RIASE
REVISTA IBERO-AMERICANA DE SAÚDE E ENVELHECIMENTO
REVISTA IBERO-AMERICANA DE SALUD Y ENVEJECIMIENTO

APPLICATIONS OF MULTIDIMENSIONAL ASSESSMENT OF INTEROCEPTIVE AWARENESS (MAIA): SYSTEMATIC REVIEW

Joana Machorrinho - Master's student in Relational Psychomotricity. Sport and Health Department. University of Évora. Portugal

Inês Rosário - Master's student in Relational Psychomotricity. Sport and Health Department. University of Évora. Portugal

Maria do Céu Marques - PhD. Coordinator-Professor. Nursing Department. University of Évora. Portugal

José Marmeleira - PhD. Assistant Professor. Sport and Health Department. University of Évora. Portugal

VOL. 3 N.º 1 APRIL 2017

ABSTRACT

Objectives: To assess the available evidence on different applications of MAIA.

Methods: This research followed three sequenced moments, done by two independent researchers. Included only published adult population studies (18-65 years old), which used complete MAIA survey, not only for translation and validation purposes. Data were extracted to predefined tables, showed as a flowchart from PRISMA Statement. Levels of evidence and methodological quality was also assessed.

Results: From 66 original studies obtained only 7 were included for analysis. 5 was observational studies, while 2 were experimental and from all, 4 have a strong methodological quality. MAIA was used in both health and clinical samples, at 7 countries from 2 continents. Mostly it was used for interoceptive awareness assessment, as a global concept but also for is subdimensions analysis.

Conclusion: We suggest more studies with larger and more heterogeneous samples. We concluded that MAIA, when compared with previous questionnaires for interoception assessment, allowed for a more complete and specialized evaluation, but some authors still suggest it can be more complex than it is now. We explore some recommendations for future clinical and scientific applications of MAIA.

Keywords: Interoception; review; awareness; questionnaires.

BACKGROUND

Exteroception, Proprioception, and Interoception are key concepts for understanding human as a biopsychosocial being who promotes bi-directional relationships with the environment. They're all related to different stimulus awareness, like sensitive, muscular and visceral ones, and their impacts have sparked a growing interest in the scientific community[1]. Interoception, as defined by Sherrington at 1906[2], is responsible for internal bodily stimulus recognition and processing, that inform us about our own well-being, emotional regulation, and homeostasis. Between those sensations, we can include temperature recognition, pain, itchiness, tickle, affective touch, visceral sensations, hunger, thirst, breathlessness, etc.[1,3].

According to Wiebking et al.[4], afferent interoceptive information seems to have cortical representation, located in the insula (where emotional processing also occurs), while most recent researches turned up specificating that representation at anterior insular cortex[3]. These insular activities allow an interoceptive awareness and seem to promote

a multilevel integrative representation of body states and of internal experiences such as emotion and pain. The authors also confirmed the activity of GABA neurotransmitter (gamma-aminobutyric acid) on insular regions, evidencing is influence on interoception, as on depressive feelings regulation capacity[4]. GABA is a preponderant component on humor disorders[4] and body tonus regulation[5], so his insula's activity allows a better comprehension about interoceptive awareness as an influent mechanism in emotional regulation and expression, decision making and interoceptive modulation (whether voluntary or not) of variables like heart rate (HR)[3,4].

All of this knowledge contribute to promoting interoception pertinence in clinical practice as well as his important appraisal, repercussions, and various contexts influence. Interoceptive awareness impact on multiple emotional, mental and physical variables, tested through experimental and observational studies, has aroused curiosity about his comprehension on some psychopathologies (eating behavior and addition), movement disorders, body Self-development, and social interaction patterns. Some interoceptive awareness researchers place it as a key element to meditation and stress reduction, supporting mind-body theories. Ainsi, body awareness has been associated to interoception. To biomedical literature, neuroscience and physiology, in body awareness comprehension are implicated proprioceptive awareness (which refers to the conscious perception of joints and muscular tension, of movement, posture, and balance), but also interoceptive one (which refers to visceral sensations as autonomic nervous system ones related with emotions). In line with Mehling et al. prepositions, we can assume that body awareness derives from sensory perception of bodily physiologic states, and may be an interactive system also influenced by beliefs, past experiences, expectations and individual contexts[3].

Each person has a specific sensibility to interoceptive awareness. This specificity and intrapersonal variability have made new methods and assessment tools to be developed. Mostly, it has been assessed trough heartbeat perception tasks, that may involve tracking, monitoring, detection and discrimination tasks[6]. These authors believe that interoception may be more than a global concept, composed by different modalities. Therefore, some questionnaires were developed to evaluate major components of interoception, such as "Body Perception Questionnaire"[7], "Body Awareness Questionnaire"[8] and, based on this last one, "Somatic Awareness Questionnaire (SAQ)"[9]. However, due to an existing lack of distinction between interoceptive awareness, accuracy, and sensitivity, these instruments seem to be too much simplistic at evaluating these differentiated modalities.

To overcome this difficulty, Mehling et al.[10] primarily identified different constructs of body awareness, as well as all the existing assessment instruments. Therefore, they confirmed this necessity, resulting Multidimensional Assessment of Interoceptive Awareness

(MAIA). MAIA has 32 items organized in 8 different subscales: Noticing, related to attention to body changes due to different factors: Not-distracting, that includes the tendency to distract or not of discomfort sensation; Not-worrying, refers to capacity to maintain emotional balance at physical discomfort; Attention Regulation, assess the capacity to maintain body processes attention and control; Emotional Awareness, describes the recognition of bodily physiological changes due to emotions, such as anger and fear; Self-regulation, assess capacity to regulate distress, focusing on body sensations; Body Listening, refers to the tendency to use or not the insight capacity, while listening body actively; and Trusting, that refers to experiencing one's body as a secure place[3,11].

MAIA Psychometric properties were already tested[3], and according to Osher Center of Integrative Medicine official site[12], it has been translated into 13 different languages and validated to 5 different countries: Chile[13], Poland[11], Iran[14], Italy[15], and Germany[16].

Once it is a very appreciated questionnaire across the scientific community, we need to know which applications and interest phenomena for what MAIA has been used, to investigate future clinical and formative applications. Some studies are known that used MAIA in eating behavior disorders, but no review was realized to list all used applications and future recommendations. A previous research made on Cochrane Database of Systematic Reviews, Pubmed and JBI Database of Systematic Reviews and Implementation Reports, proved an absence of reviews about this question, justifying the pertinence of the present systematic review. It follows the recommendations described on JBI Reviewers' Manual guidelines[17].

Review question/objective

The objective of this review is to assess and resume the available evidence on different applications of Multidimensional Assessment of Interoceptive Awareness (MAIA).

More specifically, the review will focus on the following question:

For what variables and populations have MAIA been used as an assessment tool, in adult worldwide population?

METHODS

Inclusion/Exclusion criteria

Attending to the aim of this review, we decided to include for analysis only studies with adult participants (18 to 65 years), where there had been used MAIA as a measuring tool. No geographic criterions were used as exclusion/inclusion criteria. Studies where MAIA was used partially were excluded. Once MAIA is our object of interest, we did not restrict for types of intervention, programs or context.

Types of sources

This review considered only quantitative research designs, including any experimental study designs (randomized controlled trials, non-randomized controlled trials, or other quasi-experimental studies, including before and after studies), and observational designs (descriptive studies, cohort studies, cross-sectional studies, case studies and case series studies). Questionnaire Adaptation and Validation studies were excluded.

Search strategy

The search strategy aimed to find only published studies. A three-step search strategy was used in this review. An initial limited search of B-On and Pubmed was undertaken, followed by analysis of the index words used to describe the article. A second search was done by June 13, 2016, using all identified keywords was carried out across the following databases: B-On, PubMed, Cochrane Central Register of Controlled Trials, The Joanna Briggs Institute (JBI), Web of Science and Science Direct. Only articles published in last 5 years (2011 to present) were searched, and we used the English language keywords "interoceptive awareness" AND "multidimensional assessment of interoceptive awareness" at an initial phase. Secondly, we've taken a new research on B-on and Pubmed with "interoception" AND "multidimensional assessment of interoceptive awareness".

Thirdly, and at same day, the reference list of all identified reports and articles was searched for additional studies. Only studies published in English were considered for inclusion in this review.

Data Extraction

After database research, duplicated articles were excluded. A first screening process assessed the more relevant articles to the review, based on the information provided in title and abstract, by two independent reviewers. The full article was retrieved for all relevant studies. Studies identified from reference list searches was also assessed for relevance ba-

sed on the study's title and authors. Based on full texts, two reviewers examined whether the studies conform to the inclusion criteria.

Assessment of methodological quality

Quality assessment was used to gain an understanding of the relative strengths and weaknesses of the body of evidence, according to recommendations of Center for Reviews and Dissemination[18].

This systematic review aimed to provide a broader picture of the existing studies that used MAIA as a valuable measure for different variables. Hence, we first classified the studies by Levels of Evidence, according to the ones described by JBI[19], and then assessed methodological quality of all studies using Quality Assessment Tool for Quantitative Studies, developed by the Effective Public Health Practice Project (EPHPP)[20], which classifies each study as having strong, moderate or weak methodological quality. Both processes described was undertaken by two independent reviewers. Disagreements arose about classifications were resolved through discussion.

Extraction and synthesis of the results

Quantitative and qualitative data wore extracted from papers included in the review using a charting table align to the objective and question of this research. The overview of the reviewed material was synthesized and presented in a tabular summary.

RESULTS

In databases, we identified 62 studies, and added another 4 from our previous researches. After removing all duplicates (intra and inter databases), we obtained 43 articles. From theses, 18 were excluded for not being relevant, and after applying inclusion and exclusion criteria we selected 7 final articles for revision. This process is presented in a flow chart (fig.1).

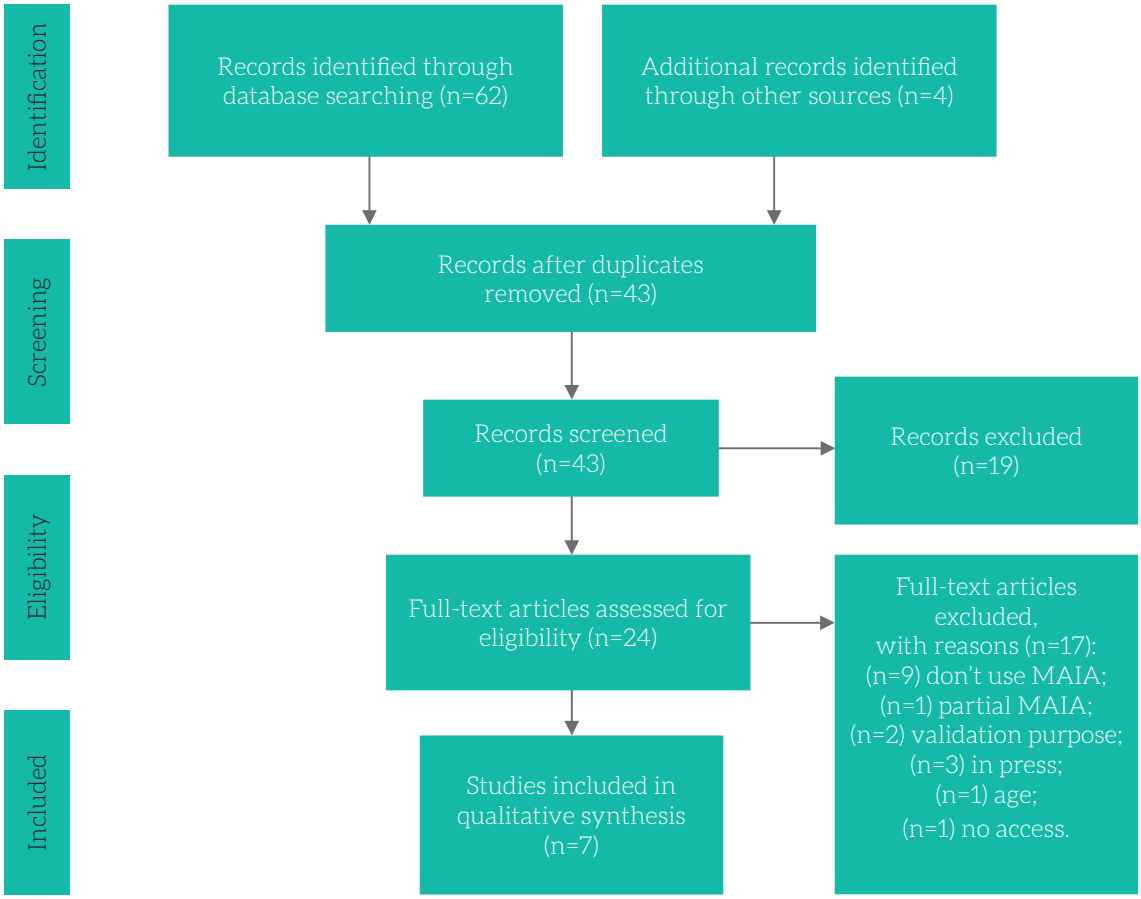

Figure 1 – Flowchart of PRISMA Statement[21].

Studies Characteristics

From the 7 articles revised, 2 were experimental studies and 5 were observational or cohort studies. They all used a complete version of MAIA as an assessment tool, and their study results were presented and discussed mainly in a quantitative form. Two of them primarily made a translation of MAIA for the study[15,16].

Methodological Quality

Following all the steps described in methods sections and best recommendations found, the results of classification by levels of evidence and methodological quality can be seen in table 1. Four out of seven studies have shown strong quality[11,16,24,25], what helps us analyzing the results in a more conclusive way and propose more feasible recommendations for future investigations and practice.

Table 1 - Classification of the revised studies by levels of evidence and methodological quality

Reference	JBI Levels of Evidence[19]	Methodological Quality[20]
Brytek-Matera et al., 2015[11]	3c – cohort study with control group	Weak
Calí et al., 2015[15]	1c – randomized control trial	Strong
Bornemann et al., 2015[16]	3c – cohort study with control group	Strong
Borg et al., 2015[22]	3e – observational study without a control group	Moderate
Lyons et al., 2015[23]	3e – observational study without a control group	Moderate
Maqueda et al., 2016[24]	1d – pseudo-rct	Strong
Mehling et al., 2013[25]	4b – longitudinal study	Strong

Results

Starting with the main objective of this review, the results were synthesized on table 2, such as the most relevant data from the 7 studies revised, including sample characteristics, type of intervention (when applied), variables assessed with MAIA, results obtained and country of origin.

Population

Analyzing table 2, we can see that MAIA has been used in different populations, both in a matter of geographical location (applied in 7 countries from two different continents), and the dichotomy health vs disease. When we look at the pathological samples of the studies, Fibromyalgia and Chronic Low Back Pain highlights, in patients from primary care units. In another hand, MAIA seems to have been more frequently used in healthy samples, especially for young individuals (psychology students and young adults experienced with drugs use), but also with adults, age between 40 and 63 years old, who practice fitness or meditation. Samples with no specific differentiation characteristic were also found in these studies.

Table 2 - Most relevant results extracted

Sample health characteristics	Intervention	Variables assessed by MAIA	Results	Country
Fibromyalgia[22]	None	Interoceptive body awareness and Body attention	The differences were not statistically significants between fibromyalgia pacients and control group, at selfawareness and body awareness.	France
No physical or psychologial problems[16]	3 months of contemplative traning: body scan and breath meditation	Interoceptive awareness	Training group - all MAIA subscales showed significantly higher scores at follow-up. Control group - no significative changes observed. No significant changes were observed at noticing , not- worrying and not-distracting subscales. Higher differences were found in Self-regulation, Attention-regulation and Body listening.	Germany
Women practicing fitness[11]	Fitness	Body perception awareness	In fitness practitioners, body self awareness showed correlation with interoceptive awareness and with a better self corporal. In this group, Noticing subscale and global esteem predicted body awareness.	Poland
Healthy psychology students[15]	None	Interoceptive awareness	Significant correlations between emotional susceptability and four of the eight MAIA subscales (Not-worrying, Attention regulation, Emotional Awareness and Trusting).	Italy
Comunity members and students[23]	None	Interoceptive awareness subscales	Men scored significantly higher than women on the Emotional Reaction and Attention Regulation dimension, whilst women scored significantly higher on Awareness of Body Sensation and Mind Body Integration.	United Kingdom
Healthy individuals with past experience on drugs use (without history of drugs or alchool adition or any psychiatric disorders)[24]	Salvinorin-A administration	Interoceptive awareness subscales	Attention Regulation and Trusting subscales showed significant changes: high doses of Salvinorin-A were correlated with low Attention regulation; Emotional Awareness also seemed to dimish when a highest dose of Salvinorin-A was administered.	Mexico
Primary care pacients with low back pain and teachers and students of mind-body practices[25]	None	Interoceptive awareness subscales	Longitudinal comparison between both groups showed important diferences in all eight dimensions of interoceptive awareness.	United States of America

Variables

Mehling et al.[3], in his study of development and validation of MAIA, concluded that this instrument has adequate psychometric properties, such as good reliability and internal consistency coefficient (Cronbachs alpha for eight subscales: .69, .66, .67, .87, .82, .83, .82, .79), as well as relatively low interscale correlations, showing independency between them (from .16 to .60). This ultimate factor is the reason some other authors from the articles reviewed here point for analyzing some subscales separately[3].

Therefore, as we can see in table 2, the most studies used MAIA to access interoceptive awareness (two of them evaluate the global concept and the other three evaluate each one of the subscales), but MAIA was also used to access another components such as body attention, and body perception awareness.

DISCUSSION

Although we can find already several studies with the aim of evaluating the interoception in different populations and contexts, this is the first systematic review to focus only on the MAIA applications, based on the fact that it is a multidimensional evaluation tool and, therefore, allows us to find interoceptive variability in more diverse contexts. When interoception began to be investigated more thoroughly, Craig[1] was one of the investigators that introduced the idea of existing intra and interpersonal variability in interoceptive abilities. This allowed scientific research to advance to experimental and observational studies evaluating this construct in both a transverse and longitudinal design.

In this review we verified that even using of MAIA as an assessment tool, this intra and interpersonal variability continues to be detected, either in a healthy population[11, 15, 16, 23, 24, 25] or with specific pathology, such as fibromyalgia[22] and lumbar pain[25].

It turned out interesting to explore some facts about pathologic samples, such as the influence that pain and discomfort seems to have on interoceptive awareness[22,25]. For the majority of the studies here revised, MAIA was not used alone[11,15,16,22-24], but complementarily to other assessment tools for differentiating the global concept of individual interoceptive awareness, from some kind of focused attention that can be directed to one specific body part. Besides, some of the results found on population with fibromyalgia suggest that better global interoception does not necessarily means low focused interoception, corroborating the thesis of a general hypervigilance existing in this population[22].

Returning to the idea of existing intra and interpersonal variability in interoceptive abilities, one study verified through MAIA some possible relation between personality traits and interoception patterns in healthy populations[23], results reinforced by another study here revised that indicate emotional susceptibility and neuroticism as being the personality traits that most relate to specific interoception patterns[15].

The specificity of constructs and correlations assessed in these studies, and even their methodological quality, makes us to believe that at least some of the associations referred were only possible due to multidimensionality of MAIA, what allows to research more deeply and diverse interoception patterns, in comparison to other assessment tools.

Maybe because of these diversity of inferences and hypothesis MAIA allows us to explore, it has been used also to assess the efficacy of some therapeutic and recreational interventions. One of these articles evaluated interoceptive awareness of healthy women practicing fitness, involving a non-practicing control group. Since they didn't found significant changes, they can assume (also based on some other previous studies referred at discussion area) that "physical activity itself is not a factor influencing body awareness", suggesting the need of association with mediation or other mind-body integration practices[11]. This suggestion was partially corroborated by another study revised which verified higher levels of interoceptive awareness in individuals who practice contemplation training and meditation for a long time, and post-practice levels were even higher in individuals with lowest initial scores of interoceptive awareness[16].

The association of interoception dimensions with physical and mental training programs has already been partially explored using other assessment instruments however, MAIA was the chosen one to evaluate the outcomes of an intervention based on opioids exposure. In this study MAIA contributed for a better discrimination of behavioral side effects, such as interoceptive dysfunction and depersonalization in individuals who took the opioid (Salvinorin-A)[24]. Here, MAIA was essential for authors to formulate more adequate medical prescription recommendations.

CONCLUSION

Through this systematic review, we were able to make some pertinent conclusions on what MAIA applications is concerned. It can be a very useful tool to development and evaluation of therapeutic programs which aim mind-body integration, but also for creating more efficient and specialized guidelines at health and education intervention policies[25].

Future recommendations

More and larger studies are needed so we can rely even better on MAIA capabilities as an assessment tool for interoceptive awareness. It should be developed more applications in healthy samples, relating this construct with personality traits but also with psychological characteristics, relational and affective styles, emotional and behavioral self-regulation, and learning styles.

Plus, some authors referred that MAIA can be even more detailed and complex so it can also assess interoceptive accuracy, which evaluation seems to be less represented with MAIA.

Conflicts of interest

There are no conflicts of interest.

REFERENCES

1. Craig AD. How do you feel? Interoception: the sense of the physiological condition of the body. Nat Rev Neurosci. 2002;3(8):655–666.

2. Craig AD. Interoception and emotion: A neuroanatomical perspective. In: Lewis M, Haviland-Jones JM, Barrett LF, editors. Handbook of emotions. New York: Guilford Press, 2008; p. 272 – 290.

3. Mehling WE, Price C, Daubenmier JJ, Acree M, Bartmess E, Stewart A. The Multidimensional Assessment of Interoceptive Awareness (MAIA). PLoS One. 2012;7(11):e48230.

4. Wiebking C, Duncan NW, Tiret B, Hayes DJ, Marjańska M, Doyon J, ... & Northoff G. GABA in the insula - a predictor of the neuronal response to interoceptive awareness. Neuroimage. 2014; 86:10-18.

5. Teive HA, Zonta M, Kumagai Y. Treatment of spasticity: an update. Arq Neuropsiquiatr. 1998;56(4):852-858.

6. Herbert BM, Pollatos O. The body in the mind: on the relationship between interoception and embodiment. Top Cogn Sci. 2012;4(4):692-704.

7. Porges S. Body perception questionnaire. Laboratory of Developmental Assessment: University of Maryland; 1993.

8. Shields SA, Mallory ME, Simon A. The body awareness questionnaire: Reliability and validity. J Pers Assess. 1989;53(4):802-815.

9. Gijsbers van Wijk CMT. Sex differences in symptom perception: a cognitive-psychological approach to health differences between men and women. Doctoral Dissertation: University of Amsterdam; 1995.

10. Mehling WE, Gopisetty V, Daubenmier J, Price CJ, Hecht FM, Stewart A. Body awareness: construct and self-report measures. PloS One. 2009;4(5):e5614.

11. Brytek-Matera A, Koziel A. The body self-awareness among women practicing fitness: a preliminary study. Pol Psychol Bull. 2015;46(1):104-111. doi: 10.1515/ppb-2015-0014

12. Osher Center for Integrative Medicine. Multidimensional Assessment of Interoceptive Awareness [Internet]. Acessed Jun 2016. Avaliable from: http://www.osher.ucsf.edu/maia/4

13. Valenzuela-Moguillansky C, Reyes-Reys A. Psychometric properties of the multidimensional assessment of interoceptive awareness (MAIA) in a Chilean population. Front Psychol. 2016;6:1-13. doi: 10.3389/fpsyg.2015.00120

14. Abbasi M, Ghorbani N, Hatami J, Lavasani MG. Validity and Reliability of Multidimensional Assessment of Interoceptive Awareness in Iranian Students. Faculty of Psychology and educational Sciences, University of Tehran; 2015 (Unpublished report). Acessed Jun 2016. Avaliable from: http://www.osher.ucsf.edu/maia/4

15. Calí G, Ambrosini E, Picconi L, Mehling WE, Committeri G. Investigating the relationship between interoceptive accuracy, interoceptive awareness, and emotional susceptibility. Front Psychol. 2015;6:1-13. doi: 10.3389/fpsyg.2015.01202

16. Bornemann B, Herbert BM, Mehling WE, Singer T. Differential changes inself-reported aspects of interoceptive awareness through 3 months of contemplative training. Front Psychol. 2015;5:1-13. doi: 10.3389/fpsyg.2014.01504

17. The Joanna Briggs Institute. Reviewers' Manual 2014 Edition. Adelaide: The Joanna Briggs Institute; 2014.

18. Centre for Reviews and Dissemination. Systematic reviews: CRD's guidance for undertaking reviews in health care [Internet]. Acessed Jun 2016. Avaliable from: http://www.york.ac.uk/inst/crd/ pdf/Systematic_Reviews.pdf

19. The Joanna Briggs Institute. Supporting for the Joanna Briggs Institute Levels of Evidence and Grades of Recommendation [Internet]; 2014. Acessed Jun 2016. Avaliable from: http://joannabriggs.org/assets/docs/approach/Levels-of-Evidence-SupportingDocuments-v2.pdf

20. Effective Pubic Health Practice Project (Ephpp). Quality Assessment Tool for Quantitative Studies [Internet]; 2009. Acessed Jun 2016. Available from: http://www.ephpp.ca/tools.html

21. Moher D, Liberati A, Tetzlaff J, Altman DG, The PRISMA Group. Preferred Reporting Items for Systematic Reviews and Meta- Analyses: The PRISMA Statement. PLoS Med. 2015;6(7):e1000097. doi:10.1371/journal.pmed1000097

22. Borg C, Emond FC, Colson D, Laurent B, Michael GA. (2015). Attentional focus on subjective interoceptive experience in patients with fibromyalgia. Brain Cogn. 2015;101:35-43.

23. Lyons M, Hughes S. Feeling me, feeling you? Links between the Dark Triad and internal body awareness. Pers Individ Dif. 2015;86:308-311.

24. Maqueda AE, Valle M, Addy PH, Antonijoan MR, Puntes M, Coimbra J, Ballester MR, Garrido M, González M, Claramunt J, Barker S, Johnson MW, Griffiths RR, Riba J. Salvinorin-A Induces Intense Dissociative Effects, Blocking External Sensory Perception and Modulating Interoception and Sense of Body Ownership in Humans. Int J Neuropsychopharmacol. 2016:1-14. doi:10.1093/ijnp/pyv065

25. Mehling WE, Daubenmier J, Price C, Acree M, Bartmess E, Stewart AL. Self-reported interoceptive awareness in primary care patients with past or current low back pain. J Pain Res. 2013;6:403-418. doi: 10.2147/JPR.S42418

Correspondence: jmachorrinho@gmail.com