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THE INFLUENCE OF JOY ON THE IMMUNE SYSTEM: A REVIEW OF THE LITERATURE

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ABSTRACT

Joy is a human emotion linked to life experiences, personal achievements, and social connections, and is also found in the appreciation of simple, everyday things in life. The immune system, responsible for protecting the body, must be considered in different dimensions that involve its functioning, analyzing how it acts and how it is affected by the emotional state, focusing on the influence of joy. In this aspect, it is observed that the emotional state can play a significant role in an individual's immune response to each existing emotion. It is necessary to consider the dimensions that permeate their role, evaluating the way in which it interferes and how it is influenced by the emotion of joy. Thus,

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the study aimed to analyze and understand the influence of the positive emotion joy on the immune system. This is a descriptive literature review with a qualitative approach, with data collection carried out through a bibliographic review in databases. By analyzing the articles found, it was found that joy as a concept is characterized by the term positive affect (PA), characterized by its broad protective influence on health and favorable impact on inflammatory processes, characterized as partially independent of negative affect. The existence of emotions contrary to joy, such as stress, affects the individual, favoring changes in the immune system, facilitating the emergence of diseases.

Keywords: Joy, Immune System, Emotion, Immunity.

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INTRODUCTION

Emotions are present in all stages of life in a significant way. However, when asked about its definition, there is a large gap in this aspect (Martins, 2016). Joy is a reaction based on the emotion we feel when something positive happens. It can be linked to life experiences, personal achievements, and social connections. Joy is also found in appreciating simple, everyday things in life, such as observing a landscape or spending quality time with someone you love (Ribeiro, 2023). Feeling joyful is a higher-level experience with different kinesthetic characteristics, usually as active well-being felt in the chest (Angart, 2003).

In this context, it is important to know the relationship between joy and the human organism from an immunological point of view. The immune system is responsible for performing the body's defense. However, beyond the concept, it is necessary to consider the dimensions that permeate its role, evaluating the way it interferes and how it is influenced by the emotional state, with an emphasis on joy. In this sense, neuroimmunology is a branch that studies the relationship between the nervous system and components of the immune system and this interaction between them proposes an immunoregulatory function for cytokines in the brain, and an attribution of the immune system in sensory afferents. Thus, showing that immune interactions are capable of modulating neuronal activity and, consequently, emotions and behavior (Alves, Neto, 2010).

Emotional state can play a significant role in an individual's immune response (Raison, 2001). Emotional aspects such as stress, anxiety and chronic sadness can cause a decrease in immunocompetence, decrease the proliferation and activity of lymphocytes, among other deficits (Maia, 2002). According to the same line of reasoning, stress, for example, impairs the body's ability to fight infections by reducing the activity of important defense cells, such as *natural killer* cells and T lymphocytes. Neurotransmitters such as serotonin and dopamine, which are related to mood, directly influence this immune response, showing changes similar to those observed in people with depression (Fagundes, Santos, 2023).

On the other hand, positive emotions, such as joy, demonstrate a beneficial impact on the immune system, characterized by increased production of antibodies and immune cells. In this idea, one can point to laughter as a trigger of a cascade of biochemical reactions that contribute to the relief of stress and anxiety. Reduced activity of stress-related neurotransmitters, such as norepinephrine, and increased activity of pleasure-related

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neurotransmitters, such as dopamine and serotonin, are neurobiological mechanisms that explain the beneficial effects of laughter on mental health (Akimbekov, Razzaque, 2021).

In this way, with this strengthened immune response, it contributes to a more robust state of health, conferring greater protection against infections and diseases. (Fredrickson, 2001). Thus, understanding this relationship and its effects on the human body can contribute to the clinical evaluations of individuals in various situations, enable multiprofessional conducts and interventions that can reestablish their health status based on the analysis of their emotions. Therefore, the present study aimed to analyze and understand the influence of positive emotion joy on the immune system.

METHODOLOGY

This is a descriptive literature review research with a qualitative approach, obtained through a literature review. The survey of indexed publications was carried out between August and October 2024, in databases such as the Virtual Health Library (VHL) and Pubmed.

To carry out the search, combinations were used between the words selected according to the Health Sciences Descriptors (DeCS): recommending the word "Joy" with Boolean operator AND with the following terms "Immunity", "Immune System", "Inflammation", "Lymphocytes", "Cytokines", Antibodies", and the same was done with the word "euphoria", crossing with the same terms. In both cases, the expressions in English and Spanish were used. The following inclusion criteria were adopted: free full texts, published in Portuguese, English, and Spanish in the last 5 years, between August 2019 and August 2024, using as exclusion criteria incomplete articles, which were not in the stipulated time, and which were not in the languages understood.

Data collection was structured by searching for the contemplated articles, and 768 articles were found in the databases mentioned above. After applying the criteria, 760 were discarded and a total of 8 articles were obtained to compose the present review.

RESULTS AND DISCUSSION

When conducting a bibliographic survey in the databases (Chart 1), 768 articles were found that were in accordance with the search criteria. After reading the titles and abstract, 8 articles were selected at the end that meet the guiding question of the study.

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Table 1: Search results according to the platform and descriptors used.

Platform	Descriptions (PT-EN)	Articles found	Articles considered
VHL	Joy AND immunity	76	0
	Joy AND Immune System	10	1
	Joy AND Inflammation	13	0
	Joy AND Lymphocytes	2	1
	Alegria AND Citocinas	6	0
	Alegria AND Anticorpos	5	0
	Euforia AND Imunidade	2	0
	Euphoria AND Sistema Imune	3	1
	Euphoria AND Inflammation	8	1
	Euforia AND Linfócitos	0	0
	Euforia AND Citocinas	0	0
	Euforia AND Anticorpos	2	1
PUBMED	Joy AND immunity	257	1
	Joy AND Immune System	106	0
	Joy AND Inflammation	1	0
	Joy AND Lymphocytes	67	0
	Alegria AND Citocinas	86	0
	Alegria AND Anticorpos	164	0
	Euforia AND Imunidade	1	0
	Euphoria AND Sistema Imune	0	0
	Euphoria AND Inflammation	7	1
	Euforia AND Linfócitos	0	0
	Euforia AND Citocinas	4	1
	Euforia AND Anticorpos	4	0

Source: Prepared by the authors (2024).

Chart 2 presents the selected studies whose organization is according to year, authors, title and objectives. Of the 8 articles selected, 62.5% are from the VHL and 37.5% are from Pubmed.

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Chart 2: Selected articles on the relationship between joy and the immune system.

Anus	Title	Authors	Objective
2019	Happiness and Inflammatory Responses to Acute Stress in People With Type 2 Diabetes.	Laura Panagi; Lydia Poole; Ruth A Hackett; Andrew Steptoe.	To examine the relationship between happiness and inflammatory markers at baseline and in response to acute stress in people with T2DM (*Type 2 Diabetes mellitus*).
2021	Trait positive affect buffers the association between experimental sleep disruption and inflammation.	Hunt, Carly A; Smith, Michael T; Mun, Chung Jung; Irwin, Michael R; Finan, Patrick H.	To test the degree to which PsA may moderate the effect of experimental sleep disruption on cellular markers of inflammation, after adjusting for NA and relevant demographic characteristics.
2024	Neural basis underlying the association between thought control ability and happiness: The moderating role of the amygdala.	Min Li; Yuchi Yan; Hui Jia; Yixin Gao; Jiang Qiu e Wenjing Yang	To investigate the neuroanatomical basis of ACT in 314 healthy subjects.
2021	Cocaine potentiates an inflammatory response in C6 astroglia-like cells	Mariam Agharhimi; Ramesh B. Badisa; Elizabeth Mazio; In Karam F. Soli; Carl B. Goodman.	To examine the potential ability of cocaine to exacerbate the production of inflammatory products, primarily free radicals superoxide (O2-), hydrogen peroxide (H2O2), and NO/nitrite (NO2-) in rat astroglia C6-like cells.
2019	Hierarchical control systems for the regulation of physiological homeostasis and affect: Can their interactions modulate mood and anhedonia?	Otto Muzik, Vaibhav A. Diwadkar	Promote a reassessment of concepts about the circumscribed role of hierarchical control systems.
2023	Recent advances in the study of the neurobiological mechanisms behind the effects of physical activity on mood, resilience and emotional disorders	Chong Chen, Shin Nakagaw	To work on the cognitive impact of AF20 to provide an exhaustive view of the neurobiological mechanisms of the affective benefits of FA.
2021	Comparison of serum BDNF, IL-1β, IL-6, TNF-α, CRP and leucocyte levels in unipolar mania and bipolar disorder	Jasmine Gorgulu; Milkibar K. Uluturk; Orchid Palabiyik	To investigate the differences between unipolar mania and bipolar disorder in terms of clinical and inflammatory parameters.

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2024	Diferent Course And Management of Khat-induced autoimmune hepatitis: report on three cases.	Ali Someili.	To assess the mechanism of khat-induced autoimmune hepatitis

Source: Prepared by the authors (2024).

JOY AS AN ACCESSIBLE CONCEPT

Of the studies considered for the research, joy as a concept is characterized with the term positive affect (PA) as it reflects a pleasurable involvement with the environment, along with emotions such as happiness, excitement, and contentment, in addition to being a component of the broader theoretical concept of subjective well-being (Panagi et al, 2019).

However, some similar terms were found in response to the survey, among them "Happiness", "Resilience" and "Well-being". Such terminologies are placed by the databases as synonyms of the conception of joy as an emotion, but they turn to the idea of temporality of a state of life, the gathering of a set of indicators of well-being that, added together, guarantees this state of mind. Joy is an intersection between the "physiological" (specifically thermoregulatory pathways) and the "psychological" specifically mood-related processes (Muzik, Diwadkar, 2019).

DEVELOPMENT OF EMOTION IN THE BODY AND IMMUNE SYSTEM

The working relationship between emotion and the immune system is complex. The association between emotions and diseases has been explained in recent decades due to advances in medicine, genetics, neurosciences and brain imaging studies. These advances have revealed the various connections between the neuroendocrine, neurological and immune systems and, in this way, exposing the relationship between emotions and diseases (Martinelli; Branches; Camargo, 2020).

Positive affect has been explored for its broad protective influence on health and favorable impact on inflammatory processes, characterized as partially independent of negative affect. In this scenario, individuals with higher levels of this positive emotion manifest more favorable inflammatory profiles, associated with lower levels of IL-6 and CRP among healthy adults (Hunt, *et al*., 2021).

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EMOTIONAL IMBALANCE IN THE ABSENCE OF JOY

Emotional imbalance can happen in different ways and directly impact human beings, as is the case with stress. People often have negative thoughts on a daily basis, either with past events or future worries, and these intrusive negative thoughts affect people's cognitive function and their ability to regulate emotion (Li, et al., 2024). The nervous, endocrine, and immune systems interact in an intertwined manner and affect each other as they react to stress. In this context, the effects of accumulated nervousness manifest themselves in the body in a physical way, including an increase in heart and respiratory rate, increase in muscle tension and metabolism, and decrease in the individual's immune function, directly impacting the body's homeostasis. The interconnected connection between the nervous, immune, and endocrine systems can be destabilized by external influences, leading to a chronic imbalance, affecting physiological and immune processes, including the inflammatory response, and serving as a trigger for the emergence of other diseases (Gontijo et al., 2023).

The practice of physical activities in emotional well-being has been constantly evidenced, including the improvement of mood, vigor, and resilience, with therapeutic effects on depression, anxiety, and stress (Chen, Nagasawa, 2023). Another way of dealing with emotions that interfere with the functioning of the immune system, essentially resulting from stress, is related to Humanistic Psychology, established in the idea of fostering personal growth through direct experience, in the development of one's potential and in the search for self-realization. The individual experiences a greater sense of purpose and well-being, which helps them to reduce stress and combat emotional imbalance, thus strengthening the immune system (Oliveira, Rocha, 2022).

EMOTION OVER THE YEARS

Research on emotional themes reveals the importance of understanding them for human life. In this context, it is notorious that aging is a natural process of living beings, and thus, emotions are present daily in all cycles of life, from childhood to old age (Penna; Santo, 2006). Emotions can be classified as external events, that is, they are understood as public events, aimed beyond the individual and perceived by third parties (Lopes et al., 2023).

Younger and older individuals are more vulnerable to infections compared to adulthood, since immune efficiency is more limited in both. The peak of the immune

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system's functioning occurs after a longer stage of life, with recurring emotions that accompany this individual, directly influencing the immune process. Aging, however, causes structural and functional changes in several cellular systems, including the immune system (Gusmão et al., 2016)

Thus, over the course of the individual's years, each type of emotion predetermines an immediate action and points to a direction that proved to be more correct in the face of the daily challenges faced by human beings throughout life. Therefore, if during any of these cycles, the existence of emotions contrary to joy is more constant, such as stress, this individual will be more susceptible to having changes in the immune system, directly affecting body homeostasis, facilitating the emergence of diseases (Oliveira, Rocha, 2022).

MECHANISMS OF ACTION INVOLVED IN THE PHARMACOLOGICAL PROCESS

In the human body, there is a division between the central nervous system (CNS) and the peripheral nervous system (PNS). The body collects sensations through the afferent organs and takes them to the brain, where they are processed. Information about the body's external conditions and interoceptive states converges on the brainstem nucleus. This convergence triggers, to a large extent, automated processes and preconscious physiological and affective responses that are initiated by the limbic system through the release of dopamine (DA) from dopaminergic neurons in the ventral tegmental area of the midbrain (VTA). The target of VTA neurons are mesolimbic structures (VP and NAcc) that generate motivational impulse (Muzik, Diwadkar, 2019).

By emphasizing the pharmacological impact, attention is drawn to the pharmacological class of central nervous system (CNS) stimulants: drugs. Among these psychoactive substances, cocaine is mentioned, an adrenergic agonist with indirect action. With its mechanism of action focused on stimulation, cocaine is a highly addictive drug that mediates its effect by altering the metabolism of dopamine in the CNS, standing out for its potential as a sympathomimetic drug. Due to its high lipophilicity, cocaine easily crosses the blood-brain barrier of the CNS and reaches various domains of the brain where it can trigger cellular damage (Agharahim, et al., 2021). Its effect has a rapid onset and causes rewarding sensations, increasing self-esteem and self-confidence by acting on the brain's reward system. An initial short-term effect due to a buildup of the neurochemical dopamine gives rise to euphoria and a desire to take the drug again (Rodrigues, Silveira, 2022).

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In addition, it should be noted that, analogous to cocaine, amphetamines act by blocking or reversing the direction of neurotransmitter transporters that mediate the reuptake of the monoamines dopamine, norepinephrine, and serotonin to presynaptic endings, potentiating dopaminergic, adrenergic and serotonergic neurotransmission (Rodrigues, Silveira, 2022). In view of the aforementioned facts, its use was observed by individuals diagnosed with bipolar disorder and unipolar mania, in order to stimulate the feeling of euphoria and relieve tension (Gorgulo; Uluturk; Palabiyik, 2021). In this bias, the expression of hormones associated with the use of these substances manifests, as a response, the intense feeling of euphoria, which is related to the emotional aspect of the human organism at the time of use.

Another substance capable of reproducing the effect of these drugs is the plant called Khat, which has a mechanism of action similar to that of a drug. It stimulates feelings of euphoria equivalent to those of taking amphetamines. The main active compound found in khat is cathinone, which is broken down into a less potent substance called R,S-(-)-norephedrine. It has been studied for its relationship with autoimmune hepatitis (Someili, 2024).

The present study presented limitations at the time of searching for the term "Joy", with difficulty in finding articles that specifically used the term due to the scope of the concept and its intersection with other words, such as happiness, allowing the ideas behind each article to be indistinct from the terminologies. In addition, there were gaps in studies that delved into the negative effects of emotion on the body with "toxic positivity".

With this investigation, there is a need to conduct other studies that clearly show the relationship between the emotion and joy with the immune system in an integral way and not only focused on the pathology of autoimmune diseases, analyzing the existing gap regarding the excess of emotion and how it can harm the body. There is an urgent need to understand the impact of emotion on immunocompetent individuals and to detail the mechanism of action of emotion in its positive and negative aspects.

CONCLUSION

This review allowed us to identify the relationship between the influence that positive emotion exerts on the human immune system, taking advantage of the literature available in the databases. The way in which this process occurs from immunological, psychological and pharmacological perspectives was observed. Thus, the deficit was also considered in

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relation to studies focused on the area and on the understanding of joy as a phenomenon that occurs in the human body.

Finally, it points to the importance of understanding the impact that joy has on the human organism, as well as the need to address this theme further in the course of the scientific environment, taking into account emotional issues and their impacts on the immune system.

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REFERENCES

1. Agharahimi, M., et al. (2021). Cocaine potentiates an inflammatory response in C6 astroglia-like cells. Biomed Reports, 14(5), 45. http://doi.org/10.3892/br.2021.1421. Epub 16 Mar. 2021. PMID: 33786174; PMCID: PMC7995314.

2. Akimbekov, N. S., & Razzaque, M. S. (2021). Laughter therapy: A humor-induced hormonal intervention to reduce stress and anxiety. Current Research in Physiology, 4, 135–138.

3. Alves, G. J., Neto, J. P. (2010). Neuroimunomodulação: influências do sistema imune sobre o sistema nervoso central. Revista Neurociências, 18(2), 214–219, 30 Jun.

4. Angart, L. (2003). Felicidade, alegria, e alegria interior. Golfinho Impresso, Jun.

5. Chen, C., & Nakagawa, S. (2023). Avanços recentes no estudo dos mecanismos neurobiológicos por trás dos efeitos da atividade física no humor, resiliência e transtornos emocionais. Advances in Clinical and Experimental Medicine, 32(9), 937–942.

6. Fagundes, M. G. F., & Santos, W. R. (2023). Deficiência imune relacionada à depressão: uma revisão integrativa. Brazilian Journal of Implantology and Health Sciences, 5(3), 1293–1307.

7. Fredrickson, B. (2001). The role of positive emotions in positive psychology. American Psychologist, 56(3), 218–226.

8. Gontijo, C. C., et al. (2023). Stress and immunity: A literature review. Research, Society and Development, 12(13), e22121344094.

9. Gorgulu, Y., Uluturk, M. K., & Palabiyik, O. (2021). Comparison of serum BDNF, IL-1β, IL-6, TNF-α, CRP, and leucocyte levels in unipolar mania and bipolar disorder. Acta Neuropsychiatrica, 33(6), 317–322, Dez.

10. Gusmão, J. E. L. S., et al. (2016). A influência das emoções sobre o sistema imunológico: visão psicossomática. Anais Congresso Brasileiro de Ciências da Saúde, At-07: Saúde Coletiva.

11. Hunt, C. A., et al. (2021). Trait positive affect buffers the association between experimental sleep disruption and inflammation. Psychoneuroendocrinology, 129, 105240, Jul.

12. Li, M., et al. (2024). Neural basis underlying the association between thought control ability and happiness: The moderating role of the amygdala. Psych Journal, 13(4), 625–638. http://doi.org/10.1002/pchj.741. Epub 7 Mar. 2024.

13. Lopes, R. F., et al. (2023). Emotions in maturity: a scope review. Research, Society and Development, 12(1), e4312139409.

Revista ARACÊ
ISSN: 2358-2472

14. Maia, A. C. (2002). Emoções e sistema imunológico: um olhar sobre a psiconeuroimunologia. Psicologia: Teoria, Investigação e Prática, 2, 207–225.

15. Martinelli, I. H., Ramos, K. A., & Camargo, M. E. E. (2024). Psiconeuroimunologia: como as emoções podem provocar alterações na fisiologia do corpo humano? In XVII Encontro de Iniciação Científica, XV Mostra de Pós-Graduação, VII Mostra de Extensão e I Mostra de Iniciação Científica Jr. - Centro Universitário Teresa D'Ávila - UNIFATEA.

16. Martins, E. C. C. (2017). A alegria, a tristeza e o medo - Reconhecimento de emoções na promoção da resiliência em crianças de 3 e 4 anos de idade. Dissertação de Mestrado, Educação Pré-Escolar, Escola Superior de Educação e Comunicação, Universidade do Algarve, Jan.

17. Muzik, O., & Diwadkar, V. (2019). Hierarchical control systems for the regulation of physiological homeostasis and affect: Can their interactions modulate mood and anhedonia?. Neuroscience & Biobehavioral Reviews, 105, 251–261.

18. Oliveira, M. S., & Rocha, F. N. (2022). Emoções, sistema imunológico e terapia centrada na pessoa. Mosaico - Revista Multidisciplinar de Humanidades, 13(1), 2–12, Jan/Apr.

19. Panagi, L., et al. (2019). Happiness and inflammatory responses to acute stress in people with type 2 diabetes. Annals of Behavioral Medicine, 53(4), 309–320, 20 Mar.

20. Pena, F. B., & Santo, F. H. E. (2006). O movimento das emoções na vida dos idosos: um estudo com um grupo da terceira idade. Revista Eletrônica de Enfermagem, 8(1), 17–24.

21. Ribeiro, E. (2023). Alegria: de onde vem, como cultivar e seus impactos na vida. Sociedade Brasileira de Hipnose, Dez.

22. Rodrigues, A., & Silveira, F. M. (2022). A neurotoxicidade no transtorno por uso de substância psicoativa derivados de cocaína. Recisatec - Revista Científica Saúde e Tecnologia - ISSN 2763-8405, 2(9), e29187.

23. Someili, A. (2024). Different course and management of Khat-induced autoimmune hepatitis: Report on three cases. Eur J Case Rep Intern Med, 11(6), 004573, May 27.