or BAOP scores, illustrates a nuanced age-related shift in body image attitudes.

## Discussion

The current study investigated anti-fat attitudes and beliefs about high-weight people as perceived by adolescents using two questionnaires AFA and BAOP translated into the Czech language. In our nationally representative nonclinical sample consisting of 3,345 adolescents aged 11–19 years attending secondary education schools, there was support for a three-factor solution for the AFA, with a high correlation between the Willpower and Dislike subscales. Girls scored higher on the AFA Fear of the fat subscale relative to boys, while boys scored higher on the Dislike and Willpower subscales. Overall, higher anti-fat attitudes were seen in those with lower BMIs and those who had high-weight family members.

The mean BAOP score observed in our sample (16.83) was lower than observed in some previous studies from Hong Kong and Taiwan in the adolescent sample (Tsai et al., 2019), in the American adult sample (Allison et al., 1991), or in the Turkish adult sample (Dedeli et al., 2014) using BAOP. In contrast, Flint et al. (2015) found in the UK adult sample a lower incidence of BAOP than in our study. Negative beliefs in our sample of Czech adolescents were somewhat lower than in most, but not all, previous studies of adults. Studies among other adolescent samples are lacking, although they can significantly help better understand weight-related beliefs and attitudes during this critical development period.

In a recent Greek study, CFA conducted for AFA was is in agreement with our results (Argyrides et al., 2023).

We hypothesized that women manifest higher anti-fat attitudes than men, influenced by stricter societal body image standards. In our results, we observed significant differences in AFA scores according to gender. For all

three subscales, boys and girls differed significantly; however, boys scored higher for the Dislike and Willpower subscales, while girls scored higher for the Fear of Fat subscale. These results confirm that women are more prone to having higher self-oriented fear of higher weight but do not have such a strong general opinion toward high-weight people (as Dislike is smaller). They also might understand more that controlling one's weight and body shape is not always based on one's actions (lower Willpower). The sum score of BAOP has no significant relation with gender. Other studies, that have examined gender differences in weight bias, have found higher levels of weight bias among men, relative to women (Aruguete et al., 2006; Crandall, 1994; Flint et al., 2015; Glenn & Chow, 2002; Hayran et al., 2013; Lewis et al., 1997; Pantenburg et al., 2012; Pearl et al., 2012; Sabin et al., 2012). Aruguete et al. (2006) introduced the hypotheses that women internalize the value of thinness through body dissatisfaction and food restriction. This aligns with our findings that the Fear of Fat subscale was higher among girls. In contrast, men externalize through showing a dislike of fat people. Girls are more likely to respond with higher response options in the Fear of Fat subscale. Since all of these three items demonstrated uniform DIF, it is impossible from our data to distinguish the source of this significant difference, whether it is because of the wording of the items (as they could have different meanings for both groups) or if the Fear of Fat as a characteristic is clearly different between them. Robinson et al. (1993) found that women were more likely than men to exhibit a pathological fear of fat. Furthermore, Lieberman et al. (2012) found that men more often assign obesity to the lack of willpower and woman experience greater fear from fat; accordingly, future studies should research specific subtypes of anti-fat attitudes to more systematically understand the gender differences.

We hypothesized that higher BMI and lower personal and parental education levels in adolescents are significantly associated with stronger anti-fat attitudes. Our results showed that adolescents who had lower BMIs held more anti-fat attitudes and negative beliefs about high-weight people. Specifically, the AFA Dislike and Willpower subscales were inversely associated lower with BMI scores, although higher Fear of Fat subscale scores were associated with higher BMI. Crandall (1994) originally reported that the Dislike subscale was not related to BMI. Several previous studies have found an inverse association between body size and negative attitudes toward people with high weight (Flint et al., 2015; Latner et al., 2005; Lieberman et al., 2012; Puhl et al., 2011; Sabin et al., 2012). In a sample of 10-year-old children, Hansson et al. (2009) did not find any differences in negative attitudes toward high-weight people according to the body sizes or shapes of children, suggesting that adolescence may be a key developmental period for the emergence of such biases.

We observed an association between some familial factors and anti-fat attitudes and beliefs about high-weight people. Specifically, students whose fathers had a higher education than primary school had a higher score in BAOP, and also in the AFA subscales Dislike and Fear of Fat. The association was not present for the mother's education. This finding aligns with a study of 9-year-old children by Davison and Birch (2004) who found that those with more educated fathers and with higher family income were more likely to hold negative stereotypes about high-weight people. This finding may reflect greater concern for one's own appearance and fear of weight gain in higher socioeconomic groups (Davison & Birch, 2004). While having a higher BMI was associated with lower anti-fat attitudes, having a high-weight family member was not similarly protective. Specifically, higher AFA scores were seen among participants who had a high-weight sibling and higher AFA of Fat subscale scores were seen in participants who had a high-weight father or sibling. These results show somehow counterintuitive outcomes since one might expect that having high-weight loved ones would serve as a protective factor from anti-fat attitudes. Several studies, however, which identify family members as perpetrators of weight stigma, suggest otherwise (Puhl & Brownell, 2006).

We hypothesized change in anti-fat attitudes with increasing age in adolescents, suggesting that older adolescents exhibit higher levels of these attitudes due to more prominent body image concerns. Indeed, we observed an association between the AFA Dislike subscale and age, with higher ages (corresponding with the late adolescence) associated with higher Dislike subscale scores, but an inverse association between age and AFA Fear of Fat subscale and BAOP score. We observed an association between school type and BAOP score and the AFA Willpower subscale, with the lowest scores seen for students attending lower secondary schools also likely reflecting an increase in negative attitudes toward high-weight people throughout adolescence. The findings from previous studies suggest that negative attitudes toward high-weight people may decrease after adolescence/young adulthood (Flint et al., 2015; Latner et al., 2005; Lieberman et al., 2012).

The theoretical one-factor solution of the BAOP did not fit our data well (Allison et al., 1991); therefore, we elected to explore the factor structure with an explorative factor solution, which yielded a bifactor solution. We also explored a second approach, where negative items were loaded onto a common factor as well as negativity factor based on the wording of the items, which fit the data well. Since the wording effect for BAOP was also present in the previous work by Tsai et al. (2019), we recommend that

the factor structure of BAOP be investigated more in the future. The BAOP Item 7 had a small item-total correlation and the smallest loading with the latent factor. The negative response values were also more selected in our sample than with other items. With a closer qualitative investigation, the research team did not find a valid reason why or if the item is different from the original scale. The internal consistency of BAOP was good (α = .76), slightly lower than in the original study (Allison et al., 1991) and higher in comparison with the study by Tsai et al. (2019) where Cronbach's α for BAOP was .61. In the Turkish version (Dedeli et al., 2014), neither the Polish version (Styk et al., 2022), the instrument has not yet been sufficiently psychometrically examined (only exploratory, the confirmatory CFA was not conducted); therefore, the one-factor structure may not be entirely pure.

Our results show that AFA has acceptable item properties. The anti-fat attitudes questionnaire was created to understand antipathy toward fat people while comparing those attitudes toward racism. Each of the three scales of the questionnaire display one anti-fat attitude (Crandall, 1994). The Dislike and Fear of Fat subscales demonstrated good reliability in our sample (α = .84 and α = .79, respectively). The Willpower subscale had acceptable but lower reliability (α = .66) than the other scales, a trend that is in line with the original study by Crandall (1994). Crandall (1994) showed that people who believe *obesity* is beyond the control of the individual have a more positive attitude than those who believe that it can be individually controlled. We found significant correlations between all the AFA subscales on a latent factor level (cleared from the measurement error) and a raw score level. The highest factorial correlation was between Willpower and Dislike. In the original article by Crandall (1994), a correlation between Willpower and Dislike was seen ($r = .43$, $n = 244$, $p < .001$), suggesting that the perception of controllability of weight and fat contributes to anti-fat attitudes. Fear of Fat did not correlate with Dislike or Willpower.

## Limitations

Only the Czech adolescents were included as participants, which could limit the applicability of the results to other age groups or cultural contexts. Furthermore, the use of self-report measurements introduces the potential for response biases.

## Conclusion

In conclusion, two questionnaires, AFA and BAOP, were translated into the Czech language and their psychometric properties were examined. Although more research is needed, both methods can be used to measure anti-fat attitudes in the Czech environment.

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**Authorship**
Helena Pipová—wrote the main parts of the paper, corresponding author, have drafted the work or substantively revised it. Kryštof Petr—conceived and design the analysis, interpretation of data, and continuously contributed to the final version of the paper. Markéta Kostková—performed the analysis and worked on the statistical parts of the text. Martin Dolejš—collected the data and was the mentoring the work on the article. Jaroslava Suchá—collected the data and commented the article. Kendrin Sonneville—supervised the manuscript and collaborated on the paper submission process.

**Open Science**
Dataset, R scripts, and supplementary tables are publicly available at https://osf.io/pghse/. Data are part of larger data collection called "Attitudes of Czech Adolescents Towards People With Obesity."

Open Data: The authors confirm that there is sufficient information for an independent researcher to reproduce all of the reported results, including codebook if relevant (Petr & Pipová, 2024).

Open Materials: The authors confirm that there is sufficient information for an independent researcher to reproduce all of the reported methodology (Petr & Pipová, 2024).

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