

# Body Responsiveness Questionnaire: Validation on a European sample, Mediation between Body Awareness and Affect, connection with Mindfulness, Body Image, and Physical Activity

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## Abstract

Body responsiveness is ‘the tendency to integrate body sensations into conscious awareness to guide decision making and behavior and not suppress or react impulsively to them’. It is assessed by a 7-item tool, the Body Responsiveness Questionnaire (BRQ), which has not yet been validated on the European population. We aimed to translate the original version of Daubenmier’s BRQ, and test its consistency and convergent validity, and explore its connection with positive and negative affect, spirituality, attention-related body sensations, cardioceptive sensitivity, age, and gender. Overall, 402 individuals participated in the research, recruited either through the internet or in a university course. The Hungarian version of the BRQ showed the same two-factor structure as the original version: importance of body in behavior, and perceived disconnection between body and mind. Total BRQ score correlated positively with body awareness, positive affect, mindfulness, spirituality, body-mind practice (e.g. yoga), negatively with negative affect and physical symptoms. NO connection was found between the BRQ scores and cardioceptive sensitivity. According to our mediation analyses, BRQ-total was a significant mediator between body awareness and affect. Our results can inspire future studies investigating somatic psychology or the effectiveness of a body-mind intervention to assess body responsiveness also.

*Keywords:* body-mind connection, embodiment, mindfulness, positive and negative affect

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## Introduction

Embodiment is defined as an ‘experience of connection, attunement and equality between the mind and the body’ (Teall, 2015, p. 8). Regarding the subjectively experienced, interpreted and verbalized embodiment, many dimensions can be conceptualized (Teall, 2015), and using these concepts questionnaires can be constructed, which help to understand and monitor the effect of body-oriented interventions. Body awareness is one of the most widely researched aspects of embodiment and is defined as the ‘perception of bodily states, processes and actions that is presumed to originate from sensory proprioceptive and interoceptive afferents’ (Mehling et al., 2009, p. 4), also referred to as interoceptive awareness (Buldeo, 2015) and somatic awareness (Bakal, Coll, & Schaefer, 2008). Recently, it has been found that there is a significant difference between interoceptive awareness, and interoceptive accuracy, i.e. the capability to

accurately detect bodily processes in objective behavioral experiments (Ceunen, Van Diest, & Vlaeyen, 2013; Garfinkel, Seth, Barrett, Suzuki, & Critchley, 2015). In fact, many previous studies showed no connection between the subjective, questionnaire based assessments of body awareness and objectively measured interoceptive sensitivity (Dunn, Dalgleish, Ogilvie, & Lawrence, 2007; Emanuelsen, Drew, & Köteles, 2015; Khalsa et al., 2008).

Other aspects of embodiment (or disembodiment) were also operationalized (Teall, 2015), e.g. (1) body image dissatisfaction (Cash & Szymanski, 1995), and more widely, (2) body shame (Lamont, 2015; McKinley & Hyde, 1996), (3) alexithymia (Taylor, Bagby, & Parker, 1991), (4) body objectification (McKinley & Hyde, 1996), and, regarding positive approaches, (5) mindfulness, i.e. an intentional, non-elaborative, non-judgmental awareness which focuses on one's emotions, thoughts and sensations (including bodily ones) in the here-and-now (Bishop et al., 2004; Hölzel et al., 2011; Mehling et al., 2009; Zgierska et al., 2009).

Body responsiveness, defined as 'the tendency to integrate body sensations into conscious awareness to guide decision making and behavior and not suppress or react impulsively to them' (Daubenmier, Sze, Kerr, Kemeny, & Mehling, 2013, p. 9), is another important dimension of embodiment. Body responsiveness is assessed using a 7-item questionnaire called Body Responsiveness Questionnaire (Daubenmier, 2005). In the original and some following papers on body responsiveness, the questionnaire was referred to as a one-factor scale (Daubenmier, 2005; Daubenmier et al., 2011; Swami & Harris, 2012). Later the presence of two underlying factors was suggested, namely the importance of body awareness in guiding behavior (I; the four positively-keyed items), and the perceived disconnection between body and mind (PD; the three reversed items) (Clarke, 2008, p. 81; Daubenmier et al., 2013).

A connection was showed between scores on BRQ-total and body-mind practice, like yoga (Daubenmier, 2005; Dittmann & Freedman, 2009; Impett, Daubenmier, & Hirschman, 2006), and contemporary dance (Swami & Harris, 2012). Further results suggests that body responsiveness is connected to increased well-being: positive affect (i.e. feeling enthusiasm, activeness, and alertness (Watson, Clark, & Tellegen, 1988)), satisfaction with the body, the self, and life), and lower levels of maladaptive psychological functioning: negative affect (i.e. experiencing various aversive mood states, like anger, fear, disgust), self-objectification (Daubenmier, 2005; Dittmann & Freedman, 2009; Impett, Daubenmier, & Hirschman, 2006). It was also identified as a mediator between well-being and body awareness, moreover, through improvements in eating behavior (supporting intuitive eating, and preventing emotional eating) it contributes to the decrease of abdominal fat, which is essential in the promotion of physical health as well (Daubenmier et al., 2011). Body responsiveness was also found to mediate the relationship between body shame and the self-rated health, symptoms, and frequency of infections in college women (Lamont, 2015). It is important to note that all the studies mentioned here (1) recruited participants from the USA, therefore the European population was not tested yet, and (2) used either a sample of females only, or included few males, therefore the gender differences regarding BRQ could not be empirically explored. However, women are thought to have a closer relationship with their body, partly because of more intensive and frequent body experiences, e.g. menstruation, partly because of socio-cultural factors (Pennebaker, 1982).

Regarding psychophysiology, in a recent fMRI study body responsiveness and body awareness were found to be connected with resilience, and the least resilient subjects showed higher activation of the insula and thalamus related to an aversive interoceptive stimulus (artificial resistance in airway) (Haase et al., 2016). Regarding non-aversive sensations of breathing, respiratory interoceptive accuracy showed a tendency to correlate negatively with BRQ-PD (Daubenmier et al., 2013). The most prevalent measurement of

interoceptive accuracy, heartbeat detection (Schandry, 1981; Schulz, Lass-Hennemann, Sütterlin, Schächinger, & Vögele, 2013; Whitehead, Drescher, Heiman, & Blackwell, 1977) is yet to be examined in the light of body responsiveness.

Body responsiveness characterizes reactions to conscious body experiences. Body sensations can be brought into awareness by focusing attention on interoceptive inputs that are usually filtered out, causing e.g. tingling, warmth, or pressure (Michael & Naveteur, 2011). The attention-related body sensations were found to be connected to body awareness (Benedek T. Tihanyi, Sági, Csala, Tolnai, & Köteles, 2016), but no empirical research has been published to date to show their connection to body responsiveness.

Mindfulness was connected to higher levels of body-mind unity (not assessed by BRQ) (Kattenstroth, 2009), and mindfulness-based interventions were successful in increasing body responsiveness (Daubenmier et al., 2011). Some of the body-mind interventions are also connected to spirituality and contemplative practices (Brytek-Matera & Koziel, 2015; Totton, 2003, p. 102). Interestingly, no empirical attempt was made to date to investigate the relationships among scores of body responsiveness, mindfulness, and spirituality.

In summary, the construct of body responsiveness assesses an important aspect of embodiment, which is ignored by most of the other body-related questionnaires, and it possibly explains and measures more precisely the health promoting attitude towards one's body-mind, the effect of body-mind methods and other therapeutic, recreational, and preventive processes. In this study, we aimed to develop the Hungarian version of the BRQ, investigate its psychometric properties, and validity. We hypothesized that BRQ would show (1) a positive connection with body awareness, mindfulness, positive affect, spirituality, physical activity, body-mind practice, and attention-related body sensations, (2) a reverse connection with negative affect and dissatisfaction with body image, and (3) positive connection with heartbeat detection accuracy. Moreover, (4) it was assumed that females would show higher levels of BR than males. Finally, (5) it was expected that body responsiveness would (4) mediate the connection between BA and affect (positive and negative). To the authors' knowledge, this research is the first to include enough male subjects to examine gender differences regarding BRQ.

## 1. Methods

### 1.1. Participants

Two groups were included in the study. One group ('online group'), was recruited on on-line forums (excluding groups which focus on any kind of body-mind practice), and completed our on-line questionnaire, where we stated that 'the opinions on body experiences (i.e. body awareness) and affective life are investigated'. Another group of participants was recruited from university students ('university group') (for details, see Table 3). Beyond the on-line questionnaire, this group completed a heartbeat detection task as well. The study was approved by the Institutional Ethical Board of Eötvös Loránd University. All participants read and signed an informed consent form before completing the questionnaire.

### 1.2. Measurements

Body Responsiveness Questionnaire (BRQ) (Daubenmier, 2005) "assesses the tendency to integrate body sensations into conscious awareness to guide decision making and behavior and not suppress or react impulsively to them". A factor analysis indicated the presence of two factors (Daubenmier, unpublished analyses). The Importance of Interoceptive Awareness subscale

(I-subscale) assesses the importance of using interoceptive information to regulate behavior and self-awareness (items include “It is important for me to know how my body is feeling throughout the day,” “I am confident that my body will let me know what is good for me”) and the Perceived Disconnection subscale (PD-subscale) measures the extent of perceived disconnection between psychological and bodily states, including suppressing and reacting impulsively to them (items include “My mind and my body often want to do different things,” “I suppress my bodily feelings and sensations,” “My bodily desires lead me to do things that I end up regretting”) ( see Table 1). Since previous Hungarian version was not available the usual method of translation was followed: two experts translated the questionnaire independently from English to Hungarian, then a third expert back-translated the consensus version, which was compared to the original English version by a native English-speaker. Identically to the original version, we used a 7-point Likert scale for the 7-item questionnaire in the Hungarian version (see Appendix 1. also). I-subscale and PD-subscale scores were calculated separately, and for the BRQ total scores, we summed the reversed PD-subscale score and the I-subscale score. For better comparability with previous studies on BRQ, we divided the scores by the number of items, similar to the scores of the further questionnaires. Then the two subscales score were also averaged (similar to every score in Table 3., total scores were divided by the number of items) showed acceptable internal consistency in both the online and the university groups (Cronbach  $\alpha$  0.82 and 0.83 for I-subscale, 0.72 and 0.63 for PD-subscale respectively).

*Body Awareness Questionnaire (BAQ)* (Shields, Mallory, & Simon, 1989). The questionnaire consists of eighteen statements that measure beliefs about one’s sensitivity to normal non-emotive bodily processes, and the ability to anticipate bodily reactions. Items are scored on a seven-point Likert scale. The BAQ is considered a reliable and valid instrument for measuring self-reported attentiveness to normal bodily processes (Mehling et al., 2009). The Hungarian version showed good validity and reliability in past studies (Emanuelson et al., 2015; Köteles, 2014). In the present study, the internal consistency of the scale was 0.89.

*Body Image Ideals Questionnaire (BIQ)* (Cash & Szymanski, 1995) is a frequently used questionnaire of body image, which examines 11 physical characteristics, namely height, muscle tone and definition, body proportion, weight, chest size, physical strength, physical coordination, facial features, hair texture and thickness, skin complexion, and overall appearance. Higher scores on the BIQ indicate a greater discrepancy between the actual self and ideal self, and greater importance put on such discrepancy, both indicated on a four-point Likert scale. Reliability of the Hungarian version was appropriate in a past study (Emanuelson et al., 2015; Tihanyi, Böör, Emanuelson, & Köteles, 2016) and also good in the present study (Cronbach  $\alpha$ : 0.81).

*The Positive and Negative Affect Schedule (PANAS)* (Watson, Clark, & Tellegen, 1988) includes two independent scales rated on a five-point Likert scale. The negative affect scale measures the general dimension of subjective distress that contains a variety of aversive mood states (fear, nervousness, anger), while the positive affect scale assesses the extent to which a person feels energetic (alert, enthusiastic). In the current study, the short (5-item) version of the scales was used (Thompson, 2007). The Hungarian version of this scale had acceptable internal consistency (Gyollai, Simor, Köteles, & Demetrovics, 2011). In the current study, Cronbach  $\alpha$  coefficients were 0.72 and 0.71, respectively.

*Mindful Attention and Awareness Scale (MAAS)* (K. W. Brown & Ryan, 2003). The 15-item scale measures the extent to which one is able to focus on the present moment in an open and non-judgmental way. Each of the items is stated inversely using a 6-point Likert

scale (from almost always to almost never) asking the respondents about how often they find themselves acting automatically, inattentively or being preoccupied. The Hungarian version had a good internal consistency (Cronbach's  $\alpha = 0.78$ ) in earlier studies (Simor, Petke, & Köteles, 2013; B. T. Tihanyi, Böör, Emanuelsen, & Köteles, 2016). In the present study, the internal consistency of the scale was 0.86.

*Spiritual Connection Questionnaire* (Wheeler & Hyland, 2008): This scale assesses an aspect of spirituality that is consistent with religious and nonreligious (e.g., New Age) interpretations of spirituality, namely the importance, experience and beliefs of spiritual connection to e.g. an inner power, interpersonal energy, ultimate force. Participants respond to the 14 items on a 7-point scale, and high scores indicate greater spirituality. The scale was found to be unidimensional, and to have high internal consistency ( $\alpha=.97$ ) and retest reliability ( $r=.99$ ) (Wheeler & Hyland, 2008). The Hungarian version had a good internal consistency (Köteles & Simor, 2013b), Cronbach  $\alpha$  was 0.95 in the present study.

*Patient Health Questionnaire Somatic Symptom Severity Scale* (PHQ-15) is a 15-item scale which measures the prevalence of the most common body symptoms (e.g. headache, stomach ache, feeling tired and trouble sleeping) on a 3-point Likert scale. PHQ-15 was proposed as a diagnostic tool for a broader category of somatoform disorders (Kroenke, Spitzer, & Williams, 2002). The Hungarian version showed good psychometric properties in previous studies (Köteles & Simor, 2013a). Cronbach  $\alpha$  was 0.81 in our sample.

*Interoceptive sensitivity* is characterized most often by heartbeat detection ability. Accuracy in perceiving heartbeats was measured here using a modified version of the Mental Tracking Method (Emanuelsen et al., 2015; Ferentzi, Drew, & Köteles, 2016; Schandry, 1981). Following a 15-second test trial, participants were asked to count their heartbeats for intervals of 30 sec, 45 sec, and 100 sec, with a 10 second break in between the estimates (intervals were arranged randomly). The experimenter counted the participants' actual heartbeats using a Polar watch (model RS-400) with a chest strap. All subjects were asked to breathe at a regular pace during the tracking intervals. Accuracy of heartbeat detection in a given session was calculated using the following formula:

$$1 - |(recorded\ heartbeats - counted\ heartbeats) / recorded\ heartbeats|$$

Interoceptive sensitivity was calculated as the mean score of three (30 s, 45 s, 100 s) heartbeat perception intervals, higher scores indicate higher levels of accuracy. Interoceptive accuracy was measured in the university group only.

*Attention-related body sensations*: Participants were asked to focus on a freely chosen body part (e.g. hand, ear) with closed eyes and to report on 1-item yes-no question whether the sensation from the chosen area had changed (e.g. tingling) as a result of paying attention to it (Tihanyi 2016). It was only assessed in the online group.

*Sport and body-mind activity* was assessed by asking questions about the weekly frequency of practice of sport (anything the participant thought to be a physical activity or sport) and body-mind method (defined as any kind of activity where body attention and inner concentration played a role, examples were autogenic training, relaxation, yoga, tai chi, meditation, contact dance), and the duration of one session. These questions were answered only by the online group. Then we calculated, how many hours were spent by sport and body-mind practice in an average week. Since the mental effect of sports and body-mind methods, especially regarding BA was found to be linked to the frequency of practice and not the years spent with practicing (Benedek T. Tihanyi, Sági, et al., 2016), we characterized these activities by the hours spent with practicing in an average week.

### 1.3. Data analysis

Data analysis was conducted using SPSS v21 software. The Hungarian version's factor structure was investigated using exploratory factor analysis (EFA; principal axis factoring with oblimin rotation). Since age, gender, and most of the psychological measures (BAQ, PANAS, but not BRQ) were non-normally distributed, non-parametric correlations were used to estimate the relationships between body responsiveness and BAQ, PANAS, sport activity, body-mind activity, heartbeat detection accuracy, and the attention-related body sensations. The Spearman rho values between these variables were then entered in a partial correlation analysis which controlled for the effect of age, gender, and group affiliation (Conover, 1999).

Mediation analyses tested whether the connection between body awareness and affect (positive and negative) is mediated by body responsiveness. A bootstrapping method was used, which does not require normal distribution for any variables, but still shows if the regression coefficient between the independent and the dependent variable is significantly changed (decreased) after including one or more (mediating) variable(s) (Preacher & Hayes, 2008).

## 2. Results

### 2.1. Sample characteristic

Overall, 402 (64.4% females; mean age:  $28.5 \pm 11.72$  years; range: 18–69 years) individuals participated in the research. Regarding the on-line group, one hundred twenty-four subjects reported to have any body-mind experience, and 68 of them reported to practice some body-mind method presently. For descriptive statistics see Table 3.

### 2.2. Structure and reliability

The exploratory factor analysis revealed a two-factor structure that was identical to the English version. Correlation between the two subscales was negligible ( $-0.038$ ) (see Table 1.). The I-subscale showed acceptable internal consistency in the total sample, as well as both the on-line and the university groups, and the internal consistency of PD subscale was acceptable in the total sample and the on-line group, but not in the university group (Cronbach  $\alpha$  0.83, 0.82 and 0.83 for I-subscale, 0.69, 0.72 and 0.63 for PD respectively). The correlation between the items and the total subscale score is showed in Table 2.

### 2.3. Descriptive Statistics and Convergent validity

The descriptive statistical data of the assessed scales are presented in Table 3. All scales had a non-normal distribution (Shapiro-Wilk 0.899-0.992,  $p < 0.05$ ), except for BRQ in both scale, and BA, mindfulness, spirituality in the student group.

According to the correlational analysis of the total sample (see Table 4.), total BRQ score (BRQ-total) correlated positively with body awareness, positive affect, mindfulness, spirituality, body-mind practice (e.g. yoga), negatively with negative affect, and physical symptoms. No significant correlation was found between BRQ-total score and cardioceptive sensitivity, attention-related body sensations, sport activity, and body image dissatisfaction in the total sample. Regarding the difference of BRQ-total in the two groups, the body image dissatisfaction correlated negatively with BRQ-total of online adults, while positively with BRQ-total among university students. The university group showed higher BRQ-total and BRQ-I than online participants. No other important difference was found between the BRQ-total score's correlation regarding the two groups. Regarding the two

subscales, BRQ-I (positively keyed when counting BRQ-total) and BRQ-PD (reversed when counting BRQ-total, unreversed when used separately) in the total sample, BRQ-I showed a significant positive correlation with body awareness, sport activity, body-mind practice (while BRQ-PD not), and BRQ-PD showed a significant positive correlation with physical symptoms (while BRQ-I not). A discordant correlation (I-subscale and unreversed PD-subscale both showed positive connection) was found in the case of attention-related body sensations and spirituality. Positive and negative affect, and mindfulness showed significant concordant correlation (connection to BRQ-I and BRQ-PD had opposite sign).

Age of online group was not significantly correlated with BRQ, while age among university students showed a positive correlation. Being female was linked to higher scores on BRQ-total and BRQ-I in the online group.

#### 2.4. Mediation

According to the mediation analyses (see in Table 5.) adjusting for age, gender, and group affiliation, BRQ-total is a significant mediator between body awareness and affect, although in the case of both positive and negative affect this was just a partial mediation, since the direct connection between body awareness and positive affect remained significant. Mediating effects calculated for the two subscales separately were not significant.

### 3. Discussion

The Hungarian version of the Body Responsiveness Questionnaire (BRQ) showed the same two-factor structure as the original version: importance of interoceptive awareness in guiding behavior (BRQ-I, positively keyed when counting BRQ-total), and perceived disconnection between body and mind (BRQ-PD, reversed when counting BRQ-total). Both subscales had acceptable internal consistency. Convergent validity was found to be good: based on the correlational analysis of the total sample, total BRQ score correlated positively with body awareness, positive affect, mindfulness, spirituality, body-mind practice (e.g. yoga), negatively with negative affect and physical symptoms. In the case of body image dissatisfaction, attention-related body sensations and spirituality, both BRQ subscales showed a positive connection, thus they neutralized each other's effect when calculating the total score. However, no significant correlation was found between any of the BRQ scores and cardioceptive sensitivity. According to our mediation analyses adjusting for age, gender, and group affiliation, BRQ-total is a significant mediator between body awareness and affect (positive and negative).

The two subscales of BRQ were not correlated in the present study, which suggests that this construct covers two independent factors: (1) the tendency to integrate body sensations into conscious awareness, and not to suppress or react impulsively to them (reversed PD-subscale), and (2) the tendency to let body sensations guide decision making and behavior (I-subscale) (Daubenmier et al., 2013). It is still an open question, if the lack of connection found here reflects a real conceptual difference, or origins from other biasing factors, e.g. response set (Herzberg, Glaesmer, & Hoyer, 2006), since now all PD-subscale items are reversed, while all I-subscale items are positively keyed. Based on our findings on the factor structure together with the different correlational pattern found in our convergent validity analysis, we recommend that future researchers examine the two subscales separately. Our results suggest that the ongoing education of the university group

on sport, health and recreation and physical trainings of these students might increase year-by-year BRQ, and cease gender differences. While in the mixed online sample, closer to the average population, BRQ is lower, not connected to age, and women showed higher scores on BRQ-total and BRQ-I.

According to the embodiment paradigm, most content of the mind can resonate and be felt somehow in the body, and analogously, every body sensation or process can evoke an emotion or thought in the mind (Gendlin, 1984). Still, BRQ clearly uses a dualistic language (talking about body and mind separately), which is nevertheless understandable, since presently that is a more dominant paradigm, and therefore more comprehensive for most of the subjects. Body awareness (as assessed by the BAQ) showed a moderate positive correlation to BRQ-I, but not to BRQ-PD. This means that, in our sample, those who reported themselves to be able to perceive, interpret, and predict body states and processes reported to let more of this bodily information guide behavior, but did not report stronger unity between body and mind. This result is plausible since subjects using a disembodied, dualistic paradigm to describe themselves can still report that their body and mind (although experienced as separated entities) can interact strongly in both direction, i.e. the body is perceived precisely by the mind, and the mind is guided heavily by the body. Interestingly, BRQ-PD covers rather the attitude to radically favoring the mind (against the body) as an aspect of the self which is wiser, more trustful, more true, although the opposite attitude (favoring body over mind) would be a disconnected, dualistic and not-embodied attitude again, involved unclearly in the PD-subscale.

The lack of connection between BRQ and heart-rate detection ability in our study suggests that those who can monitor and perceive the cardiac activity accurately will not necessarily trust their own body and experience a connection between body and mind. Even the connection of interoceptive sensitivity and self-reported body awareness is questionable (Ainley, Maister, & Tsakiris, 2015; Emanuelsen et al., 2015). As well as the intention to define body awareness as based on interoceptive stimuli, since somatic experiences are also shaped by top-down processes (Pennebaker, 1982), moreover, perceiving a body sensation is possible even without any interoceptive input (H. D. Brown, Kosslyn, Delamater, Fama, & Barsky, 1999; R. J. Brown, Brunt, Poliakoff, & Lloyd, 2010), for example by the means of the as-if-body neural loop within the brain (Bechara & Damasio, 2005). This raises the possibility, that the term 'body' in the expressions of body awareness and body responsiveness could not only mean the organic, physical part of oneself, but also a projective surface where mental processes (emotions, thoughts) can be manifested.

Our results are in accordance with previous findings showing a significant correlation between BRQ and affect (Impett et al., 2006). Moreover, body responsiveness was a significant mediator of the connection between body awareness and affect. This finding suggests that those who stated to be more sensitive to body sensations and attend to them more regularly were found to report more positive emotions (e.g. feeling energetic, proud, strong) and less negative emotions (e.g. afraid, nervous, ashamed), and this connection was mediated by BRQ. This is in line with former suggestions, namely that a higher awareness of body sensations, together with a stronger perceived connection (and coherence) between body and mind and a behavior taking account of body signals, supports behaviors which satisfy more psychophysiological needs, which leads to a better mood (Farb et al., 2015; Fogel, 2013). However, the causal link might not just start from body awareness towards positive affect, it can also be directed the other way round, or a circular causality can also be hypothesized. For example, positive emotional states, especially feeling safe was found to support body awareness, while negative emotional states, especially fear was found

in cases to dissociate body from mind, close the interoceptive pathways and allocate attention to the outer world (Fogel, 2013). Other variables which could mediate the connection between body awareness and positive affect at least partly independently from body responsiveness are body posture, basic respiratory pattern, health behavior (e.g. sport and body-mind activity, nutrition, sleep hygiene), social support, traumatic experience, perceived body symptoms and diseases. On the contrary, BRQ mediated completely the connection between body awareness and negative affect, which means that all the possible mediating variables were covered by the construct of body responsiveness in our sample. The finding that the correlational coefficients tended to be higher between I-subscale and positive affect, and PD-subscale and negative affect might reflect on the use of reversed items in the case of PD-subscale.

In the on-line sample body image dissatisfaction was not connected to I-subscale, but was connected positively to PD-subscale, supporting the notion that in average sample body disconnectedness and dissatisfaction are connected. Surprisingly, in the case of the university sample, higher body image dissatisfaction appeared together with higher importance of body signals to guide behavior, but was not connected with disconnectedness. This could mean that in this sample, taking into account body sensations and bodily intentions was motivated partly by dissatisfaction or shame.

In the case of attention-related body sensations, measured only in the online sample, a discordant connection was found, i.e. both BRQ-I and BRQ-PD had a significant positive correlation with it. It is easy to interpret, that those who regularly use body signals to guide behavior can connect more easily to subtle body sensations, or ‘evoke’ them by focusing attention on the body (Benedek T. Tihanyi, Köteles, et al., 2016). The positive connection between perceived body-mind disconnectedness and attention-related body sensations might be caused by a lack of or lowered actual interoceptive input, which gives space to top-down processes (evoking body sensations by attention, imagination) and as-if body experiences, or might be understood by noticing that attention-related body sensations had been also linked to discharges caused by anxiety and other negative emotions, or a numbness to cover body sensations from mind (Benedek T. Tihanyi, Köteles, et al., 2016). Spirituality showed a similar discordant correlation with the two BRQ subscales. The connection between I-subscale and spirituality could possibly reflect to a general experience of interconnectedness, between body, mind, other beings and objects. Regarding the positive connection between perceived disconnectedness and spirituality, since the correlation was the strongest with the item ‘My mind and body often want to do two different things’, it might suggest that those with higher spirituality are more sensitive to moments when body and mind seem to disconnect and disagree; PD-score does not show if a subject can manage such perceived disconnection and reconnect and integrate body and mind. It is important to note, that body responsiveness total score showed no or weaker connection with body image dissatisfaction, attention-related sensations, and spirituality, since I-subscales and PD-subscales correlations neutralized each other when the two subscales were summed, which highlights the usefulness of examining the two subscales separately in future studies.

The aspects of body responsiveness were integrated in other scales since the publishing of BRQ, e.g. a multidimensional scale of body awareness (MAIA) (Mehling et al., 2012), and mindful self-care, representing the “daily practice of being aware of the physical and emotional needs, and behaving to meet these needs”, has also inspired a scale, whose psychometric validation is under process (Webb, Wood-Barcalow, & Tylka, 2015). Body intelligence was also assessed by a self-report questionnaire, defined as “the awareness and

use of bodily sensations to (a) support health and well-being, (b) supply information about environmental safety and comfort, and (c) enhance personal and spiritual development over a lifetime” (Anderson, 2006). Even a multi-dimensional questionnaire of experienced embodiment was conceptualized, which involved the connection with the body, agency and functionality, attunement and self-care, experience and expression of desire, and inhabiting the body as a subjective site (Teall, 2006). Future studies might examine the relationship between these constructs, and might create a multidimensional scale for body responsiveness, analogous to the one for body awareness (Mehling et al., 2012).

The most important limitation of the present cross-sectional study is that it could not reveal the causal direction of the reported connections. During the correlational analysis numerous statistical tests were performed, therefore a correction (e.g. Bonferroni) could help to clarify which coefficients’ significance were likely not just by chance. Moreover, our sample was not representative, thus the generalizability of the results is limited, even though the effect of gender and age was controlled. Participants completed the questionnaire online, therefore the conditions of answering were not controlled, although the mode of data collection was controlled in the analyses. Furthermore, as a self-report questionnaire, the BRQ can assess the self-perceived importance of body signs in guiding behavior and the disconnectedness, which would be interesting to compare with scores given by outer observers of the subjects.

In conclusion, our findings are in accordance with previous results, and together they suggest that higher body responsiveness is connected to (1) higher self-regulation: not just recognizing (body awareness), accepting (mindfulness) inner needs, but also integrating, and satisfying them, (2) increased positive affect and decreased negative affect, (3) increased self-acceptance, self-care (sport activity and body-mind practice), decreased body dissatisfaction, (4) connectedness to others and the universe (spirituality) (Daubenmier, 2005; Fogel, 2013). Our results can inspire and support future studies investigating the body-mind interaction, somatic psychology, assessing the effectiveness of various body-mind interventions (somato-psychotherapy, bodywork, sport) and follow body-related psychiatric patients (body image disorder, alexithymia, somatoform disorders) to include the BRQ.

## BIOGRAPHY

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### Appendix 1.

The Hungarian version of the Body Responsiveness Questionnaire (Daubenmier, 2005)

Testi válasz-készség skála

értékelés: 1 (*egyáltalán nem igaz rám*) ... 7 (*teljesen igaz rám*)

1. Biztos vagyok abban, hogy a testem (szervezetem) tudatja velem, hogy mi a jó nekem.
2. Testi vágyaim olyan dolgokra sarkallnak, amiket végül megbánok.
3. Az elmém és a testem gyakran két különböző dolgot akar tenni.
4. Elnyomom a testi érzéseimet és érzeteimet.
5. Odafigyelek a testemre, hogy tanácsot adjon nekem, hogy mit tegyek.
6. Fontos számomra, hogy tudjam, hogyan érez a testem a nap folyamán.
7. Élvezem, amikor tudatába kerülök annak, hogyan érez a testem.

I tételek: 1, 5, 6, 7.

PD tételek (BRQ totál pontszámhoz megfordítandó): 2, 3, 4.

### Tables

Table 1. Factor matrix of EFA (principal axis factoring with oblimin rotation)

Item (subscale)	1st factor	2nd factor
1. (I) I am confident that my body will let me know what is good for me.	0.53	
2. (PD) My bodily desires lead me to do things that I end up regretting.		0.63
3. (PD) My mind and body often want to do two different things.		0.85
4. (PD) I suppress my bodily feelings and sensations.		0.52
5. (I) I 'listen' to my body to advise me about what to do.	0.78	
6. (I) It is important for me to know how my body is feeling throughout the day.	0.91	
7. (I) I enjoy becoming aware of how my body feels.	0.74	

Table 2. Corrected item-total correlation for the two subscales (I and PD)

	Corrected item-total correlations
Items of I-subscale	
1.	0.49
5.	0.68
6.	0.78
7.	0.67
Items of PD-subscale	
2.	0.52
3.	0.59
4.	0.41

Table 3. Descriptive statistics (mean, standard deviation) of the variables for the two groups separately. N.M.: not measured

	On-line group (n = 242)	University group (n = 160)
Gender ratio (females)	78.7%	42.5%
	Mean $\pm$ std. deviation	Mean $\pm$ std. deviation
<i>Age (years)</i>	32.9 $\pm$ 13.21	22.0 $\pm$ 2.81
<i>Body responsiveness</i>	4.6 $\pm$ 0.91	4.7 $\pm$ 0.78
<i>BRQ-I</i>	4.5 $\pm$ 1.24	4.9 $\pm$ 1.04
<i>BRQ-PD (unreversed)</i>	3.4 $\pm$ 1.27	3.6 $\pm$ 1.09
<i>Body awareness</i>	4.8 $\pm$ 0.85	4.8 $\pm$ 0.70
<i>Body image dissatisfaction</i>	6.1 $\pm$ 1.87	6.6 $\pm$ 2.30
<i>Positive affect</i>	3.6 $\pm$ 0.62	3.5 $\pm$ 0.86
<i>Negative affect</i>	2.1 $\pm$ 0.72	1.9 $\pm$ 0.71
<i>Physical symptoms</i>	1.5 $\pm$ 0.33	1.4 $\pm$ 0.33
<i>Mindfulness</i>	3.9 $\pm$ 0.74	4.0 $\pm$ 0.60
<i>Spirituality</i>	4 $\pm$ 1.65	3.8 $\pm$ 1.29
<i>Sport activity (hours/week)</i>	6.3 $\pm$ 17.45	N.M.
<i>Body-mind practice (hours/week)</i>	0.7 $\pm$ 1.96	N.M.
<i>Interoceptive sensitivity</i>	N.M.	0.6 $\pm$ 0.23
<i>Attention-related body sensations</i>	0.6 $\pm$ 0.49	N.M.

Table 4. Spearman correlation coefficients with significance between BRQ-total, BRQ-I and BRQ-PD subscales and variables controlled for age, gender and group affiliation, in total sample, online sample and university sample. N.M.: not measured

	<i>BRQ-total</i>			<i>BRQ-I</i>			<i>BRQ-PD</i>		
	<i>total</i>	<i>online group</i>	<i>university group</i>	<i>total</i>	<i>online group</i>	<i>university group</i>	<i>total</i>	<i>online group</i>	<i>university group</i>
<i>Group affiliation</i>	0.15***			0.20***			0.01		
<i>Age</i>	0.41**	0.03	0.27***	0.29*	-0.01	0.22**	0.11	-0.07	-0.24***
<i>Gender</i>	0.06	0.11*	0.11	0.03	0.11*	0.08	-0.05	-0.05	-0.06
<i>Body awareness</i>	0.39***	0.42***	0.34***	0.46***	0.47***	0.45***	-0.07	-0.10	-0.02
<i>Body Image Dissatisfaction</i>	-0.02	-0.12*	0.13*	0.1*	0.03	0.21**	0.17***	0.25***	0.05
<i>Positive affect</i>	0.23***	0.28***	0.2**	0.2***	0.19**	0.24**	-	-	-0.07
							0.19***	0.27***	
<i>Negative affect</i>	-0.27***	-0.3***	-0.21**	-0.1*	-0.09	-0.09	0.33***	0.37***	0.25***
<i>Physical symptoms</i>	-0.17***	-0.15*	-0.17*	-0.02	0.03	-0.08	0.27***	0.31***	0.21**
<i>Mindfulness</i>	0.27***	0.34***	0.15*	0.11*	0.15**	0.01	-	-0.4***	-0.24**
							0.34***		
<i>Spirituality</i>	0.24***	0.25***	0.22**	0.41***	0.45***	0.32***	0.12**	0.15*	0.08
<i>Sport activity</i>	0.12	0.11	N.M.	0.16*	0.14*	N.M.	-0.02	-0.03	N.M.
<i>Body-mind practice</i>	0.24***	0.23***	N.M.	0.27***	0.25***	N.M.	-0.03	-0.04	N.M.
<i>Interoceptive sensitivity</i>	0.05	N.M.	0.03	0.10	N.M.	0.04	-0.01	N.M.	0.01
<i>Attention-related body sensations</i>	0.03	0.03	N.M.	0.15**	0.14*	N.M.	0.11*	0.10	N.M.

\*:p&lt;0.05, \*\*:p&lt;0.01, \*\*\*p:&lt;0.001.

Table 5. Descriptive statistics (mean, 95% confidence intervals, standard error) of the indirect effect of body awareness (independent variable, IV) on dependent variables (DV) mediated by body responsiveness, and the coefficient and significance of the direct effect, calculated from 1000 bootstrap samples for the two mediation analyses. Total sample involved, effect of age, gender, and group affiliation was controlled for.

<i>Dependent variable</i>	<i>Mediator</i>	<i>Mean of the Indirect Effect</i>	<i>95% CIs</i>	<i>SE</i>	<i>Model summary (R-Direct effect of IV on DV)</i>	
<i>Positive affect</i>	<i>BRQ</i>	<b>0.036</b>	0.013 - 0.635	0.013	0.084***	0.085**
	<i>BRQ-I</i>	0.019	-0.011 - 0.053	0.016	0.06***	0.101***
	<i>BRQ-PD</i>	0.004	-0.005 - 0.016	0.005	0.085***	0.118***
<i>Negative affect</i>	<i>BRQ</i>	<b>-0.058</b>	-0.086 - -0.035	0.013	0.12***	0.013
	<i>BRQ-I</i>	-0.016	-0.046 - 0.018	0.016	0.06***	-0.03
	<i>BRQ-PD</i>	-0.007	-0.028 - 0.012	0.01	0.16***	-0.04

\*: p < 0.05, \*\*: p < 0.01, \*\*\* p < 0.001.