Running head: INTEROCEPTION AND BODY IMAGE

An Exploration of the Associations between Facets of Interoceptive Awareness and Body Image in Adolescents

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**Abstract**

Previous research suggests that lower interoceptive awareness is associated with more negative body image during adolescence. However, studies have not distinguished between adaptive and maladaptive modes of attention toward interoceptive signals, and relationships between interoceptive awareness and positive body image remain unexplored. To address these issues, a sample of 265 British adolescents (140 girls, 125 boys) aged 13-16 years completed measures of interoceptive awareness, body appreciation, functionality appreciation, body pride, body shame, and body surveillance. Correlational analyses broadly indicated that greater interoceptive awareness was significantly associated with more positive body image. Multiple regressions revealed significant predictive relationships between interoceptive awareness and all facets of body image in both girls and boys, except body surveillance, which was not statistically significant for girls. At the univariate level, the interoceptive awareness facets of Attention Regulation, Body Listening, Self-Regulation, and Trusting emerged as significant predictors for at least one facet of positive body image, whilst the Noticing and Emotional Awareness facets did not. These findings broadly align with previous research with adults, which has indicated that the way interoceptive stimuli are appraised and responded to might be more closely associated with facets of body image than the tendency to notice interoceptive stimuli.

**Keywords:** Interoception; Interoceptive awareness; Positive body image; Adolescence; Body surveillance; Body shame

**1. Introduction**

Bodily awareness can be divided according to internal and external domains of the body. The term *interoception* refers to the processing of stimuli originating inside the body (Craig, 2003), while *body image* refers to the generation of external, appearance-related perceptions, affects, and cognitions (Cash, 2004). Both constructs are essential components of personal identity and contribute to the regulation of human behaviour (Cash, 2004; Craig, 2009; Damasio, 2010). However, the interaction between the two constructs is complex, as they are both considered to be multidimensional (Cash & Smolak, 2012; Khalsa et al., 2018; Murphy et al., 2019; Tylka, 2018). This, in turn, has important clinical implications for the identification of therapeutic targets for the treatment of body image concerns and the promotion of healthier body image.

Body image can be parcellated into the distinct, higher-order constructs of positive body image and negative body image (Tylka, 2018; Tylka & Piran, 2019). *Negative body image* comprises many forms, including appearance dissatisfaction, body surveillance, body shame, and internalisation of media appearance ideals (Tylka, 2018). Conversely, informed by qualitative research and psychometric studies, *positive body image* refers to an overarching love and respect for the body, incorporating appreciation for the body and the functions it performs, acceptance of aspects of appearance that are inconsistent with social ideals, and interpretation of incoming information in a body-protective manner (Tylka, 2018; Wood-Barcalow, Tylka, & August-Horvath, 2010). While indices of positive and negative body image are often negatively correlated (Tylka, 2018), the two constructs do not represent opposites ends of the same continuum and are also associated with outcome variables – such as psychological well-being and weight-related health behaviours – in unique ways (e.g., Davis, Fowler, Best, & Both, 2019; Gillen, 2015; Thomas & Warren-Findlow, 2019).

On the other hand, interoception has been divided into numerous components that span both conscious and subconscious awareness (Khalsa et al., 2018; Murphy et al., 2019). The present work focuses on *interoceptive awareness*, which refers to self-reported detections of interoceptive stimuli using questionnaire-based measures 1. In addition to perceptual elements, interoceptive awareness also encompasses cognitive and behavioural aspects (Mehling, 2016), such as appraisals and beliefs surrounding interoceptive stimuli, attention regulation, and behavioural responses. Coverage of all of these aspects of interoceptive awareness can be obtained using the Multidimensional Assessment of Interoceptive Awareness (MAIA; Mehling et al., 2012; for a full description, see Section 2.2.1).

In recent years, some authors have suggested that there may be a causal relationship between interoception and body image. Specifically, it has been hypothesised that lower levels of interoceptive awareness (and other components of interoception) could predispose individuals to body dissatisfaction and body image disturbances (Ainley & Tsakiris, 2013; Badoud & Tsakiris, 2017). A theoretical mechanism for this argument focuses upon the ability to divide attention between interoceptive and exteroceptive stimuli (Badoud & Tsakiris, 2017). The *competition of cues hypothesis* (Pennebaker, 1982; Pennebaker & Lightner 1980) suggests that attention paid to internal stimuli will reduce attentional resources available for external stimuli and *vice versa.* It has been further suggested that attention toward interoceptive and exteroceptive stimuli is directed according to the reliability of the stimuli (Ainley, Apps, Fotopoulou, & Tsakiris, 2016). That is, in the absence of accurate interoceptive percept, bodily awareness may be predominantly based upon exteroceptive (i.e., visual) cues (Tajadura-Jimenez & Tsakiris, 2014; Tsakiris, Tajadura-Jiménez & Constantini, 2011).

It is possible that this increased reliance upon exteroceptive inputs encourages a greater focus upon visual aspects of the body and even susceptibility to broader exteroceptive inputs, such as sociocultural appearance ideals. Indeed, a preference for exteroceptive cues has been associated with body image disturbances and eating disorder symptomatology (Eshkevari, Rieger, Longo, Haggard, & Treasure, 2012, 2014; Mussap & Salton, 2006). Furthermore, Mussap and Salton (2006) found that the degree of acceptance, and perceived importance, of cultural standards of beauty significantly mediated associations between unhealthy body change strategies and the preference for interoceptive/exteroceptive stimuli. In summary, it is posited that individuals with lower interoceptive awareness will be more likely to experience body dissatisfaction because of a bias toward exteroceptive stimuli, such as the visual characteristics of the body. Conversely, individuals with higher interoceptive awareness may be more likely to experience positive body image, due to the preferential processing of interoceptive (physiological) stimuli, which could promote greater awareness of, and appreciation for, the positive functions that the body performs.

In adult samples, research supports the hypothesis that there are significant associations between interoceptive awareness and facets of both negative and positive body image (Badoud & Tsakiris, 2017; Todd, Aspell, Barron, & Swami, 2019). In general, findings have converged to suggest that lower interoceptive awareness is associated with body image disturbances (Badoud & Tsakiris, 2017; although this may not be consistent across other components of interoception; e.g., Eshkevari, Rieger, Musiat & Treasure, 2014; Goldzak-Kunik, Friedman, Spitz, Sandler & Leshem, 2012; Khalsa et al., 2015). Similarly, research indicates that people who are more attentive to interoceptive stimuli tend to have more positive body image (Daubenmier, 2005; Duschek, Werner, Reyes del Paso, & Schandry, 2015; Oswald, Chapman, & Wilson, 2017; Todd et al., 2019).

However, to date, our understanding of the associations between interoception and body image during adolescence remains severely limited. This is important because evidence suggests that adolescence is a significant period for the development of both interoceptive processing and body image. For example, regarding interoception, findings from neuroimaging studies suggest that between 13 and 17 years of age, adolescents experience increased activity in regions associated with interoceptive processing, in comparison to pre-adolescents, young adults, and mature adults (Li, Zucker, Kragel, Covington, & LaBar, 2017; May, Stewart, Tapert & Paulus, 2014). Similarly, regarding body image, research suggests that there tend to be increases in negative body image between the ages of 12 and 17 –

for both girls and boys – with the sharpest increases occurring between the ages of 13 and 15 (Bucchianeri, Arikian, Eisenberg, & Neumark-Sztainer, 2013; Eisenberg, Neumark-Sztainer, & Paxton, 2006; Frisén, Lunde, & Berg, 2015). In the context of these findings, it is therefore necessary to explore associations between interoception and body image during adolescence, because results with adult populations may not generalise to younger age groups.

In particular, there are three areas that the available adolescent literature does not adequately address. First, research has exclusively focused upon associations between facets of interoception and negative body image (Emanuelsen et al., 2014) and associations with psychopathology (e.g., Dakanalis et al., 2014; Killen et al., 1996; Leon, Fulkerson, Perry, & Early-Zald, 1995; Sim & Zemanm, 2004), while associations with facets of positive body image remain unexplored. In adult samples, research indicates that the associations between interoceptive awareness and positive body image tend to be of greater magnitude than associations between interoceptive awareness and negative body image (Todd et al., 2019). This could be due to the relatively greater focus on exteroceptive appearance within the construct of negative body image, in contrast to the preferential focus upon physiological factors, such as body functionality, strengths, and health within the construct of positive body image (Avalos, Tylka & Wood-Barcalow, 2005; Tiggemann & McCourt, 2013; Tylka & Wood-Barcalow, 2015; Wood-Barcalow et al., 2010). Such a distinction is important because further research could reveal novel intervention targets. Indeed, the benefits of body image therapies that aim to reduce symptoms of negative body image, without attempting to enhance aspects of positive body image, may be limited (Tylka, 2018; Tylka & Piran, 2019; see also Guest et al., 2019).

Second, though evidence supports interoceptive awareness as a multifaceted construct (Mehling, 2016; Mehling et al., 2009, 2012), the majority of the adolescent literature has only considered the perceptual aspects of interoception (e.g., Emanuelsen et al., 2014), which do not distinguish between adaptive and maladaptive modes of attention towards interoceptive signals (Mehling et al., 2009; 2012). In adult samples, research has indicated that appraisals of interoceptive stimuli are more closely associated with facets of body image than the tendency to notice such cues (Brown et al., 2017; Oswald et al., 2017). For example, Todd and colleagues (2019) found that of the MAIA subscales, the facet of body trust had the strongest, and most consistent relationships with facets of body image. Regulatory aspects of interoceptive awareness (i.e., the MAIA Attention Regulation and Self-Regulation subscales) were also found to be positively associated with facets of positive body image. However, the tendency to notice interoceptive stimuli was found to negatively predict body appreciation and to positively predict overweight preoccupation and appearance orientation. Similarly, in a (94% female) sample of adults and adolescents diagnosed with eating disorders, Brown and colleagues (2017) found that body trust was inversely associated with scores on all subscales of the Eating Disorder Examination Questionnaire (Fairburn & Beglin, 1994), including the Shape Concern and Weight Concern subscales, but the tendency to notice interoceptive stimuli was not significantly associated with any of the subscales. However, it is not yet clear whether these findings will generalise to non-clinical adolescent boys and girls.

Finally, it has not been ascertained whether relationships between interoception and body image are consistent across gender during adolescence. The identification of gender differences in the associations between interoceptive awareness and body image could have important implications for the targeting of interventions. To date, the available literature is equivocal: the inverse association between interoception and negative body image has been found to be of greater magnitude for adolescent girls than boys in a Hungarian subsample, but there were no statistically significant gender differences in a Norwegian subsample (Emanuelsen et al., 2014). Furthermore, due to the dearth of research exploring interoception and positive body image during adolescence, it is not known whether gender is an important factor for the relationship between facets of interoceptive awareness and positive body image. Previous qualitative research has indicated that the positive comments that adolescent girls receive typically relate to appearance, while the comments that adolescent boys receive typically relate to body functionality (McCabe, Ricciardelli & Ridge, 2006; see also Holmqvist Gattario & Frisén, 2019). It is possible that this difference in exteroceptive inputs could promote differences in the extent to which interoceptive stimuli are relied upon for facets of positive body image, particularly the appreciation of body functionality.

**1.1.** **The Present Study**

In the present study, we sought to address the three aforementioned limitations of the available adolescent literature. To summarise, the primary aims were to: (1) explore associations between interoceptive awareness and positive body image; (2) expand the current body of literature – which suggests associations between perceptual facets of interoception and negative body image during adolescence – by considering further facets of interoceptive awareness, such as the appraisal and regulation of interoceptive stimuli, and; (3) explore whether the associations between facets of interoceptive awareness and body image are consistent across gender. To facilitate aim (1), we selected three variables to provide broad coverage of the positive body image construct (in accordance with best-practise guidelines; Webb, Wood-Barcalow, & Tylka, 2015): body appreciation, appreciation of body functionality, and body pride. To facilitate aim (2), we included measures of body shame and body surveillance (that is, the extent to which individuals monitor their appearance from an externalised perspective; McKinley & Hyde, 1996). The MAIA was selected to assess interoceptive awareness because, at the time that this study was designed, it was the only available measure that assessed the type and purpose of attention toward interoceptive stimuli, in addition to the tendency to notice interoceptive signals (Mehling, 2016; Mehling et al., 2009; 2012). To facilitate aim (3), we planned to conduct analyses separately for girls and boys, and compare the magnitude of associations gender.

In terms of hypotheses, at the broadest level we expected to identify positive associations between interoceptive awareness and positive body image, and negative associations between interoceptive awareness and body shame and body surveillance. As previously discussed, it is possible that the magnitude of the associations between interoceptive awareness and negative body image variables would be greater for girls (Emanuelsen et al., 2014). It was unclear whether there would be an effect of gender upon the associations between interoceptive awareness and positive body image. More specific hypothesis related to the univariate facets of interoceptive awareness. In line with previous research (Brown et al., 2017; Todd et al., 2019), we expected to identify differences in the magnitude of the relationships between the perceptual, cognitive, and behavioural elements of interoceptive awareness and the facets of body image under investigation. We hypothesised that the associations between body trust and the body image indices would be positive and strongest in magnitude. We also expected to identify positive associations between the Regulatory aspects of interoceptive awareness (i.e., the MAIA Attention Regulation and Self-Regulation subscales) and the positive body image variables. Finally, we expected to find that the tendency to notice interoceptive stimuli (as evidenced by scores on the MAIA Noticing subscale) would have the weakest associations with the body image variables and that the associations would possibly be of an inverse orientation (Todd et al., 2019).

**2. Method**

**2.1. Participants**

Participants were all students in year groups 9-11 at a secondary school in Cambridgeshire, in the United Kingdom. The sample (*N* = 277) consisted of 140 girls and 125 boys, and 12 people who described their gender as ‘other’. Due to the gender-specific nature of all further analyses, we only included participants who described themselves as ‘male’ or ‘female.’ The remaining (*n* = 265) participants were aged between 13 and 16 (*M* = 14.11, *SD* = 1.01), and the majority of participants self-reported their ethnicity as White (69.8%; Asian or British Asian = 13.7 %; Black, British Black, or African Caribbean = 6.1%; mixed or multiple ethnic groups = 5.0%; other = 5.4%).

**2.2. Measures**

**2.2.1. Interoception.** We assessed interoceptive awareness using the Multidimensional Assessment of Interoceptive Awareness (MAIA) questionnaire (Mehling et al., 2012), a 32-item self-report measure that comprises eight subscales. The MAIA provides a multidimensional profile of interoceptive processing, with each subscale assessing a different dimension of interoceptive awareness. The Noticing subscale (4 items) assesses the subjective awareness of body sensations (sample item: “I notice changes in my breathing, such as whether it speeds up or slows down”). The Attention Regulation subscale (7 items) assesses the ability to control and maintain attention towards bodily sensations (sample item: “I can pay attention to my breath without being distracted by things happening around me”). The Emotional Awareness subscale (5 items) assesses the awareness of the relationship between emotional and bodily states (sample item: “I notice how my body changes when I feel happy/joyful”). The Self-Regulation subscale (4 items) assesses whether a person uses attention to bodily sensations to regulate distress (sample item: “When I am caught up in thoughts, I can calm my mind by focusing on my body/breathing”). The Body Listening subscale (3 items) assesses how often a person actively attends to their bodily sensations for insight (sample item: “When I am upset, I take time to explore how my body feels”). The Trusting subscale (3 items) assesses the extent to which a person experiences their body as a ‘safe’ and ‘trustworthy’ source of information (sample item: “I trust my body sensations”). We did not include the Not Distracting and Not Worrying subscales because scores on these subscales consistently perform poorly in terms of internal consistency coefficients (Mehling, 2016). Responses for all items were given on a 6-point scale, ranging from *never* (0) to *always* (5). Scores for each subscale were computed as the mean of all associated items, and higher scores reflect greater interoceptive awareness. In adult samples, scores on the MAIA have adequate levels of internal consistency and good convergent and discriminant validity (Brown et al., 2017; Mehling et al., 2012). Because the MAIA has not been validated for use with adolescent samples, we conducted a pilot study (see Supplementary Materials) which confirmed the understanding and appropriateness of the items in an adolescent sample. Confirmatory factor analysis (CFA) also indicated that the 6-factor structure had adequate fit in the present study following modifications (see Supplementary Materials). Throughout the present work, we estimated internal consistency using omega (ω), which performs more favourably than Cronbach’s alpha (Dunn, Baguley, & Brunsden, 2014). Omega for scores on each MAIA subscale were as follows: Noticing = .79 (95% CI = .74, .83); Attention regulation = .91 (95% CI = .87, .92); Emotional Awareness = .82 (95% CI = .76, .85); Self-Regulation = .89 (95% CI = .86, .92); Body Listening = .84 (95% CI = .79, .88); Trusting = 91 (95% CI = .88, .93).

**2.2.2. Body appreciation**. Body appreciation was assessed using the Body Appreciation Scale-2 for children (BAS-2C; Halliwell, Jarman, Tylka, & Slater, 2017). The BAS-2C comprises 10 items that assesses body-related positive opinions and acceptance (regardless of actual physical appearance), respect for the body by engaging in healthy behaviours, and protection of body image when exposed to appearance-based media (sample item: “I feel good about my body”). All items were rated on a 5-point scale, ranging from 1 (*never*) to 5 (*always*) and an overall score was computed as the mean of all items. Higher scores on this scale reflect greater body appreciation. Scores on the BAS-2C have a one-dimensional structure in children and adolescents, are invariant across gender, and have adequate internal consistency and test-retest reliability over a 6-week period, and good patterns of construct, criterion-related, and incremental validity (Halliwell et al., 2017). In the present work, ω for scores on this scale was .94 (95% CI = .93, .95).

**2.2.3. Functionality appreciation.** Functionality appreciation was assessed using the Functionality Appreciation Scale (FAS; Alleva, Tylka & Kroon van Diest, 2017). The FAS is a 7-item scale that assesses the extent to which an individual appreciates and respects the body for the functions it is capable of performing (sample item: “I respect my body for the functions that it performs”). Items were rated on a 5-point scale ranging from 1 (*strongly disagree*) to 5 (*strongly agree*), and an overall score was computed as the mean of all items, with higher scores reflecting greater functionality appreciation. In adult samples, scores on the FAS have a one-dimensional structure, are invariant across gender, have adequate internal consistency and test-retest reliability over a 3-week period, and good convergent, discriminant, and incremental validity (Alleva et al., 2017). In a pilot study (see Supplementary Materials), the understanding and appropriateness of the items was confirmed with an adolescent sample. CFA indicated that the one-dimensional factor structure had adequate fit in the present data following modifications (see Supplementary Materials). In the present study, ω for scores on this scale was .89 (95% CI = .86, .91).

**2.2.4. Body pride**. Body pride was assessed using the Authentic Pride subscale of the Body and Appearance Self-Conscious Emotions Scale (BASES-AP; Castonguay, Sabiston, Crocker, & Mack, 2014). This is a 6-item measure that characterises body pride as personal appearance-related achievements and behaviours (sample item: “I am proud of my appearance efforts”). Items for this subscale were rated on a 5-point scale, ranging from 1 (*never*) to 5 (*always*). The scale is scored by calculating the mean of all 6 items, and higher scores reflect greater body pride. In an adult sample, Castonguay et al. (2014) reported that BASES scores had good factorial validity and that subscale scores had good test-retest reliability over a 2-week period, and good construct validity. A pilot study (see Supplementary Materials), confirmed the understanding and appropriateness of the items with an adolescent sample, and CFA indicated that the one-dimensional factor structure had an adequate fit in the present work following modifications. In the present work, ω for scores on this subscale was .94 (95% CI = .92, .95).

**2.2.5. Additional body image measures.** Two subscales from the Objectified Body Consciousness-Youth Scale (OBC-Youth; Lindberg, Hyde, & McKinley, 2006) were used to assess body shame and body surveillance, respectively. The Body Shame subscale (5 items) assesses the degree to which individuals feel shame when their body does not conform to cultural ideals (sample item: “When I am not the size I think I should be, I feel ashamed”). The Body Surveillance subscale (4 items) assesses the degree to which individuals adopt an externalised (outsider’s) perspective to monitor their appearance (sample item: “I often worry about how I look to other people”). Participants rated their agreement with each item on a 7-point scale, ranging from 1 (*strongly disagree*) to 7 (*strongly agree*) or indicated that the item did not apply to them. Higher scores indicate greater body shame or body surveillance. Scores on these subscales have demonstrated adequate internal consistency, test-rest reliability over a 2-week period, and construct validity in groups of adolescent girls and boys (Lindberg et al., 2006; Slater & Tiggemann, 2011). In the present work, ω for scores on the body shame and body surveillance subscales were .91 (95% CI = .88, .93) and .91 (95% CI = .88, .93), respectively.

**2.2.6. Demographics.** Participants were asked to provide demographic details consisting of gender, age, ethnicity (based on ethnicity categories in the United Kingdom census), height, and weight. We used the final two items to compute self-reported body mass index (BMI) as kg/m2.

**2.3. Procedures**

Permission was sought from the head teacher of a secondary school in Cambridgeshire and the study was approved by the relevant university ethics committee (approval number: FST/FREP/17/742). Both parents and students received a study information sheet and a consent form to read and to sign. The study took place under controlled conditions during lessons within the school day. Students responded to the questionnaire using computers. All participants volunteered their time and were not offered remuneration. Teachers provided an appropriate alternative activity for pupils who had not consented. At the start of the survey, all participants were presented with a written summary of the information sheet and were asked to provide additional digital informed consent before completing the survey. Participants completed the measures described above in an anonymous form, which was presented in randomised order. The questionnaire was completed in 14 minutes on average. All participants received written debriefing information at the end of the survey and this information was also sent home to parents following the study.

**3. Results**

**3.1. Data Screening**

A substantial proportion of the data for self-reported BMI was missing (43.5%; 45.7% for girls and 38.4% for boys). We therefore elected to exclude this variable from analyses. For the remaining variables, missing data (< 3.0% of the total dataset) were missing completely at random, as determined by Little’s (1988) Missing Completely at Random test, χ22(3579) = 3557.43, *p* = .598. Therefore, we replaced missing values using the multiple imputation technique, using the MICE package (van Buuren, 2018) in *R* (*R* development Core Team, 2014). Further data screening did not reveal any unduly influential univariate or multivariate outliers.

**3.2. Descriptive Statistics**

Means and standard deviations for all variables are reported in Table 1. We controlled for false discovery rate (FDR) through use of the Benjamini-Hochberg (1995) procedure, which was computed using the Stats package in *R*. As can be seen in Table 1, statistically significant gender differences after FDR correction were identified for body appreciation (boys reported significantly greater body appreciation), body surveillance (girls reported a significantly greater tendency to monitor their appearance), and body shame (girls reported significantly greater levels of body shame).

**3.3. Bivariate Correlations**

Bivariate correlations between all variables were computed separately for boys and girls. Adjusted thresholds for rejecting the null hypothesis were also computed separately. The full results are reported in Table 1.

**3.3.1. Boys.** Each of the MAIA subscales tended to have small (≥ .20), positive associations with the body image variables. A notable exception to this was body pride, which was moderately (≥ .50) associated with the MAIA Attention Regulation, Self-regulation, and Body Listening subscales. Regarding age, there was a small, positive association with body surveillance; associations with all other variables were < .20.

**3.3.2. Girls.** There tended to be small, positive associations between the MAIA subscales and the positive body image variables, and negative associations with the negative body image variables. The MAIA Trusting subscale exceeded this, with moderate associations with body appreciation and functionality appreciation. All of the associations between the MAIA subscales and the negative body image variables were >.20, except the association between body shame and the MAIA Trusting subscale, which approached a moderate effect size. Regarding age, associations with all variables were < .20 and the association with body shame (*r* = -.19) was the only incidence of statistical significance.

**3.3.3. Gender differences.** Fisher’s *r* to *z* transformation was computed to examine differences in the pattern of the correlation coefficients across gender. The full results are reported in Supplementary Table 1. Of note, the associations between the MAIA subscales and body pride, body surveillance, and body shame were significantly different, with the correlations generally tending to be of greater magnitude for boys.

**3.4. Multiple Regression Analyses**

Multiple regression analyses were conducted separately for boys and girls. Five pairs of regressions were conducted: the body image variables were entered as criterion variables, and the MAIA variables were entered simultaneously as predictor variables. Correlational analyses (see Table 1) indicated that it was not necessary to control for age. Variance inflation factors were ≤ 2.84 for all regressions, indicating that multicollinearity was not a limiting issue (Hair, Anderson, Tatham, & Black, 1995).

**3.4.1. Boys.** The results for body appreciation, functionality appreciation, and body pride are reported in Table 2. As can be seen, the MAIA variables accounted for 29.3% of the variance for body appreciation, 21.4% of the variance for functionality appreciation, and 38.9% of the variance for body pride. The results for body surveillance and body shame are reported in Table 3. The MAIA variables accounted for 6.5% of the variance for body surveillance, and 7.2% of the variance for body shame. At the univariate level, the MAIA Self-Regulation, Attention Regulation, Body Listening, and Trusting subscales all emerged as a significant predictor for at least one of the body image variables, while the Noticing and Emotional Awareness scales did not. In the case of body surveillance, none of the MAIA subscales were significant univariate predictors.

**3.4.1. Girls.** The results for body appreciation, functionality appreciation, and body pride are reported in Table 4. The MAIA variables accounted for 25.9% of the variance for body appreciation, 32.5% of the variance for functionality appreciation, and 14.5% of the variance for body pride. The results for body surveillance and body shame are reported in Table 5. The MAIA variables accounted for 22.0% of the variance for body shame. For body surveillance, the MAIA variables accounted for 0.7% of the variance and the regression was not significant (*p* = .324). At the univariate level, the MAIA Trusting and Self-Regulation subscales emerged as significant positive predictors for facets of positive body image and there was also a significant inverse association between the Trusting subscale and body shame. Conversely, the MAIA Body Listening subscale emerged as a significant negative predictor for functionality appreciation, and a significant positive predictor for body shame.

**4. Discussion**

In the present study, we assessed relationships between multiple facets of interoceptive awareness and body image in a sample of British adolescent girls and boys. Overall, we identified significant relationships between interoceptive awareness and body appreciation, functionality appreciation, body pride, and body shame, for both girls and boys. However, regression analyses indicated that the MAIA variables were not significantly associated with body surveillance for girls and, while a statistically significant regression was observed for boys, none of the MAIA subscales emerged as significant univariate predictors.

**4.1. Interoceptive Awareness and Positive Body Image**

Regarding the positive body image variables, our results complement and extend previous findings of associations between interoceptive awareness and positive body image in adults (Daubenmier, 2005; Oswald et al., 2017; Todd et al., 2019) by demonstrating that these relationships are also present during adolescence. As an additional extension of the available literature, we observed notable gender differences in the patterns of association. Specifically, for body pride, the MAIA variables accounted for 38.9% of the variance in boys, but a more modest 14.5% for girls. Conversely, for functionality appreciation, the MAIA variables accounted for 32.5% of the variance for girls, but only 21.4% for boys. These findings suggest that interoceptive awareness might be more relevant to the development of body pride for adolescent boys and more relevant to the development of functionality appreciation for adolescent girls. One possible explanation for these findings relates to the aforementioned antagonism in the processing of interoceptive and exteroceptive cues (attention toward one may reduce the resources available for the other, with attention directed according to the precision of the stimuli; Ainley et al., 2016; Badoud & Tsakiris, 2017). In terms of exteroceptive inputs, there appears to be a gender-specific focus upon appearance versus body functionality in the sociocultural messages that adolescent girls and boys receive: the positive comments that adolescent girls receive typically relate to appearance, while the comments that adolescent boys receive typically relate to body functionality (Gattario Holmqvist & Frisén, 2019; McCabe et al., 2006). Therefore, it is possible that the relatively greater contribution of exteroceptive stimuli regarding appearance renders interoceptive stimuli less salient or reliable for the development of body pride in adolescent girls. Similarly, for boys, it could be that the relatively greater contribution of exteroceptive stimuli regarding body functionality renders interoceptive stimuli less salient or reliable for the development of functionality appreciation.

However, while these findings point toward gender-specific associations between interoceptive awareness and particular facets of positive body image, it is also important to note that the inter-correlations between the positive body image variables were high, particularly for girls. Specifically, the direct correlations between body appreciation and appreciation body functionality (*r* = .68), and body appreciation and body pride (*r* = .70), indicate that these facets of positive body image may not be distinct for adolescent girls (Newman, Joseph, & Hulin, 2010). For boys, however, the inter-correlations between the positive body image variables were all lower in magnitude (< .62), indicating a greater degree of distinction. We therefore echo the calls of previous researchers (e.g., Swami, Weis, Barron, & Furnham, 2018) for a thorough examination of the degree to which facets of positive body image share the same conceptual space.

**4.2. Interoceptive Attention and Negative Body Image**

Regarding body shame, we identified significant associations with the MAIA for both girls and boys. This is consistent with the finding of an association between interoception and body dissatisfaction in a previous adolescent study (Emanuelsen et al., 2014). In the same study, Emanuelsen and colleagues (2014) also presented conflicting evidence for gender differences in the magnitude of the association between interoception and body dissatisfaction: the association was found to be of greater magnitude for adolescent girls than boys in a Hungarian subsample, but there were no statistically significant gender differences for a Norwegian subsample. The results from the present study support the hypothesis that facets of interoception explain a greater proportion of the variance for negative body image in girls. Specifically, the MAIA variables accounted for 22% of the variance for girls, but only 7.2 % of the variance for boys. Together, these findings indicate that bodily awareness-based interventions to reduce facets of negative body image, such as body shame, might be more relevant for adolescent girls than adolescent boys. Indeed, consistent with previous research (Knauss, Paxton, & Alsaker, 2008), we found that levels of body shame were significantly higher for adolescent girls in comparison to adolescent boys.

Regarding body surveillance, we found that the MAIA variables were not associated in any statistically meaningful way for girls (Ferguson, 2009) and were only weakly associated for boys. As previously discussed, current theorising posits that, in the absence of accurate interoceptive percept, bodily awareness may be predominantly based upon exteroceptive (i.e., visual) cues (Tajadura-Jimenez & Tsakiris, 2014; Tsakiris et al., 2011), which may encourage a greater focus upon the visual aspects of the body (Badoud & Tsakiris, 2017). Against this context, it is surprising that body surveillance – the extent to which individuals monitor their appearance from an externalised (i.e., third person) perspective – was not found to be significantly associated with interoceptive awareness in the present sample. One possible explanation for this finding is that the component of interoception under investigation does not reflect the *precision* of interoceptive signalling (Murphy et al., 2019). Indeed, in adult samples, an inverse association between interoception and the tendency to adopt an externalised perspective has been evidenced when the accuracy of interoceptive percept is assessed (Ainley & Tsakiris, 2013), but not when interoceptive awareness is assessed (Tiggemann & Kuring, 2004; Tiggemann & Slater, 2001). We therefore recommend that future adolescent research should examine the association between body surveillance and interoceptive accuracy.

**4.3. Univariate Associations between Interoceptive Awareness and Body Image**

Further gender differences were observed in the univariate relationships between the MAIA subscales and the body image variables. For adolescent girls, the MAIA Trusting subscale emerged as the strongest, and most consistent predictor variable, which is consistent with findings from British adults (Todd et al., 2019). However, for adolescent boys, it appears that the ‘regulatory’ aspects of interoceptive awareness (i.e., the Self-Regulation, Attention Regulation, and Body Listening subscales) are the most relevant to body image. Nevertheless, the overall shape of the results complements findings from adult research, which have indicated that the appraisal and regulation of interoceptive signals tend to be more closely associated with facets of body image than the tendency to notice interoceptive stimuli (Brown et al., 2017; Daubenmier, 2005; Oswald et al., 2017; Todd et al., 2019). Indeed, in the present study, the Noticing subscale did not emerge as a statistically significant univariate predictor within any of the regression analyses.

Given the consistent associations between body trust and facets of body image for both adolescent girls and adults (Todd et al., 2019), further examination of these results is warranted. In particular, an important limitation may be the degree to which body trust is truly distinct from facets of positive body image, such as body appreciation. Construct overlap can be demonstrated through strong direct correlations (i.e., *r* > .70; Newman et al., 2010). In the present study, the MAIA Trusting subscale was only moderately correlated with BAS and FAS scores for girls (*r* = .53 and .51, respectively). For boys the correlations were smaller (*r* = .44 and .39, respectively). Therefore, our analysis suggests that there is a small degree of overlap, but that body trust and positive body image are distinct constructs, particularly for adolescent boys. However, in adult samples, the direct correlations between body trust and body appreciation have been found to be greater in magnitude (*r* = .70 for women, and .69 for men; Todd et al., 2019). Given the cross-sectional nature of both studies, it is not possible at present to ascertain why body trust appears to become less distinct from body appreciation over time. In the absence of further data, it could be concluded that the MAIA Trusting subscale is related, but nonetheless distinct from to positive body image in adolescents, but that it is conceptually intertwined with body appreciation in adults. Future research should seek to fully explore the extent to which body trust is distinct from positive body image – particularly for adults – through methods such as cluster analysis or latent semantic analysis.

Additional univariate relationships that warrant further consideration relate to the MAIA Body Listening subscale, which emerged as significant positive predictor of body shame for both genders, and a significant negative predictor of functionality appreciation for girls within the regression models. These results would appear to suggest that the tendency to ‘listen to’ interoceptive signals for insight is maladaptive during adolescence, when considered in relation to body image. An alternative possibility is that one of the other variables may have biased the regression slopes (see Fuller, 1987). While the direct correlations between body shame and body listening were positive, they were also below the recommended thresholds for statistically meaningful correlation in social sciences (Ferguson, 2009). Furthermore, with regards to the functionality appreciation result, the correlation between body listening and functionality appreciation was also weak, and, in contrast to the regression result, the correlation was *positive*. Therefore, a possible interpretation is that the univariate results for the Body Listening subscale have been affected by regression dilution (Fuller, 1987). Indeed, although VIFs were all within acceptable limits, the correlation between the MAIA Body Listening and the Self-Regulation subscales was high for girls, indicating conceptual overlap in this subsample (Newman et al., 2010).

**4.4. Additional Limitations and Future Directions**

The large proportion of missing data for self-reported BMI is an important limitation of the present work. This appears to be a common issue with adolescent samples (for a review, see Sherry, Jefferds, & Grummer-Strawn, 2007). Given that BMI has been consistently associated with facets of interoception (e.g., Herbert et al., 2013; Herbert & Pollatos, 2014) and body image (e.g., Paxton et al, 2006; Tylka & Wood-Barcalow, 2015), it is plausible that BMI accounts for some of the variance that has been attributed to the MAIA variables within the present study, and future work should seek to address this issue. Future work should also seek to explore whether the relationships identified in the present work are robust across other facets of interoception (Garfinkel, Seth, Barrett, Suzuki, & Critchley, 2015; Khalsa et al., 2018; Murphy et al., 2019), and whether they are stable longitudinally. Indeed, as previously discussed, due to the cross-sectional nature of the present work and similar research with adult samples (Todd et al., 2019), it is not possible at present to ascertain when or why relationships between facets of interoceptive awareness and body image may change between adolescence and adulthood. In a similar vein, the data in the present study were gathered from adolescents at a single school in the United Kingdom and, as such, it will be important to determine to what extent the present findings are stable both nationally and in other social identity and cultural groups.

**4.5. Conclusion**

In summary, the present work identified associations between interoceptive awareness and four facets of body image in an adolescent sample. Consistent with previous research (Daubenmier, 2005; Oswald et al., 2017; Todd et al., 2019), we observed that appraisals of interoceptive stimuli, and the regulation of attention toward interoceptive stimuli, appear to be more closely associated with body image than the tendency to notice interoceptive stimuli in a previously unexplored developmental period. As a further extension of previous literature, we also identified complex associations between facets of interoceptive awareness and body image that appear to be gender-specific. Considered altogether, there is a growing body of evidence to suggest that mindful attention toward interoceptive signals could promote positive body image. The present work also indicates that potential interventions may need to be targeted according to developmental stage (adolescence or adulthood) and gender. However, it is also important to note that, due to the cross-sectional design of the present (and previous) work, a causal relationship between interoceptive awareness and body image can only be inferred hypothetically at present. It is also possible, for example, that processes between the variables are bi-directional (Cook-Cottone, 2018). In particular, whilst longitudinal research supports the assertion that early impairments in interoceptive awareness are associated with later vulnerability to the development of eating disorders (Killen et al., 1996; Leon et al., 1995; Lilenfeld et al., 2006), no such studies have explored positive body image.

**Footnotes**

1Note that, researchers have yet to reach a consensus about the nomenclature for different components of interoception (e.g., Garfinkel et al., 2015; Mehling, 2016; Murphy et al., 2019; Khalsa et al., 2018). In the present work, we use the term interoceptive awareness, which is consistent with the Multidimensional Assessment of Interoceptive Awareness (Mehling et al., 2012). However, other researchers have used the term *interoceptive sensibility* to refer to self-reported detections of interoceptive stimuli, and have used *interoceptive awareness* to refer to the ‘meta-cognitive’ correspondence between behavioural and self-report measures of interoception (Garfinkel et al., 2015).

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Table 1. *Means, Standard Deviations, and Bivariate Correlations between All Variables for Girls (Upper Diagonal) and Boys (Lower Diagonal).*

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) | (12) |
| (1) Noticing |  | .58\*\* | .45\*\* | .46\*\* | .42\*\* | .26\* | .16 | .18\* | .19\* | .02 | .04 | .08 |
| (2) Attention Regulation | .66\*\* |  | .54\*\* | .68\*\* | .64\*\* | .41\*\* | .26\* | .34\*\* | .32\*\* | -.04 | -.02 | -.08 |
| (3) Emotional Awareness | .66\*\* | .67\*\* |  | .58\*\* | .50\*\* | .32\*\* | .24\* | .33\*\* | .24\* | .09 | .03 | .08 |
| (4) Self-Regulation | .48\*\* | .57\*\* | .64\*\* |  | .72\*\* | .51\*\* | .34\*\* | .41\*\* | .35\*\* | -.04 | -.10 | -.03 |
| (5) Body Listening | .40\*\* | .60\*\* | .54\*\* | .64\*\* |  | .46\*\* | .23\* | .20\* | .29\*\* | -.07 | .03 | .04 |
| (6) Trusting | .30\* | .55\*\* | .37\*\* | .39\*\* | .50\*\* |  | .53\*\* | .51\*\* | .37\*\* | -.16 | -.42\*\* | .11 |
| (7) Body Appreciation | .33\*\* | .44\*\* | .35\*\* | .49\*\* | .41\*\* | .44\*\* |  | .68\*\* | .71\*\* | -.38\*\* | -.47\*\* | -.01 |
| (8) Functionality Appreciation | .26\* | .45\*\* | .29\* | .36\*\* | .36\*\* | .39\*\* | .52\*\* |  | .59\*\* | -.15 | -.34\*\* | .03 |
| (9) Body Pride | .44\*\* | .52\*\* | .44\* | .59\*\* | .50\*\* | .38\*\* | .62\*\* | .50\*\* |  | -.21\* | -.33\*\* | .03 |
| (10) Body Surveillance | .29\* | .30\* | .27\* | .25\* | .20\* | .17 | .04 | .17 | .34\*\* |  | .53\*\* | .10 |
| (11) Body Shame | .17 | .13 | .15 | .23\* | .28\* | <.01 | -.08 | -.03 | .14 | .45\*\* |  | -.19\* |
| (12) Age | -.04 | -.10 | -.05 | -.02 | -.07 | -.05 | -.02 | -.05 | .09 | .20\* | .13 |  |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| *M* (Boys) | 3.16 | 3.16 | 3.31 | 2.97 | 2.69 | 3.41 | 3.87 | 4.12 | 3.50 | 4.10 | 3.10 | 13.80 |
| *SD* (Boys) | 1.09 | 1.02 | 1.04 | 1.09 | 1.06 | 1.19 | 0.75 | 0.63 | 0.99 | 1.48 | 1.36 | 0.86 |
| *M* (Girls) | 3.20 | 2.98 | 3.26 | 2.84 | 2.43 | 3.06 | 3.40 | 3.92 | 3.22 | 5.45 | 4.06 | 14.16 |
| *SD* (Girls) | 0.77 | .81 | 0.83 | 1.00 | 1.00 | 1.08 | 0.89 | .70 | 0.97 | 1.21 | 1.48 | 1.07 |
| *t* | †0.37 | †1.55 | †0.45 | 1.03 | 2.07 | 2.54 | †4.64 | 2.46 | 2.35 | 8.38 | 5.51 | †3.07 |
| *p-FDR* | .713 | .163 | .712 | .367 | .060 | .028 | <.001 | .028 | .034 | <.001 | <.001 | .006 |
| *d* | 0.04 | 0.20 | 0.05 | 0.12 | 0.25 | 0.31 | 0.57 | 0.30 | 0.29 | 1.00 | 0.68 | 0.37 |

*Notes.* Boys *n* = 125, Girls *n* = 140. \**p-*FDR *<.*05, \*\* *p-*FDR<.001, where FDR = False Discovery Rate. †Denotes that Levene’s test was significant and, therefore, Welch’s *t* value was utilised.

Table 2. *Multiple Regressions for Boys, with Body Appreciation, Functionality Appreciation, and Body Pride as Criterion Variables.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Body Appreciation | | | | | Functionality Appreciation | | | | | Body Pride | | | | |
| MAIA Variable | B | SE |  | *t* | *p* | B | SE |  | *t* | *p* | B | SE |  | *t* | *p* |
| Noticing | .044 | .077 | .064 | 0.57 | .569 | -.025 | .065 | -.046 | -0.39 | .697 | .132 | .094 | .145 | 1.40 | .165 |
| Attention Regulation | .089 | .092 | .123 | 0.97 | .333 | .195 | .078 | .331 | 2.49 | .014 | .152 | .113 | .157 | 1.34 | .183 |
| Emotional Awareness | -.080 | .088 | -.111 | -0.91 | .367 | -.050 | .075 | -.086 | -0.67 | .505 | -.111 | .108 | -.116 | -1.02 | .308 |
| Self-Regulation | .241 | .077 | .351 | 3.15 | .002 | .090 | .065 | .163 | 1.39 | .168 | .369 | .094 | .406 | 3.91 | <.001 |
| Body Listening | .021 | .077 | .029 | 0.27 | .791 | .017 | .066 | .029 | 0.26 | .799 | .105 | .095 | .113 | 1.11 | .271 |
| Trusting | .151 | .059 | .240 | 2.55 | .012 | .090 | .050 | .178 | 1.79 | .076 | .062 | .073 | .074 | 0.85 | .397 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Adj. *R2* | .293 |  |  |  | <.001 | .214 |  |  |  | <.001 | .389 |  |  |  | <.001 |
| *F* (*df*) | 9.55 (6) | |  |  |  | 6.63 (6) | |  |  |  | 14.14 (6) | |  |  |  |

*Notes. n* = 125. MAIA = Multidimensional Assessment of Interoceptive Awareness.

Table 3. *Multiple Regressions for Boys, with Body Shame and Body Surveillance as Criterion Variables.*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Body surveillance | | | | | Body Shame | | | | |
| MAIA Variable | B | SE |  | *t* | *p* | B | SE |  | *t* | *p* |
| Noticing | .190 | .169 | .144 | 1.12 | .265 | .170 | .160 | .136 | 1.06 | .291 |
| Attention Regulation | .195 | .204 | .139 | 0.96 | .341 | -.098 | .193 | -.074 | -0.51 | .611 |
| Emotional Awareness | .025 | .195 | .018 | 0.13 | .899 | -.094 | .184 | -.072 | -0.51 | .609 |
| Self-Regulation | .120 | .170 | .091 | 0.71 | .482 | .143 | .160 | .114 | 0.89 | .375 |
| Body Listening | -.017 | .171 | -.012 | -0.10 | .922 | .413 | .162 | .321 | 2.56 | .012 |
| Trusting | .017 | .131 | .014 | 0.13 | .895 | -.203 | .124 | -.176 | -1.64 | .104 |
|  |  |  |  |  |  |  |  |  |  |  |
| Adj. *R2* | .065 |  |  |  | .029 | .072 |  |  |  | .021 |
| *F* (*df*) | 2.45 (6) |  |  |  |  | 2.61 (6) |  |  |  |  |

*Notes. n* = 125. MAIA = Multidimensional Assessment of Interoceptive Awareness.

Table 4. *Multiple Regressions for Girls, with Body Appreciation, Functionality Appreciation, and Body Pride as Criterion Variables.*

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | Body Appreciation | | | | | Functionality Appreciation | | | | | Body Pride | | | | |
| MAIA Variable | B | SE |  | *t* | *p* | B | SE |  | *t* | *p* | B | SE |  | *t* | *p* |
| Noticing | -.030 | .105 | -.026 | -0.29 | .773 | -.067 | .079 | -.074 | -0.85 | .397 | -.016 | .124 | -.013 | -0.13 | .896 |
| Attention Regulation | .038 | .125 | .034 | .30 | .765 | .145 | .095 | .166 | 1.53 | .129 | .149 | .148 | .123 | 1.01 | .316 |
| Emotional Awareness | .071 | .100 | .066 | 0.71 | .481 | .125 | .076 | .148 | 1.65 | .101 | .022 | .118 | .019 | 0.19 | .851 |
| Self-Regulation | .115 | .109 | .129 | 1.05 | .297 | .185 | .083 | .262 | 2.23 | .027 | .138 | .129 | .141 | 1.07 | .288 |
| Body Listening | -.110 | .098 | -.124 | -1.12 | .265 | -.236 | .074 | -.337 | -3.17 | .002 | -.007 | .116 | -.007 | -0.06 | .953 |
| Trusting | .401 | .071 | .487 | 5.66 | <.001 | .283 | .054 | .434 | 5.28 | <.001 | .225 | .083 | .250 | 2.70 | .008 |
|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| Adj. *R2* | .259 |  |  |  | <.001 | .325 |  |  |  | <.001 | .145 |  |  |  | <.001 |
| *F* (*df*) | 9.11 (6) | |  |  |  | 12.13 (6) | |  |  |  | 4.92 (6) | |  |  |  |

*Notes. n* = 140. MAIA = Multidimensional Assessment of Interoceptive Awareness*.*

Table 5. *Multiple Regressions for Girls, with Body Shame and Body Surveillance as Criterion Variables.*

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| MAIA | Surveillance | | | | | Body Shame | | | | |
| Variable | B | SE |  | *t* | *p* | B | SE |  | *t* | *p* |
| Noticing | .053 | .163 | .035 | 0.33 | .744 | .144 | .179 | .076 | 0.81 | .421 |
| Attention Regulation | -.071 | .195 | -.048 | -0.37 | .715 | .006 | .214 | .003 | 0.03 | .979 |
| Emotional Awareness | .262 | .156 | .183 | 1.68 | .095 | .169 | .171 | .095 | 0.99 | .324 |
| Self-Regulation | .012 | .170 | .010 | 0.07 | .946 | -.163 | .187 | -.110 | -0.87 | .385 |
| Body Listening | -.090 | .153 | -.075 | -0.59 | .559 | .410 | .168 | .279 | 2.44 | .016 |
| Trusting | .192 | .110 | -.174 | 1.75 | .083 | -.741 | .121 | -.542 | -6.14 | <.001 |
|  |  |  |  |  |  |  |  |  |  |  |
| Adj. *R2* | .007 |  |  |  | .324 | .220 |  |  |  | <.001 |
| *F* (*df*) | 1.17 (6) |  |  |  |  | 7.52 (6) |  |  |  |  |

*Notes. n* = 140. MAIA = Multidimensional Assessment of Interoceptive Awareness*.*

**Supplementary Materials**

**Supplementary Methods: Pilot Study**

The MAIA, FAS, and BASES-AP had not been validated for use with adolescents. We therefore recruited 24 participants (14 girls and 10 boys) aged 13-16 (*M* = 14.33 ± 1.13) for a pilot study to assess the understanding and appropriateness of each measure with this younger cohort. This is the recommended sample size for pilot studies exploring conceptual, item, and semantic equivalence (Beaton et al., 2000) and is a much larger sample than those used for similar pilot studies (e.g., Halliwell et al., 2017).

Participants completed a paper-and-pencil questionnaire in which they were asked to consider each item from the measures mentioned above, and respond to the following open-ended questions (adapted from Halliwell et al., 2017): “Does this statement make sense to you?”; “Do you think this statement would make sense to other adolescents your age?”; “Could you respond to this statement on the [appropriate response scale for each instrument, e.g., the ‘strongly disagree’ to ‘strongly agree’ scale]?”; and “Do you think we need to make any changes to this statement?” The majority of participants (20/24) responded positively to all items, across all three measures. For the remaining participants, negative responses were logged for items within the MAIA only, but no item attracted more than two negative responses. Therefore, we made no adjustments to the wording of the items or response scale.

**Supplementary Results: CFA Analyses**

CFA analyses were conducted for the MAIA, the FAS, and the BASES-AP data to assess whether the factor structures from the parent models were an appropriate fit for the present sample. For all three scales, the data were neither univariate (Sharipo-Wilks, *p* < .001) nor multivariate normal (MAIA: Mardia’s skewness = 7843.784, *p* < .001, Mardia’s kurtosis = 57.905*, p* < .001; FAS: Mardia’s skewness = 683.142, *p* < .001, Mardia’s kurtosis = 30.67*, p* < .001; BASES-AP: Mardia’s skewness = 282.800, *p* < .001, Mardia’s kurtosis = 20.883*, p* < .001). Therefore, parameter estimates were obtained using the robust maximum likelihood method with the Satorra-Bentler correction (Satorra & Bentler, 2001).

For the MAIA, fit indices for a 6-factor structure were as follows: SBχ²(284) = 574.886, SBχ²normed = 2.02, robust RMSEA = .075 (90% CI = .066-.084), SRMR = .061, robust CFI = .901, robust TLI = .887, BL89 = .876. As fit indices were less than ideal, suggested modification indices were consulted to improve model fit, with modifications being based on correlations among like items from the same factor. Error covariances were freed for Items 3 and 4 of the Self-Regulation subscale (MI = 69.782; Likelihood ratio: χ2(1) = 64.356, *p* < .001), and Items 4 and 5 of the Emotional Awareness subscale (MI = 49.432; Likelihood ratio: χ(1) = 43.552, *p* < .001). In the final modified model, fit indices were acceptable, SBχ²(282) = 494.472, SBχ²normed = 1.75, robust RMSEA = .064 (90% CI = .55-.074), SRMR = .058, robust CFI = .916, robust TLI = .916, BL89 = .900.

For the FAS, fit indices for a unidimensional structure were as follows: SBχ²(14) = 28.935, SBχ²normed = 2.07, robust RMSEA = .86 (90% CI = .040-.130), SRMR = .047, robust CFI = .960, robust TLI = .940, BL89 = .945. Since fit indices were less than adequate, modification indices were consulted to free error covariances. Error covariances were freed for Items 2 and 3 (MI = 26.845; Likelihood ratio: χ2(1) = 20.586, *p* <.001). In the final modified model, fit indices were good, SBχ²(13) = 19.410, SBχ²normed = 1.49, robust RMSEA = .056 (90% CI = .001-.104), SRMR = .036, robust CFI = .984, robust TLI = .975, BL89 = .973. Finally, for the BASES-AP, fit indices for a unidimensional structure were good, SBχ²(9) = 18.047, SBχ²normed = 2.01, robust RMSEA = .083 (90% CI = .022-.139), SRMR = .028, robust CFI = .986, robust TLI = .977, BL89 = .980.

Supplementary Table 1. *Fischer’s zobserved Values and Associated p-values for Gender Comparisons of the Correlation Coefficients.*

|  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) | (9) | (10) | (11) |
| (1) MAIA Noticing |  | 1.06  .289 | 2.71  .007 | 0.3  .764 | -0.16  .873 | 0.33  .741 | 1.42  .156 | 0.64  .522 | 2.17  .03 | 2.28  .023 | 1.03  .303 |
| (2) MAIA Attention Regulation |  |  | 1.69  .091 | -1.36  .174 | -0.56  .576 | 1.76  .078 | 1.62  .105 | 1.03  .303 | 1.91  .056 | 2.77  .006 | 1.21  .226 |
| (3) MAIA Emotional Awareness |  |  |  | 0.83  .407 | 0.47  .638 | .48  .631 | 0.92  .358 | -0.33  .741 | 1.81  .070 | 1.5  .134 | 0.97  .332 |
| (4) MAIA Self-Regulation | . |  |  |  | -1.14  .254 | -1.22  .223 | 1.52  .129 | -0.41  .682 | 2.53  .011 | 2.41  .016 | 2.64  .008 |
| (5) MAIA Body Listening |  |  |  |  |  | 0.49  .624 | 1.62  .105 | 1.38  .168 | 2.01  .044 | 2.25  .024 | 2.02  .043 |
| (6) MAIA Trusting |  |  |  |  |  |  | -0.92  .358 | -1.2  .230 | 0.04  .968 | 2.63  .009 | 3.62  <.001 |
| (7) Body Appreciation |  |  |  |  |  |  |  | -1.95  .051 | -1.34  .180 | 3.48  <.001 | 3.4  <.001 |
| (8) Functionality Appreciation |  |  |  |  |  |  |  |  | -1.05  .294 | 2.59  .010 | 2.65  .008 |
| (9) Body Pride |  |  |  |  |  |  |  |  |  | 4.47  <.001 | 3.89  <.001 |
| (10) Body Surveillance |  |  |  |  |  |  |  |  |  |  | -0.82  .412 |
| (11) Body Shame |  |  |  |  |  |  |  |  |  |  |  |

*Notes.* Boys *n* = 125, Girls *n* = 140. MAIA = Multidimensional Assessment of Interoceptive Awareness*.*