

Measuring alexisomia and its relation to alexithymia using the Body Awareness Questionnaire

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Abstract

Background: Awareness of one's own states is a particularly important part of cognition and emotion regulation. Difficulties in this domain is seen as the roots of several types of disorders. Impairments in perceiving emotional states has been widely documented, leading to show alexithymia - the difficulty in identifying, conceiving and communicating one's states - as a central mechanism of somatic and mental disorders. Recently, the concept of alexisomia has been used to refer to lack of awareness and expression of somatic sensations. Developing self-reported questionnaires to evaluate alexisomia represents a challenge for clinical psychology and medicine. In this context, we suggested to adapt the Body Awareness Questionnaire (BAQ, Shields et al., 1989) in France to assess alexisomia in relation to alexithymia.

Methods: For this study, 610 participants completed questionnaires measuring alexithymia and alexisomia.

Results: Confirmatory factor analyses showed that the BAQ can be envisaged through 4 factors as well as a unidimensional model to refer to alexisomia. We also found that body awareness was negatively related to scores of alexithymia.

Conclusion: Results are discussed in light of the construct of alexisomia and its clinical implications in somatic as well as mental disorders. We suggest that alexisomia is a key concept, in the same way as alexithymia, to design treatment and prevention programs.

Background

The field of grounded and embodied cognition points to a bidirectional link between emotional processing and body functioning (Barsalou, 2008; Niedenthal et al., 2009). The relationship between the perception of a subjective (feeling) and an objective (bodily components) state influences the sense of coherence of the emotional experience (Sze et al., 2010), and appears to play an important role in emotional, behavioral and health regulation (Mehling et al., 2009). Psychiatric and psychological disorders as well as Somatic Symptom Disorder are all related to emotional regulation difficulties (Gross & Jazaieri, 2014). These difficulties occur at the affective, cognitive and social level, ranging from emotional awareness to regulatory strategies (Barlow et al., 2004; Boden & Thompson, 2015; Gross, 2002).

Difficulties in emotional awareness, associated with verbalization difficulties, have been widely studied in psychopathology and psychosomatics through the construct of alexithymia (Berthoz et al., 2011; Kojima, 2012a; Leweke et al., 2012). Alexithymia, initially introduced by Sifneos (Sifneos, 1973), is used to describe cognitive or personality traits including difficulty identifying emotions, describing feelings to others, externally oriented thinking (a preference for focusing on external events than personal feeling), and a limited imaginative capacity (Nemiah et al., 1976). More recently, beyond emotional awareness and its physiological component, greater attention is paid to the awareness of bodily states. Studies on

chronic somatic disorders and pain has led to the proposition that they are characterized by alexithymia associated with physiological hyperarousal and an intense way of perceiving its sensations (and symptoms) as an hypersensitivity (Kano & Fukudo, 2013; Lumley et al., 1996) and sometimes, the reverse an hyposensitivity (Neumann et al., 2004; Rubio et al., 2014) both situations suggesting a mismatch between sensation and perception reflecting a disorder of interoception. Recently, the clinical importance of impairments in processing somatic sensation has been synthesized (Oka, 2020). Indeed, it helps to understand lack of consciousness of a present illness, and that could lead to kind of risky behaviors that contribute to maladaptive states (i.e. regulation of behaviors, awareness of fatigue and physical limits, therapeutical observance). Based on the Japanese construct of "*shitsu-taikan-sho*" ("*shitsu*" for lack, "*taikan*" for bodily sensations, and "*sho*" for symptoms) driven by psychosomatic studies, Ikemi suggested impairments that seems to be more extensive than alexithymia (emotion awareness) and refer to alexisomia (Ikemi & Ikemi, 1983).

Alexisomia, or "no words to describe bodily states", is a clinical concept that refers to characteristics of having difficulties in the awareness and expression of somatic sensations (Kanbara & Fukunaga, 2016; Moriguchi & Komaki, 2013). In the most recent evolution of the conceptualization of alexisomia, this has been viewed as a related but independent construct of alexithymia (Ikemi & Ikemi, 1986).

If the concept of alexisomia appears relevant for neuropsychiatric, somatic and somatoform disorders (Fiene et al., 2018; Gan et al., 2016; Oka, 2020), it still needs to be understood and assessed since it should be linked to the ability to accurately sense the bodily states. Recently, a scale designed to assess the construct, named the *Shitsu-taikan-sho* Scale (STSS) has been developed and published in English by Oka (2020). This scale is composed of the following three dimensions: *i*) difficulties in identifying bodily sensations, *ii*) over-adaptations that refers to excessive responses to social demands which overlooks one's real affective and physical states and needs, and *iii*) lack of health management based bodily sensations. At a conceptual level, it appears that non-affective body awareness represents the roots of the concept of alexisomia as it taps on a central deficit of interoception. Recent research underlines that alexisomia is a way to better understand processing involved in interoception. As this has been underlined from past research, we suggest measuring alexisomia through a scale that only focuses on this aspect: the Body Awareness Questionnaire (BAQ) (Shields et al., 1989). Indeed, the BAQ taps in explicit vigilance about the variations in body cues and its consequences for health. It is an 18-item scale designed to assess self-reported attention and awareness of normal non-affective bodily processes. It can be used as a unidimensional approach of interoception, but it can also be divided into four dimensions. These four dimensions refer to: *i*) the response or changes in body processes, *ii*) the prediction of body reaction, *iii*) the perception of sleep-wake cycles, and *iv*) the self-prediction of the onset of illness.

The aim of this study was twofold. First, to validate the French version of the Body Awareness Questionnaire (BAQ), and to test its psychometric properties in a general (non-clinical) population, and second, to test its relation to alexithymia. To the best of our knowledge, that is the first study that approach the BAQ through the construct of alexisomia and its relation to alexithymia.

Methods

Participants

Six hundred and ten participants agreed to take part to the study. The study was conducted in three universities (Univ. Grenoble Alpes, Univ. Savoie Mont Blanc, and Univ. Paris 8 Vincennes-Saint-Denis). Data were acquired in face-to-face protocols as well as by web-designed surveys with no financial counterpart. Seventy-seven participants took part in the re-test three weeks later. Participants were aged from 18 to 80 years (Mean Age = 30.5, SD = 13.2). Academic levels were comprised between secondary education and higher education. Due to a technical problem, 168 levels of education were not recorded.

Procedure

This study was elaborated in accordance with the Declaration of Helsinki and its later amendments. It was in accordance with the French Deontological code of Psychology. All participants signed an informed consent before the study. Participants filled in information about their age, gender and level of education. As this study involved the validation of a tool in the general population, only participants with no significant current comorbidity (psychiatric, somatic or psychological problems assessed by self-report of health actual and past issues) and for whom the data were complete were retained.

Measures

Interoception: The Body Awareness Questionnaire (BAQ)

The BAQ is an 18-items scale developed by Shields et al. (1989) that assess consciousness of physical variations, and more precisely attentiveness to non-emotional body functioning. Two factorial solutions are usually identified. A first with four dimensions that encompasses body cycles and rhythms, the detection of changes of the body, and the ability to anticipate bodily reactions (Shields et al., 1989). Items are distributed in the following dimensions: items 1, 4, 10, 13, 14, 16 in BAQ-Body Change for “note response or changes in body process” (e.g., *I notice specific body responses to changes in the weather*); items 2, 3, 8, 11, 12, 15, 16 in BAQ-Predict for “predict body reactions” (e.g., *I always know when I've exerted myself to the point where I'll be sore the next day*); items 7, 8, 9, 15, 17, 18 in “sleep–wake cycle” (e.g., *I can accurately predict what time of day lack of sleep will catch up with me*), and items 5, 6, 7, 10 in Illness for “Onset of illness” (e.g., *I know in advance when I'm getting the flu*). A second factorial solution is unidimensional (Löf et al., 2013). Low scores of body awareness reflect high alexisomia. The French version was adapted regarding rigorous back-translation proceed by a native-speaker colleague.

The Bermond-Vorst Alexithymia Questionnaire (BVAQ-B)

The Bermond–Vorst Alexithymia Questionnaire is a 40-items questionnaire that exists in two part of 20-items each. We used the BVAQ part B. Participants were asked to read items and select their response of a 5-point Likert scale. The questionnaire comprises five dimensions, which are impairments in identifying (B1), verbalizing (B2), analyzing (B3), fantasizing (B4), and emotionalizing (B5) emotions. High scores

reflect high levels of alexithymia (de Vroege et al., 2018; Vorst & Bermond, 2001). A subsample of 412 people filled the BVAQ. Mc Donald's ω of reliability of the BVAQ-B was set at .78

The Toronto Alexithymia Scale (TAS)

The Toronto Alexithymia Scale (TAS) is a 20-items questionnaire where participants are asked to respond on a 5-point Likert scale (Bagby et al., 1994; Loas et al., 1996). High scores reflect high levels of alexithymia. is composed of three subscales: Difficulties in Identifying Feelings (DIF), Difficulties in Describing Feelings (DDF), and Externally Oriented Thinking (EOT or attention to external events). A subsample of 198 people filled this scale. Mc Donald's ω of reliability of the TAS was set at .86.

Statistical Analyses

In order to determine how many factors to select for the French validation of the scale, we proceeded with the assessment of the dimensionality of the set of items.

First, we verified the distribution of the data. Using the Shapiro-Wilk test, we found that items of the BAQ were not normally distributed ($p < .001$ for all items).

We performed a Confirmatory Factor Analysis (CFA) using a diagonally weighted least squares estimator for ordinal non-normally distributed data (Gana & Broc, 2018; Li, 2016). Goodness of fit was evaluated using the χ^2 test. However, as the χ^2 test is highly affected by sample size (Bentler & Bonett, 1980), we also considered the relative χ^2 (ratio χ^2/Df), which is suggested to be less influenced by the sample size; acceptable relative χ^2 values range from less than two (Ullman, 2001) to less than five (Schumacker & Lomax, 2010). In addition, the following fit indices were assessed: the Comparative Fit Index (CFI; Bentler, 1990), the Tucker-Lewis Index (TLI; Tucker & Lewis, 1973), and the Root Mean Square Error of Approximation (RMSEA; Steiger, 1990). Good fit were indicated by a nonsignificant chi-square test, CFI and TLI values > 0.95 (acceptable fit if > 0.90) and RMSEA < 0.06 (Hu & Bentler, 1999).

Next, internal consistency was assessed using the Cronbach's alpha. Alpha values were interpreted as insufficient when $< .70$, correct if between $.70$ and $.79$, good when between $.80$ and $.89$, and values $\geq .90$ were considered as excellent (Cicchetti, 1994). Regarding limitations of the Cronbach's alpha in multidimensional data (Sijtsma, 2009), and taking into account that the BAQ could also be multifactorial, we suggested to proceed with the calculation of McDonald's Omega (McDonald, 2011). After establishing the final factor solution of the scale, we investigated the relation between interoceptive consciousness assessment (BAQ) and external validity indicators, such as alexithymia. Statistical tests were considered significant at $p < .05$. Data was analyzed using R version 3.0 (R Core Team, 2016). We used several R packages ('psy', 'psych' and 'lavaan').

Table 1
Descriptive statistics

Variable	Mean	SD	Females Mean (SD)	Males Mean (SD)	<i>n</i> males / Ntotal
Age	30.52	13.21	29.4 (12.6)	34.6 (15.1)	481/610
BAQ-BODY CHANGE	17.6	4.79	17.7 (4.76)	17.1 (4.87)	129/610
BAQ-PRED.BODY	16.4	4.74	16.4 (4.74)	16.6 (4.78)	129/610
BAQ-SLEEP.WAKE	14.1	3.61	14.3 (3.66)	13.7 (3.42)	129/610
BAQ-ILLNESS	14.7	3.78	14.7 (3.82)	14.6 (3.61)	129/610
BAQ-TOTAL	62.8	12.7	63.1 (13)	61.9 (11.6)	129/610
BVAQ-B1	11.5	1.76	11.4 (1.68)	11.8 (1.91)	112/412
BVAQ-B2	9.23	3.33	8.94 (3.17)	9.99 (3.64)	112/412
BVAQ-B3	9.73	2.51	9.59 (2.61)	10.1 (2.22)	112/412
BVAQ-B4	8.91	2.67	8.29 (2.33)	10.6 (2.81)	112/412
BVAQ-B5	7.65	2.51	7.25 (2.25)	8.72 (2.86)	112/412
BVAQ-TOTAL	47	7.59	45.4 (7.04)	51.2 (7.43)	112/412
TAS-DIF	16.2	5.52	16.4 (5.48)	14.8 (5.88)	17/198
TAS-DDF	12.7	5.19	12.7 (5.26)	12.9 (4.53)	17/198
TAS-EOT	15.1	4.16	15 (4.2)	15.6 (3.68)	17/198
TAS-Tot	44	11.9	44.1 (12.1)	43.2 (10.4)	17/198

BAQ: Body Awareness Questionnaire; *Body.Change*: the response or changes in body processes; *Pred.Body*: the prediction of body reaction, *Sleep.Wake*: the perception of sleep-wake cycles; *Illness*: the self-prediction of the onset of illness. BVAQ: Bermond–Vorst Alexithymia Questionnaire; B1: impairments in identifying feelings; B2: impairments in verbalizing feelings; B3: impairments in fantasizing; B4: impairments in emotionalizing; TAS: Toronto Alexithymia Scale; DIF: Difficulties in Identifying Feelings; DDF: Difficulties in Describing Feelings; EOT: Externally Oriented Thinking

Results

Descriptive statistics are shown in Table 1.

Factorial analyses

The results indicated a very good model fit testing the four-factor solution concerning the ratio χ^2/Df (207.28/124 = 1.671), and the fit indices (CFI = .985; TLI = .978; RMSEA = .033 [CI₉₀ = .025-.041]). Regarding the standard loadings of items, all were > .30 except the items number 7 (.20), 10 (.23), 15 (.20), and 16 (.10). None of these items was concerned by the study of Modification Indices, so we decided to test a model without these four items. After removing them, the model was not better than the previous one: χ^2/Df (123.168/70 = 1.765) CFI = .980; TLI = .974; RMSEA = .035 [CI₉₀ = .025-.046].

Then, we tested the unidimensional model of the BAQ. This unique factor solution revealed acceptable but worse fits concerning the ratio χ^2/Df (316.713/135 = 2.346), and the fit indices (CFI = .961; TLI = .956; RMSEA = .047 [CI₉₀ = .040-.054]). McDonald's ω of reliability was set at .83

Correlation analysis

We performed correlations analyses. Regarding the distribution of the data, we calculated Spearman's rho coefficients. Interoceptive consciousness (BAQ total score) negatively correlated with difficulties in identifying emotions (BVAQ-B3 analyzing emotions and TAS-DIF Difficulties in Identifying Feelings), and difficulties in analyzing emotions (BVAQ-B5 emotionalizing and TAS-EOT Externally Oriented Thinking). It was also negatively related to difficulties in describing feelings (TAS-DDF). When regarding correlations between subdimensions of the BAQ and the several dimensions of alexithymia (assessed by the two scales), we found negative correlations with the BVAQ-B3 (analyzing emotions) and the BVAQ-B5 (emotionalizing). Subdimensions of the BAQ about the awareness on sleep-wake cycles (BAQ-SLEEP.WAKE) and the onset of the illness (BAQ-ILLNESS) were all related with alexithymia as assessed by the TAS. Details are shown in Table 2. Test and retest correlations were generated based on an interval of three weeks. Total scores showed a high temporal fidelity ($r = .81$; $p < .001$). The response or changes in body processes was set at .73 ($p < .001$); the prediction of body reaction correlation was set at .71 ($p < .001$); the perception of sleep-wake cycles was set at .88 ($p < .001$), and finally the self-prediction of the onset of illness was set at .71 ($p < .001$).

Table 2
Correlation analyses

	BAQ- BODY CHANGE	BAQ- PRED.BODY	BAQ- SLEEP.WAKE	BAQ- ILLNESS	BAQ- TOTAL
BVAQ-B1	.057	.060	.002	-.020	.035
BVAQ-B2	.035	.007	-.123	.096	.013
BVAQ-B3	-.104 *	-.195 ***	-.162 **	-.233 ***	-.216 ***
BVAQ-B4	-.050	-.038	-.006	.003	-.056
BVAQ-B5	-.197 ***	-.119	-.225 ***	-.173 ***	-.234 ***
BVAQ total	-.081	-.120	-.189 ***	-.088	-.141 **
TAS DIF	-.060	-.209**	-.278 ***	-.209 **	-.209 **
TAS DDF	-.200 **	-.205 **	-.300 ***	-.227 **	-.196 **
TAS EOT	-.192**	-.100	-.199 **	-.241 ***	-.222 **
TAS total	-.163*	-.214 **	-.324 ***	-.279 ***	-.247 ***
* p < .05, ** p < .01, *** p < .001. BAQ: Body Awareness Questionnaire; <i>Body.Change</i> : the response or changes in body processes; <i>Pred.Body</i> : the prediction of body reaction, <i>Sleep.Wake</i> : the perception of sleep-wake cycles; <i>Illness</i> : the self-prediction of the onset of illness. BVAQ: Bermond-Vorst Alexithymia Questionnaire; B1: impairments in identifying feelings; B2: impairments in verbalizing feelings; B3: impairments in fantasizing; B4: impairments in emotionalizing; TAS: Toronto Alexithymia Scale; DIF: Difficulties in Identifying Feelings; DDF: Difficulties in Describing Feelings; EOT: Externally Oriented Thinking					

Discussion

The goal of the present study was to investigate the psychometric properties of the French version of the Body Awareness Questionnaire (BAQ) in a sample of healthy participants in order to study the construct of Alexithymia and its links to the various dimensions of alexithymia in a non-clinical population. This was the first time that the BAQ was adapted and validated in French.

Our results showed acceptable internal consistency and reliability of this translated scale. Based on previous validation study, we suggested that the BAQ could present a good fit with the four or one factorial solution. Indeed, Confirmatory Factorial Analysis (CFA) revealed that a modified four-factor solution fitted correctly the data. Results were better with the four-factor model than with the single factor model. Our results in a French general population of adults support the initial factorial structure of the BAQ (Shields et al., 1989). Regarding correlations between the BAQ, the Toronto Alexithymia Scale (TAS) and the Bermond-Vorst Alexithymia Questionnaire (BVAQ), we found that scores of body awareness were negatively related to scores of alexithymia. This was especially the case for the subscales of the tools that tap into identifying and analyzing emotions. Assuming that low interoceptive awareness (BAQ)

scores indicate alexisomia, this first study reports negative correlations, which indicates that low interoceptive awareness is associated with difficulties dealing with one's own emotional states. In other words, our results showed significant low or moderate correlations between awareness of bodily and affective states, emphasizing both the relatedness and the distinction between alexithymia and alexisomia. This result is in line with a recent study investigating the two constructs as it precise the kind of relations that could exist (Oka, 2020).

We suggest that alexisomia and alexithymia represent two psychological constructs that reflect impairments in the processing of the visceral brain, as had been shown in past research (de Vroege et al., 2018; Maclean, 1949). Health appears to be associated with both emotional and somatic regulatory and homeostatic processes (Tsakiris & Critchley, 2016) intimately related to interoception (Bonaz et al., 2021). Therefore, awareness of bodily sensations and of emotions reflect the ability to access to our own states. Impairments in this awareness represents a path to somatic or mental disorders, as it has been shown with alexithymia (Kojima, 2012b). Moreover, recent reconsideration of the factorial structure of alexithymia TAS-20 pointed out an independant factor that reflect interoceptive abilities and associated with more somatic disorders and medication intake (Fournier et al., 2019). Furthermore, a recent review (Pinna et al., 2020) highlighted the importance of alexithymia in the response to treatment in psychiatry. This underlines the importance of the link between body perceptions and emotions in well-being and prevention of mental health disorders as shown gastrointestinal chronic diseases where difficulties in interoceptive abilities within alexithymia is an important dimension for assessing potential risk for those diseases (Fournier et al., 2020).

Working on alexisomic characteristics of psychopathological patients appears to be relevant as a first step before working on emotional states as assume by mind-body therapies (Li et al. 2019; Cerritelli et al., 2021) and body-oriented psychotherapies (Galbusera et al., 2019). We assume that approaching body awareness from a neutral point of view, that is to say with not affect-related items and constructs could represent a first step in therapeutical interventions. For peoples with impairments in access to affective states, this could represent a first access to internal states before more complex representations based on emotions. Following a neuropsychological model of emotional awareness (Moriguchi & Komaki, 2013), we suggest that the awareness of one's bodily sensations (that is to say, to treat alexisomia) would enable patients to better succeed in becoming more finely and explicitly aware of their own emotional states (treating alexithymia). To this end, the psychometric relations assessed by questionnaires should be replicated in the general population, as well as in clinical populations. These clinical samples could be from somatic and/or psychiatric disorders. Indeed, pain, somatic disorders, as well as eating, addictive disorders seem relevant to investigate the impairment in bodily and affective processing. Moreover, studies using other methodologies, such as experimental or neurophysiological protocols, to assess theses constructs and their relationship should be conducted in a perspective of a multilevel and comprehensive view of mechanisms.

Psychological interventions can be envisaged, around problems of regulation of the emotions which integrate disturbances in the interoceptive awareness. For example, in the context of eating disorders, the

alexisomia component remains to be investigated in the light of this construct, but it is well established that the processing of bodily information is altered and that it can be the object of remediation through the practice of mindfulness (Hölzel et al., 2011; Shankland et al., 2016). Impairments in interoceptive processes related to craving in addictive disorders lead to better understanding patients' alexisomic characteristics (Flaudias et al., 2019). In clinical contexts, assessment of alexisomia (associated with other impaired components of emotional regulation) represents a way of better understanding specific dysfunctions of individuals and evaluating the effects of treatment. This represents a way to better conceptualize difficulties related to interoception and to design the psychotherapeutic treatment based on the patient's characteristics. Behavioral, cognitive and emotional therapies can thus focus on the access to the bodily awareness and its processing with affective states. We suggest that this could be stimulated, fostering new learning, and thus helping to reduce mental health disorders.

Conclusion

Alexisomia is a concept which has recently raised the attention of researchers and clinicians in the same way as alexithymia has been shown to be particularly useful to design treatment and prevention programs. Focusing on interoception processing and impairments could be a means of better understanding emotions (Critchley & Garfinkel, 2017) and would be a relevant target for psychotherapies. Our study suggests that both concepts are related but distinct. Further studies may test how reducing alexisomia can be a first step to reducing alexithymia in general as well as clinical populations. This would help improve knowledge about the main psychological mechanisms which help develop emotional competences and hence improve mental health.

Abbreviations

BAQ: Body Awareness Questionnaire;

BVAQ: Bermond–Vorst Alexithymia Questionnaire;

TAS: Toronto Alexithymia Scale;

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