Postural control and body awareness in mental disorders. Topic review

El control postural y la conciencia corporal en los trastornos mentales. Revisión de tema

Controle postural e consciência corporal em transtornos mentais. Revisão de tópico

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Abstract: The affectation of higher mental functions as a consequence of mental disorders generates alterations in the control of movement and corporal conscience from the lived, perceived, and represented body. Mental functions are recognized as essential pillars for the development of the human motor system.**Objective:** To evidence the relationship that exists between postural control alterations and body awareness with mental pathologies, described from Physiology and Pharmacology, and the sequelae within human body movement and the acquisition of motor skills. **Materials and methods:** a review of the literature from the search for information related to terms in Spanish and English.**Results:** twelve articles in different academic journals were selected; the exposed information allowed us to describe the altered physiological processes in the central nervous system, mental disorders, body awareness, involvement of psychopharmacology, and considerations regarding the theories on the mindbody relationship. **Conclusions:** Although the literature recognizes the bodymind duality, its importance within human body movement, and the alterations that mental disorders can generate in motor skills and postural control, more research on this association is necessary to find the significance of the results.

Keywords: Mental health, postural balance, mental disorders, proprioception and interoception.

Resumen: La afectación de las funciones mentales superiores como consecuencia de trastornos mentales, genera alteraciones en el control del movimiento y la conciencia corporal, desde el cuerpo vivido, percibido y representado. Las funciones mentales son reconocidas como pilares esenciales para el desarrollo del sistema motor en el humano. **Objetivo:** Evidenciar la relación que existe entre las alteraciones del control postural y la conciencia corporal con patologías mentales, descritas desde la Fisiología y la Farmacología y, las secuelas dentro del movimiento corporal humano y la adquisición de habilidades motoras. **Materiales y métodos:** revisión de la literatura a partir de la búsqueda de información relacionada con términos en español e inglés. **Resultados:** se seleccionó doce artículos en diferentes

revistas académicas. Con la información expuesta se describe los procesos fisiológicos alterados en el sistema nervioso central, los trastornos mentales, la conciencia corporal, la implicación de la psicofarmacología y las consideraciones frente a las teorías sobre la relación mente-cuerpo. **Conclusiones:** la literatura reconoce la dualidad cuerpo-mente, su importancia dentro del movimiento corporal humano y, las alteraciones que los trastornos mentales pueden generar en la habilidad motora y el control postural; sin embargo, es necesaria una mayor investigación sobre esta asociación, para encontrar significancia de resultados.

Palabras clave: salud mental, equilibrio postural, trastornos mentales, propiocepción e interocepción.

Resumo: A afetação das funções mentais superiores em decorrência dos transtornos mentais gera alterações no controle do movimento e na consciência corporal, a partir do corpo vivido, percebido e representado. As funções mentais são reconhecidas como pilares essenciais para o desenvolvimento do sistema motor em seres humanos. **Objetivo**: Evidenciar a relação existente entre as alterações do controle postural e da consciência corporal com as patologias mentais, descritas a partir da Fisiologia e da Farmacologia, e as sequelas no movimento do corpo humano e na aquisição de habilidades motoras. **Materiais e métodos**: revisão da literatura a partir da busca de informações relacionadas a termos em espanhol e inglês. **Resultados**: doze artigos em diferentes periódicos acadêmicos foram selecionados; as informações expostas permitiram descrever os processos fisiológicos alterados no sistema nervoso central, transtornos mentais, consciência corporal, envolvimento da psicofarmacologia e considerações face às teorias sobre a relação mente-corpo. **Conclusões**: embora a literatura reconheça a dualidade corpo-mente, sua importância no movimento do corpo humano e as alterações que os transtornos mentais podem gerar nas habilidades motoras e no controle postural, mais pesquisas sobre essa associação são necessárias para encontrar a significância dos resultados.

Palavras-chave: saúde mental, equilíbrio postural, transtornos mentais.

Introduction

Postural control is an essential element of human body movement that allows acquiring complex motor skills and maintaining positions to develop, both activities of daily living (ADL) and basic daily activities (BDA), thanks to the union of several systems that facilitate the control of voluntary movement, as argued by Duclos et al. (2017).

Thus, in the face of evidence of alterations in the central nervous system (CNS), such as mental health disorders, mainly caused by impairment of higher mental functions (HMF), executive functions, and affective and behavioral processes, which are associated with severe impairments in individual functioning and in the context (Carrasco et al., 2015), it constitutes an accumulation of factors that produce functional impairment and, therefore, affectations at the neuromuscular level in all aspects covered by postural control,

as stated by Burbano et al. (2016), since "they are closely related aspects and different levels of functioning of the central nervous system are involved in it" (p. 83).

As a consequence of the affectation of the HMF and, therefore, of the neurological system, alterations in movement control and posture maintenance are generated, because any affectation in cognitive control and, mainly, in functions such as attention and memory (Cano de la Cuerda et al., 2016), has repercussions on the anticipatory or adaptive responses to movement, causing changes in sensory-motor aspects and in the effective response through movement, to possible intrinsic and extrinsic demands and, from this, changes are made in motor control, in the way of adapting to movement and in how to be aware of it, starting from body recognition to the motor act as the ultimate goal.

Thus, it is intended to understand how the lived, perceived, and represented body is a fundamental pillar for the development of the motor system in the human being and, even more, to obtain the consciousness of it, "because the body is skillful, competent, and correlative to its environment" (García, 2018, p. 305) since, despite the fact that its consolidation is obtained from childhood, it can be modified by different contextual and own factors such as psychiatric alterations and, it is there where there is complication in the acquisition of motor skills, due to changes in the superior control at the functional level of the nervous system, which will generate multifactorial consequences in the different systems that compose the organism and that further compromise the processing of movement information.

All this, combined with the possible adverse effects that can be caused by chronic consumption of psychotropic drugs within the motor system, indicated as extrapyramidal signs or adverse effects to treatment, will lead to poor control of movement in the user with psychiatric pathology (Carrière et al., 2015), added to alterations in postural control, inherent in the development or evolution of these pathologies and, with it, limiting physical health, such as deconditioning, immobility, loss of balance when walking, risk of falls and functional limitation that, glimpsed from the biopsychosocial approach, are summarized in situations of disability (Hartford et al., 2017).

Hence, mental disorders, in addition to being neurodegenerative diseases, are a priority public health problem because, in addition to having important comorbidity, "due to their chronicity, they generate high levels of disability as a result of the affectation of body awareness and postural control" (Beauchamp et al., 2016, p. 16), as broad, basic and essential components for the development of the intentional motor act and task-focused human body movement, summarized in a single word: functionality.

Methodology

A study derived from a literature review was conducted, through scientific articles published between 2016 and 2020. The databases used were: PubMed, Scielo, PEDro, and Scopus. For the bibliographic search, terms such as: DECS and MESH and/or, keywords and, the principle of combining the search with words of the general subject and words suggested by the search engine were used. The following English terms were used for the review: mental health, postural balance, mental disorders, proprioception, and interoception. Subsequently, titles and abstracts were reviewed to identify relevant studies within the topic and a second review was to assess whether the studies met the predetermined inclusion criteria; finally, the selection and interpretation were made to initiate the thematic discussion (Figure 1).

Selection of studies - inclusion criteria: studies published in English and Spanish, descriptive studies, case studies or systematic reviews on populations with mental disorders and assessments of their postural control and/or, randomized controlled trials (RCT) that compared pre- and postintervention values, studies that included evaluations or interventions in adult users with mental disorders institutionalized or in the community. The following were excluded: articles without full text and research on users with psychoactive substance use.

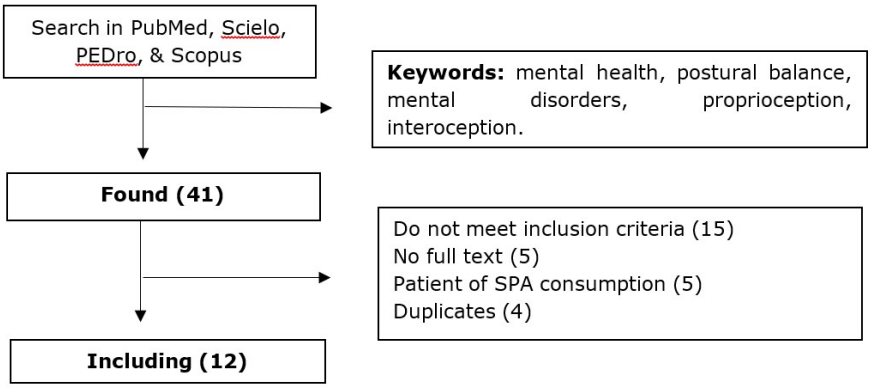

FIGURE 1
Item selection flowchart

Postural control and mental disorders

Understanding that the control of movement and the consciousness of the body itself, from the experience, perception, and representation is one of the most complex aspects in the human being and, even more so when suffering from a pathology or mental disorder, through this thematic review we intend to recognize, based on scientific evidence, postulates that consolidate the knowledge regarding the affections in the human body movement as a consequence of psychiatric disorders, highlighted for many years and until today by the World Health Organization (WHO, 2004), as a public health problem; therefore, there is a need to analyze its consequences concerning the objective of the study, as professionals in Physiotherapy.

From this point, it is necessary to identify, initially, the importance of postural control, understood as the ability to be able to control the position of the body in space, determined by a complex interaction between the musculoskeletal and neurological systems (Cano de la Cuerda et al., 2016) and, which aims to connect the relationship between the person-task-environment triad, so that the human being moves with a goal and can be functional (Cieślik et al., 2019). To achieve this optimal relationship, HFM, and psychological and behavioral processes have been highlighted as fundamental physiological aspects, due to the superior control exerted by the CNS to be able to generate controlled and voluntary movement.

On the other hand, it is significant to understand that mental disorders, defined by the American Psychiatric Association (2014) as "syndromes characterized by a clinically significant alteration in the cognitive state, emotional regulation or behavior of an individual, reflecting a dysfunction of the psychological, biological, or developmental processes underlying his mental function" (p. 216), are disorders usually associated with significant stress or disability, so "it is evident the conceptual relationship and the implications that this type of pathologies generates in the human being, from a psychosocial and integral component of the individual" (Feldman et al., 2019, p. 3), as a physical and emotional being that fulfills a role in his or her community.

Body movement and mental health

Following the evidence review, different research findings converge that emphasize the existing relationship between movement and an individual's mental health, as argued by Lahousen and Kapfhammer (2018):

> Any somatic or bodily activation related to posttraumatic psychological or psychiatric events is typically coupled with a perceptual amplification of physical sensations and a predominant bodily focus that often represents a catastrophic environment of affective and cognitive processing because of systemic stress. (p. 479)

...therefore, it is understood that there is a direct relationship between mental health alterations and the body somatization processes that these entail and, therefore, with the alteration of superior control, changes in physical health, an increase of comorbidities and disability due to the minimum control of movement due to the imbalance between aferences and eferences, which imply functional disorganization of the CNS.

According to this approach, Martin et al. (2016) have delimited that "affect and cognition are not only reflected in body posture and movement, but also, they are considerably influenced by each other" (p. 483); that is, they are two transversal elements that need to be in balance to supply the functional needs of the human being; moreover, it has been shown that different movement qualities such as, for example, the so-called movement rhythm, are affected in psychiatric conditions of a psychotic nature, altering coordination, specific movement inhibition, perception, and, therefore, effective movement (Auer et al., 2018).

Because of this type of motor aspects, motor control becomes even more complex, as evidenced in users with dementia, as in the study by Toots et al. (2016): 83% of their target population were people with Alzheimer's disease, with concomitant difficulty in the transfer of motor skills, due to their cognitive impairment. It has also been reported that these alterations generate more loss of task specificity and functionality, due to poor ability to use acquired skills in new contexts (Todri et al., 2020), thus corroborating the balanced interaction that must exist in these processes, for the achievement of optimal postural control and movement that is possible to transfer to everyday situations and ADLs.

Discriminating the evidence at the regional level, the study by Burbano et al. (2016) sought the existing relationship between mental disorders and balance in neuropsychiatric patients; 60% of the evaluated population showed changes in aspects of static balance, especially with the decrease in the base of support, which generates a greater risk of falls and indicates that psychotic pathologies occur with underlying neurological signs, due to the damage of subcortical structures that cause difficulty in planning and executing a motor task (Rojas-Bernal et al., 2018; Gunaydin & Kreitzer, 2016).

Mental disorders and movement control

In addition to this general context with respect to movement in people suffering from psychiatric disorders, within the affections of the neuromuscular system are included some sensory aspects that are determinant for the execution of motor acts, such as, for example, visual abilities, because it is a sense that contributes significantly in the modulation and precision of motor responses, as stated by South American authors such as Torales et al. (2020) and Robles et al. (2010).

The presence of visual perceptual disturbances also has an effect on the functional outcomes of patients with schizophrenia, both in their cognition and in their functioning in the community. Positive and significant relationships have been found between abnormalities in motion perception and have even been determined as "a risk factor for the occurrence of aggravating psychotic symptoms such as suicidal ideation" (Baldin et al., 2016, p. 2). Thus, it is understood that the visual system and its damage by alterations in major neurotransmitters at the pathophysiological level such as dopamine (Tregellas et al., 2019), where the dysfunction of NMDA[1] and GABA[2] systems are also involved in schizophrenia, are factors that, at the same time, modulate visual processing and, therefore, generate neurotoxic damage that will affect the control of voluntary movement in relation to temporary space perception, an important element when generating protective reactions to environmental stimuli and changes in any of the biomechanical aspects necessary in the maintenance of a posture.

In addition to these perceptual alterations or agnosia that the user may suffer from, there are also deficits in multisensory integration and the inability to perceive one's own intracorporal signals. Ardizzi et al. (2016) conducted a study of these elements in users with schizophrenia and named them as the interoception ability, evaluating the possible association between interoceptive accuracy against movement and patients'

symptomatology through tests verifying the perception of chest movement and heartbeat, finding for the first time as a result, that these patients have a reduced sensitivity to their internal body signals, indicating also, a weak body property and a hyper-excited nervous system (Chamard-Witkowski et al., 2019), there is an impaired interoceptive accuracy and, the more positive or psychotic signs exist in a mental entity, the lesion will progressively increase and, motor accuracy due to the damage of cortical areas will be particularly affected.

To this sum of sensory and motor complications is added the medical treatment for these disorders, which increases and generates a greater risk of alteration of movement, posture, and, therefore, their control, since psychotropic drugs are classified as highintensity drugs, that act against the CNS control using neurotransmitters such as dopamine and acetylcholine (Domenech-Cebrían et al., 2019), which, despite decreasing the signs of mental illness, induce side and adverse effects involving functionality and body movement (Martino et al., 2018). It is evidenced that, the drugs used in patients with schizophrenia of antipsychotic type and first generation, bring as a consequence, a greater amount of extrapyramidal signs such as dystonia and akathisia, but, in the same way, the second generation antipsychotics, which are more used in clinical practice, generate relevant changes such as tremor. Although the findings in these studies were not significant, they are an aspect that mitigates the possibilities of obtaining optimal conditions of movement, due to the obligatory nature of the medication for treatment and, the maintenance of the users' conditions at a psychic level.

All the mentioned aspects lead to re-think in the consolidation of theories that comment that mind and body are one and, it is there when corporeality is relevant within how and why the individual moves; therefore, Cramer et al. (2018) in their research on users with chronic pain due to mental disorders conclude that postural awareness is associated with the intensity of the perception of stimuli, such as, for example, the noxious sensation of pain that, being negative, generates physical impairments and has an impact on body image, validating that "the perceived connection between mental and physical processes reflects a common direction of an individual's plans or desires and their bodily desires" (p. 109); despite this, the authors refer to the existence of biases in their evaluation, due to the difficulty in evaluating users and the minimal tools themselves as professionals in rehabilitation for the identification of movement alterations in them (Carrière et al., 2015). Consequently, HFM conditions such as agnosia and other essential functions, make individuals feel disconnected from their own body; this corroborates that, movement is a reflection of the mind and, therefore, it is necessary to determine the levels of intracorporal attention, since these elements allow inferring what the motor response capacity is and what possibilities the individual has to respond to emotional demands, which will be different in each one, even more so when talking about a population with psychiatric background (Espinoza et al., 2015).

Under this scenario, it is necessary to understand that the human being and its HFM create a movement and that a container is necessary for them, such as the ascending reticular activating system (RAS), so that it activates the nervous system and promotes effective functioning of them, which suggests that a content or some HFM with deficits will indicate the initial loss of self-awareness and, as expressed by Martin et al. (2016), "attention deficits can be caused by the fragmentation of action and thought units, generating the dis-automation of habitual bodily actions" (p. 483) and, consequently, "difficulty in performing motor skills and acts previously learned and, likewise, in basic physiological processes" (Kogan et al., 2018, p. 297), which are pillars for the "continuous motor and sensory processing in higher areas and the development of ADL and BDA achieved, in their majority, through the mobility factor, which will allow the participation of the individual" (Choperena et al., 2019, p. 4).

In addition to this, it is possible to understand that the user with a psychiatric diagnosis, presents or not with cognitive deficits of different severity that cannot be generalized for all individuals and that neurological development and the acquisition of complexity in the functioning of the CNS will allow the development of specific skills at the motor level, which must be specifically evaluated and identified, accurately determining

their real involvement in the control of voluntary movement and corporeality, understood as the relationship between movement, action, and sensory perception.

Thus, it must be understood that a single unit, made up of the CNS, the effector organs of movement, and all the systems involved in their control, confirms that the body, through its mobility, demonstrates many more aspects than just the indemnity of a musculoskeletal system; then, the consolidation and maintenance of the lived, perceived, and represented body is necessary to obtain an adequate postural control and an awareness of movement that, although it has been consolidated since childhood thanks to pathological, physiological, and environmental processes, can be seen altered and, generate complex consequences such as falls, loss of balance and, of very complex patterns in the human being such as walking, fundamental from a functional point of view in the individual; its reorganization will depend on exhaustive rehabilitation processes that, ultimately, combine the cognitive and motor aspect, for the performance of tasks in daily life.

Conclusions

It is important to recognize the body-mind duality and, even more so, in users who suffer from mental disorders, to understand that the relationship with postural control goes beyond physiological processes at the CNS level and allows us to understand the significance of human body movement and its intentionality, which broadens the spectrum of analysis of these alterations, not only from Psychiatry but also from the complementarity of other disciplines such as Physiotherapy, which studies these processes from a vision of movement and opens the doors to a vital complement in the treatment of motor alterations in this type of users, something that, in essence, has reported significance in some investigations.

Postural control involves many motor aspects commanded by the CNS, which are physiologically affected by mental pathologies, which modify the dynamics of voluntary movement and body control, generating complications in biomechanical aspects such as the base of support, balance, the timing of the movement and, finally, the acquisition of motor skills in the task, this being the explanation of the motor dysfunctions found in these patients.

To conclude, the user with a mental disorder, rather than an individual with emotional and behavioral disorders, represents an individual with deeper movement disorders, such as body awareness, due to the initial damage to the body schema and body interoception, as important elements in the represented body, which are based on postural control and which require comprehensive physiotherapeutic care; hence the importance of being included in the rehabilitation team and mental health care services.

Conflicts of interest

The authors of this article declare that they have no conflicts of interest in the work presented.

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Notes

[**1**] N-methyl-d-aspartate

[**2**] Gamma-aminobutyric acid