A HIPÓTESE FISIOLÓGICA DO USO DA DANÇA PARA POTENCIALIZAR AS EXPRESSÕES HUMANAS: UMA REVISÃO

THE PHYSIOLOGICAL HYPOTHESIS OF USING DANCE TO POTENTIATE HUMAN EXPRESSIONS: A REVIEW

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Resumo

A dança é uma das manifestações mais antigas da humanidade, e instiga pesquisas diante de suas bases das funções cerebrais. Sendo assim, o presente estudo tem por objetivo compilar e discutir de forma sucinta as principais hipóteses fisiológicas sobre a neurociência da atividade com dança que, tornam plausível a sua utilização como forma potencializadora de expressões humanas. Revisão bibliográfica, utilizando artigos publicados nas bases de dados Scielo, Pubmed, Lilacs e Cochrane, e descritores: dance, ballroom dance, music, brain, pleasure, desire, emotions, interpersonal relations, sendo selecionados estudos de acordo com a relevância e sua correlação com o tema proposto para investigação. Foi possível, através de hipóteses fisiológicas tornar plausível a utilização da dança, como potencializadora das expressões humanas de prazer, desejo, padrões emocionais e da interação social. No entanto, ainda tornam-se necessários futuros estudos, o que apoiarão o crescimento desta atividade no campo multidisciplinar e sua possível implicação clínica.


Abstract

Dance is one of the oldest manifestations of mankind, and it instigates research before its bases of the cerebral functions. Thus, the present study aims to compile and discuss succinctly the main physiological hypotheses on the neuroscience of dance activity, which make plausible its use as a way of enhancing human expressions. Bibliographical review, using articles published in the databases scielo, pubmed, lilacs and cochrane, and descriptors: dance, ballroom dance, music, brain, pleasure, desire, emotions, interpersonal relations, being selected studies according to relevance and their correlation with the proposed theme for research. It was possible, through physiological hypotheses to make plausible the use of dance, as a potentiator of human expressions of pleasure, desire, emotional patterns and social interaction. However, further studies are still necessary, which will support the growth of this activity in the multidisciplinary field and its possible clinical implication.

Keywords: Central Nervous System. Pleasure. Emotions. Interpersonal relations
Introduction

Dancing is one of the earliest manifestations of mankind, and it is currently considered a widely spread form of human expression\(^1,2\).

Some studies have been conducted to assess the benefits from dancing, by considering\(^3,4,5,6\) the possibility of using dancing as a physical activity linked to music\(^7\) and to the capacity of integrating physical activity and social support\(^8\). Accordingly, the "dance-music" association is widely mentioned; music and dance end up interchangeable, or even the very same thing in many cultures\(^7\).

Dancing provides a unique research model on how the brain is able to integrate movement and sound, as well as on the intense practice of sensorimotor activities\(^8\). The studies on dancing offer a unique window to investigate the interaction between the brain and human behaviors\(^8\), which makes the hypothesis that dancing may be able to favor emotional\(^9,10\) standards and to lead to positive effects on the pleasure, desire and social interaction levels, feasible\(^11\).

Although countless studies have investigated the emotional neuro-architecture of dancing through the visual perception of dancers’ body language\(^11\), there is no evidence of studies investigating the basis of brain functions in activities involving dancing\(^10\). Thus, these integrative actions of the central nervous system remain neglected by perception studies\(^11\).

Therefore, the aim of the current study is to briefly compile and discuss the main physiological hypotheses about the neuroscience of activities involving dancing, and about its plausible use to potentiate human expressions such as pleasure, desire, emotional patterns and social interaction.

Methodology

The present study is a literature review and it has the aim to list the possible effects of dancing on potentiating human expressions. The searches were carried out in the following databases: Scielo, PubMed, LILACS and Cochrane. The following mesh terms were used: dance, ballroom dance, music, brain, pleasure, desire, emotions, interpersonal relations. It should be noticed that studies related to music became fundamental in the search for the physiological hypothesis of the neuroscience of dance. Accordingly, the descriptor "music" was also used in the search.

Since the present study is not a systematic review, which would require standardizations according to the proper regulations, the chosen inclusion criteria regarded the relevance and correlation of the studies with the present investigation theme. The studies could have been published in English, Portuguese or Spanish, as long as they were available in whole. The publication year was not an exclusion criterion.

Results and Discussion

Integrative action between the brain and the auditory system

As a physical activity alone, music is able to modulate the functioning of the body, mainly of the nervous system. As any other sound, music penetrates the human ear through the cochlea. It produces vibrations in the basilar membrane and transforms musical waves into an electrical activity, which is transmitted to the thalamic and subthalamic regions of the human brain. The first acoustic signal processing (cortical processing) takes place in these regions\(^12,13\).

Subsequently, the information leaves the medial geniculate nucleus of the thalamus and heads toward the auditory sensory cortex (areas 41, 42 and 52 Brodmann), also called primary cortex. Musical patterns are particularly analyzed in the auditory cortex and the musical physical properties are turned into perceptual properties (Figure 1)\(^12\).

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However, music rarely comes alone, it is often followed by dancing or by other synchronized movements\(^15\). Thus, there are common elements between music and dancing such as rhythm, melody, pitch, harmony, tone and dynamics in the soil. Among all these elements, pitch (tone) and rhythm are considered the basic elements able to change the emotional, behavioral and physiological states of
humans, whereas the melody (combination of pitch and rhythm) is defined as a pattern able to evoke emotions and rewards\(^\text{(18)}\).

"Dancing and the expressions of pleasure and desire"

Humans have the ability to feel pleasure from abstract stimuli such as music and art. In turn, music is seen as a potent pleasure stimulator, since it is mainly based on the reward system \(^\text{(16,17)}\).

The "reward" system can be understood as something that produces hedonic pleasure feelings. There is the tendency of repeating behaviors that have led to positive results. Results of the mesolimbic system have shown that the dopamine release and the strong hemodynamic activity in the mesolimbic areas have reinforced love, sexual, and pleasure feelings\(^\text{(17)}\), which implies reinforcement and motivation\(^\text{(16,17)}\).

The electrical impulses generated in the inner ear by music hearing are known to flow through the nerves and the thalamus towards the acoustic sensory cortex; from this region, they are then sent to the mesolimbic system and activate this system's areas\(^\text{(17)}\). Nowadays, the nucleus accumbens (NAcc) is an area that deserves prominence in music studies. It is featured as a structure of the mesolimbic dopaminergic system located in the hippocampus, in the ventral striatum, and directly connected to the central region, which is responsible for processing reward and pleasure information (Figure 2). Additionally, there is increase in the activity of neurons in the NAcc, as well as in the dopamine release during reward experiences. Such sensations are similar to the reward feelings resulting from eating and from the use of substances such as cocaine and nicotine\(^\text{(18,19)}\).

![Figure 2: Reward circuit in the Human Brain. The figure shows structures linked to the nucleus accumbens (NAc), which are important regions to the "reward" system: prefrontal cortex (OFC), orbitofrontal cortex (mPFC), anterior cingulate cortex (Thal), thalamus (purple), hippocampus (ACC) and amygdala (brown), sending projections to NAc (adapted from Robson e Nestler, 2012\(^\text{20}\)).](image)

The sexual desire, also defined as "sex drive", is related to attraction, to wanting others, to the will for physical contact and to sexual fantasies. Similarly to pleasure, desire is a phenomenon that can be triggered by sound stimuli and it is mediated by central dopaminergic pathways linked to the reward system\(^\text{(16,21)}\). It is assumed that such mesolimbic pathways mediate not only the desire mechanisms and the sexual drive, but also orgasm\(^\text{(21)}\).

Beyond the music capacity of promoting human expressions of pleasure and desire\(^\text{(16)}\), as well as affection experiences, music may be able to potentiate such expressions when it comes along with dancing\(^\text{(16)}\), which is seen as one of the most expressive forms of body language\(^\text{(22)}\).

Some authors consider synchronizing the body to rhythmic events, such as dancing, more relevant for survival than food and sex. The reward evoked by the rhythmic events may be a primary reward capable of activating the mesolimbic system, which is likewise activated by food, sex and drugs\(^\text{(19)}\).

Dancing enables intimate contact between its practitioners, mainly in Ballroom dancing, since it requires affective interaction for partners to dance together. A certain degree of emotional empathy is necessary to find harmony in the dancing couples, and it makes dancing truly pleasant. At the same time, dancing is the best alternative when individuals are looking for a physical activity to be practiced together, aiming at emphasizing affective interaction/sociability, intimate physical contact and respect between the partners\(^\text{(23)}\).

Emotions are responsible for coloring every aspect of life. They are essential to the social relations, the psychological welfare, the cognitive system and to the development of other processes. Accordingly, understanding the emotions is crucial for the survival of mankind\(^\text{(23)}\), because emotions are among the most rewarding human experiences\(^\text{(19,24,25)}\). The emotions are regulated through an internal process that enables the person to keep a comfortable state of excitement by modulating one or more aspects of the emotion\(^\text{(25)}\).

Daily emotions can be interpreted through the quality of the voice. However, they can also be transmitted through non-verbal communication channels such as music\(^\text{(24)}\). The emotional power evoked by music is evident, since humans use sounds as means of communication and as cognitive representations of their inner states\(^\text{(17,25)}\). Music has an impact on neural areas involved in emotion processing\(^\text{(25)}\).

Researches in the psychology field have shown strong evidences that have confirmed that the affective responses reply to the sensory modality (visual) and that they can be changed through the information coming from another sensory modality (auditory). This effect is known as "cross-
polarization", and it demonstrates that the visual perception is enhanced by concurrent auditory stimuli. These stimuli are able to strengthen the neural activation in areas such as amygdala and striatum, which are related to the psychological level of excitement experience\(^2\).

The auditory system is also able to take sound information to the limbic system in the human brain, and it plays a key role in the emotion processing\(^1\). The amygdala\(^12,24\) and the hippocampus are the most influenced limbic system structures concerning the control of emotions, however, such system encompasses other important structures (Figure 3).

The perception of negative or dissonant music increases the amygdala activity through negative responses of different natures. Such perception emerges as the mostly known feeling in the subject "fear"\(^12\).

However, positive or consonant music generates positive responses associated with cerebral blood flow increase in the anterior cingulate cortex, which is responsible for the psychophysiological motor, as well as for the cognitive and motivational responses. These responses trigger the positive emotional response to music\(^12\).

Emotions induced by music also take place through the dopamine release in the NAcc, which is a region involved in the euphoric components of psychostimulants such as cocaine. This region is closely connected to the limbic regions, which mediate the emotional responses\(^27\).

Emotions may be transmitted not only through verbal communication, but also through body language, mainly through specific parts of the body such as the trunk, arms, and hands. Dancing, in its simplest manifestation, is an important type of body expression, because it is one of the earliest forms of expression developed by mankind. Dancing is capable of facilitating the expression of different emotions\(^25\).

Studies show that the body movement plays an important role in musical rhythm perception, and it shows that music and movement share a dynamic structure that supports the universal expressions of emotions. In addition, there is consensus that dancing helps the expression of many different emotions. The ability of decoding emotions through dancing is noticed from the age of five on\(^25\).

Melody and dancing are temporal sequences of pitch and movement, respectively; thus, both can be integrated into a common form of rhythmic movement. The perception, processing and synchronizing of these temporal sequences trigger positive and negative emotions\(^2\).

**Dancing as a form of positive social interaction**

Dancing, in its different forms and possibilities, seems to evoke a positive response regarding practitioners' emotional reactions. Dancing is these practitioners' form of communication, either in therapy, playful situations, or in its interpretive or performative form, among others\(^28\). Therefore, dancing involves rhythmic sound movements and plays an important role in creating social bonds\(^29\). This "social relationship" effect reflects on pro-social behaviors; thus, it plays an important role in the evolution of human society\(^29\).

Additionally, a recent study showed that the improved mood is the main reason leading individuals to dance and socialize\(^29\). Dancing is directly linked to music and movement. The direct physical response of the body to music is a phenomenon observed in daily life. The mere presence of music induces head, feet and hand movements, and it means that dancing is part of human beings' daily lives. The motor responses induced by music are featured by synchronized movements, which are performed by people, often in social activities. Such response reinforces the feeling of belonging to a group. Individuals understand this feeling as positive and reassure it, because such feeling triggers positive emotional responses\(^12\).

Humans tend to repeat the behaviors understood as positive as an attempt to reinforce pleasure sensations\(^17\).

Dancing is the opportunity of having direct physical contact with others. It makes individuals more involved with dancing activities, because it provides more personal experiences than other conventional physical activities. Thus, dancing helps developing positive social interactions\(^30\).

The social behavior is an important feature resulting from the difference between activities involving music or not; the shared rhythm and the
externalization allow synchronizing two or more people, and it has a strong impact on the emotional experiences. Additionally, there is the consensus that such feelings come from the endorphins and cytokines released during the synchronization of musical beats\(^{29,30}\).

Dancing gives the opportunity of physical contact with other person, and it makes individuals more involved with such activity. It provides a personal experience and facilitates positive social integration\(^{30}\). The social behavior is an important feature distinguishing activities involving music from other activities. Sharing the rhythm and its externalization allows synchronicity between two people or more, and it has an impact on affective experiences\(^4\).

Conclusion

The present review led to the better understanding of the central mechanisms and such understanding enabled stating that it is plausible using dancing as a physical activity linked to music, to pleasure and desire expressions, as well as to emotional patterns and to social interaction.

Nevertheless, neuroscience studies related to the herein assessed topic remain scarce, even when there are interactions between dancing and the expression of variables found in the current literature. Accordingly, it is necessary developing further studies on the Neuroscience of Dance in order to support the broader use of this activity in a multidisciplinary field. Additionally, little was explored about the herein studied association and its possible clinical implications; therefore, further investigations are required in order to provide the understanding about such implications and about the validation of dancing as a form of therapy.

References


