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Does human-dog attachment increase the resilience and resistance to COVID-19? A biopsychosocial approach and future research

¿El apego humano-perro aumenta la resiliencia y la resistencia a la COVID-19? Un enfoque biopsicosocial y una investigación a futuro

O apego humano-cão aumenta a resiliência e a resistência ao COVID-19? Uma abordagem biopsicossocial e pesquisas futuras

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***Abstract*:** This article is a biopsychosocial proposal about improvement of resilience to diseases, including the COVID-19, due to affective attachment between humans and dogs. Resilience concerns the physical and emotional human capacity to respond positively to the adverse events such as diseases. Recently, some authors have proposed independent hypotheses about role of oxytocin (OT) and crossed immunity to increase the psychological resilience and immune response against the COVID-19. This text extends the hypothesis to a biopsychosocial field, including the well-known benefits of the human-dog affective attachment on human health. And proposes that a strong and reciprocal affection between human and dog can increase the resilience and resistance to COVID-19, due the role of OT in the immune response, adding to crossed immunity. Other benefits such as emotional buffering, mental comfort and stress alleviation are adjunctive roles of dogs on human health and vice-versa.

***Keywords**:* attachment; canis lupus familiaris; cross immunity; oxytocin; pandemic.

***Resumen*:** Este artículo es una propuesta biopsicosocial sobre la mejora de la resiliencia a enfermedades, incluida la COVID-19, debido al apego afectivo entre humanos y perros. La resiliencia se refiere a la capacidad humana física y emocional de responder positivamente a los eventos adversos, como las enfermedades. Recientemente, algunos autores han propuesto hipótesis independientes sobre el papel de la oxitocina (OT) y la inmunidad cruzada para aumentar la resiliencia y la respuesta frente a la COVID-19. Aquí se extiende esa hipótesis al campo biopsicosocial, incluyendo los bien conocidos beneficios del apego afectivo humano-perro sobre la salud humana. Se propone que las relaciones de afecto fuerte y recíproco entre humanos y perros pueden aumentar la resiliencia a la COVID-19, debido al papel de la OT en la respuesta inmune, sumando inmunidad cruzada. Otros beneficios como amortiguar el efecto de las emociones, la comodidad mental y el alivio del estrés son funciones complementarias de los perros en la salud humana y viceversa.

***Palabras clave**:* apego; canis lupus familiaris; inmunidad cruzada; oxitocina; pandemia.

***Resumo*:** Este artigo é uma proposta biopsicossocial sobre a melhora da resiliência a doenças, incluindo a COVID-19, devido ao apego afetivo entre humanos e cães. A resiliência diz respeito à capacidade física e emocional do ser humano de responder positivamente aos eventos adversos, como as doenças. Recentemente, alguns autores propuseram hipóteses independentes sobre o papel da oxitocina (OT) e da imunidade cruzada para aumentar a resiliência e a resposta contra o COVID-19. Estende-se a hipótese a um campo biopsicossocial, incluindo os benefícios bem conhecidos do apego afetivo humano-cão à saúde humana. É proposto que as relações de afeto recíproco e forte entre humanos e cães podem aumentar a resiliência ao COVID-19, devido ao papel do OT na resposta imune, somando-se à imunidade cruzada. Outros benefícios, como proteção emocional, conforto mental e alívio do estresse são funções auxiliares dos cães na saúde humana e vice-versa.

***Palavras-chave**:* apego; canis lupus familiaris; imunidade cruzada; ocitocina; pandemia.

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Several studies have explored the relationship between humans and pets as a condition for good health (Beck & Meyers, 1996; Mueller, Gee & Bures, 2018). Pet ownership may serve as a social determinant of health by increasing the potential for social interaction and social support (Mueller et al., 2018). Despite some doubts about the role of pets as carriers of SARS-CoV-2 (Kiros et al., 2020), the role of these animals as social companions seems very positive for owners and their families during the pandemic COVID-19 (Ratschen et al., 2020). We agree that pets and dogs in particular, help to mitigate social isolation and alleviate feelings of anxiety, fear and hopelessness. However, the accumulation of evidence of the role of dogs in people's health by SARS-CoV-2, created the conditions for us to make a proposal that a mutual attachment relationship between dogs and their owners strongly influences the resilience and resistance to COVID-19.

This article is a biopsychosocial proposal about resilience and resistance to diseases, including the COVID-19, which could improve due to affective attachment between humans and pets (Wells, 2007). Resilience is the human psychological capacity to respond positively to the adverse events such as diseases (Cal, Sá, Glustak & Santiago, 2015). The link between a good mental state and good health is known (Kiecolt-Glaser, McGuire, Robles & Glaser, 2002), leading us to suggest that people with greater psychological resilience may have

greater immunological capacity to fight off viruses such as SARS-CoV-2. Resistance is defined as the ability to limit pathogen burden due a immune response to infection (Schneider & Ayres, 2008).

Affective attachment is an inherent disposition of humans (Bowlby, 1979; Sussman & Chapman, 2004), which could improve the resilience to diseases. Human attachment has been studied by many science branches, with a large number of love taxonomies and associated vocabularies such as romantic love, passion, friendship, close relationship, attachment, affection and affective bond. Love is the complex and diffused expression of emotions that includes attraction and feelings of affection and well-being in the company of another person. Depending on the cultural characteristics of society, love can be expressed by specific and ritualised behaviours, whose neuroendocrine substrates are ubiquitous in human beings (Cacioppo, Bianchi-Demicheli, Hatfield & Rapson, 2012). Likewise, it can be considered an emotion that has led humans to become gregarious and highly social (Sussman & Chapman, 2004).

In humans, love can be classified as passionate love, companionate love, maternal love, parental love and the so-called unconditional love (Cacioppo et al., 2012). The physiological mechanism of affective ties between humans is homologous to the relationship between humans and domestic dogs, *canis lupus familiaris* (Romero, Nagasawa, Mogi, Hasegawa & Kikusui, 2014). The oldest human-animal relationship is with dogs, characterized by a strong emotional part, although in some cultures it is a neglected species due to the taboo of the impure animal (Serpell, 2016). The emotional attachment between human and dog is well supported by many studies (Wells, 2007), especially in the industrialized countries. People define the attachment for your dogs as like as "a love feeling for a relative", sometimes acquiring a role equal to a sibling or children (Payne, Bennett & McGreevy, 2015; Serpell, 2016).

The relationship between people and dogs is a two-way road, because there are evidences that dogs are emotionally attached to owners (Romero et al., 2014). Despite the psychosocial approach of mutual attachment between humans and dogs, new studies approaching neuroendocrine mechanism are revealing the molecular basis of mutual affection between human and dogs (Romero et al., 2014). Given the cultural and subjective character of human love for other animals, the relationships between individuals can be studied with other paradigms with specific nomenclature such as attachment and pair bond (Crawford, Worsham & Swinehart, 2006; Liu & Wang, 2003; Romero et al., 2014).

We propose a complementary, heterodox and biopsychosocial theoretical construct to explain about differences on psychological resilience and immunological resistance to diseases, particularly to COVID-19 pandemic. For the purposes of constructing this theoretical proposal, we will consider affective attachment in a broader sense as a feeling of attraction and affection between a person and a dog.

Human-dog affective attachment mechanism

In many societies, the relationship between people and their pets is characterized as a strong feeling of affection (Kurdek, 2008). Often such relationships are classified as parental or maternal love. Dogs are considered friends ("A man's best friend"), children or family members, bringing emotional comfort and health benefits to their owners (Crawford et al., 2006).

There are many examples where these relationships of affection between people and pets are homologous to that between humans (Kurdek, 2008). The different types of love have been studied using different methods, mainly using self-declared scales and visual stimuli. Love and its wider dimension are not just a cultural construct but also have strong neural and endocrine bases that have culminated in humans the discovery that each type of love has different neural circuitry in addition to overlapping brain pathways and regions (Feldman, 2017). To understand the physiological mechanism, many studies with non-human primates (Putnam, Young & Gothard, 2018), prairie voles and cichlid fishes have elucidated the neuroendocrine homologies of love in humans (Feldman, 2017).

In common, many studies have shown an increase in OT levels according to the type of love, with more emphasis on companionate love (Cacioppo et al., 2012). Oxytocin (OT) is a nonapeptide synthesised in several cells in the body mainly by the cells of the pituitary, whose expression is related to several prosocial behaviours (Loth & Donaldson, 2021).

Although more depth is required to understand the biopsychosocial base of affective relationships between humans and dogs, several studies have elegantly designed and demonstrated an oxytonergic neuroendocrine basis. For example, dog and human gazing at each other increases OT levels in both, reciprocally, which is believed to be a sign of attachment between the two species (Nagasawa et al., 2015). In one study, the authors observed a significant oxytocin peak at 1, 3, or 5 min higher compared to baseline, applying a test of human-dog contact (Handlin et al., 2011). Human-dog interactions, especially those initiated by the dog's gaze, can increase the urinary OT concentrations of their owners as a manifestation of attachment behaviour (Nagasawa, Kikusui, Onakab & Ohtaa, 2009). Thus, in humans and between humans and pets, the mechanism of affection is mediated in part by neuroendocrine changes, where OT seems to be a mediator of attraction and affective bonds (Nagasawa et al., 2009).

Feelings of emotional attachment have a complex hormonal and neurotransmitter interactions in a net of unique brains (Feldman, 2017; Loth & Donaldson, 2021). Interesting, OT pharmacological administration (e.g., nasal spraying) is not a prosocial hormone ever, since experimental studies showed a decreasing sociability, and increasing aggressive behaviour depending on the context (Cai, Feng & Yap, 2018). Other studies did not successful to prove an increase proximity and contact seeking behaviour of dogs for owners after administration of nasal OT (Thielke, Rosenlicht, Saturn & Udell, 2017). Authors of a review about OT effect on social cognition of the dogs concluded that advances were done last years, but there is an incomplete understanding of the attachment mechanisms, especially about the interaction between genes and environment (Kis, Ciobica & Topál, 2017). Therefore, we argue that affective attachment precedes some beneficial OT effects on human health, since emotional ties are not a result of only one hormone. Thus, only OT without "love feelings" (at broader sense) is not enough to trigger the best immune defence.

In patients that have presented with chronic diseases, the role of social support is well known for improving health conditions, in recovery or in response to therapeutic processes (Salas García, Schorr, Arnold, Fei & Gilbert, 2020). Family and loved ones play an important role in mitigating pain, feelings of helplessness and emotional discomfort in chronic patients (Cal et al., 2015). A similar effect can be observed with pets in hospitals and nursing homes to improve the well-being of patients and inmates, respectively (Wells, 2007). The physiological mechanism behind increasing health by social support in humans is complex; however, OT appears as a molecule strongly involved in the effect (Carter, 1998).

The theoretical proposal

Soumier and Sirigu (2020) defended OT as a possible adjuvant in the fight against COVID-19, due to its immune-mediating effects and activator of enzymatic mechanisms for the synthesis of nitric oxide (NO). The authors consistently defended pharmacological OT can putatively improve resistance against COVID-19. In another article, Jurgiel et al. (2020) argued that prolonged contact between people and dog could reduce the severity of COVID-19, because of the cross-immunity mechanism. Cross-immunity is defined as a protection against a specific infection due to antibodies developed from past exposure to a pathogen or its antigens (Welsh, Che, Brehm & Selin, 2010). Dogs are commonly affected by infection by some coronavirus strains (Decaro & Buonavoglia, 2008), less virulent for humans, which could trigger some type of protection against SARS-CoV-2. Despite being something speculative (but see Loos et al., 2020), we agree with the views of both the authors and hope to test this hypothesis soon. However, we suggest these neuroendocrine and primarily strong affective bonds between humans and dogs can strengthen the immune-mediated mechanisms against SARS-CoV-2 infection. We extended the hypothesis to a biopsychosocial field, without excluding the original hypothesis of those authors.

Affectionate relationships and friendly social life can act as behavioural pathways to increase resilience to COVID-19 by increasing the OT expression in pituitary and other body cells. Paradoxically, sociality can lead people to maintain broader contacts, increasing the transmission of the SARS-CoV-2. Dogs are an effective alternative, no less than affections between people; human-dog attachment could be an emotional support that fulfils the need of affection for people (Crawford et al., 2006). The long-lasting interaction between people and their dogs can strengthen bonds of affection and companionship. In this case, the "quality" or intensity of the affective bond behaves as the differential point to distinguish more psychological resilience and immune resistance to COVID-19. In addition, we agree with the hypothesis that the close contact between a species susceptible to other strains of coronavirus, such as dogs, may have stimulated cross-immunity in humans who own dogs (Jurgiel et al., 2020).

Our point of view, based on the evidence in the literature on the role of pair bonds and affection in improving people's health, has led us to suggest that affective attachment is a determinant for resilience to COVID-19. In other words, we propose two hypotheses on resilience and resistance to COVID-19. First, we hypothesised that people who cultivate strong bonds of affection to their dogs are more resilient to emotional challenges of COVID-19 infection. Second, we hypothesised that, people who is strongly attached for their dogs, are more resistant to contamination and severe symptoms of COVID-19. This assumption is

based on the rationale that the prosocial behaviours with a high level of affection and reciprocity mediate by OT, reinforce good mental state, and competent immunity.

This theoretical proposal did not exclude the other benefits of dogs on human health such as emotional buffering, mental comfort, and stress alleviation (Salas García et al., 2020). Indeed, the role of OT expressed by the affective attachment could be a neuroendocrine support to explain this emotional and mental states reported by people.

Considering the diversity of the expression of affective bonds, cultural differences can be conditioning factors for different degrees of resilience to diseases, including the devastating COVID-19. Likewise, in addition to the symbolic valence of the affective attachment, there is strong evidence that neuroendocrine systems are age–sex dependent and respond differently to the same stimulus of affection and attachment (MacDonalds, 2013).

To test this hypothesis, retrospective and cross-sectional studies on the relationship between people and dogs should be applied, relating the different levels of exposition and development (if any) of COVID-19 symptoms. Strict control of epidemiological variables and methods should be considered in these future studies. In the studied sub-populations, the variables social support, personality type, and socioeconomic status should be strictly controlled for future studies. The differences in the types of affective attachment may emerge from studies on resilience to COVID-19 considering affective ties as a determinant in health.

Confirming the hypotheses presented can explain part of the mortality and morbidity of people to COVID-19. It is not yet known what the future scenario of the pandemic will be, but this will certainly not be the last, and new challenges will await health researchers to predict and mitigate the effects of such devastating pandemics. Knowledge about the affective relationship between people and dogs will help health professionals to develop strategies that promote affection as an adjunct to disease prevention and treatment.

Conclusions

We presented an unconventional biopsychosocial theoretical proposal to study the effect of human-dog attachment on COVID-19 resilience and resistance. Four points should be highlighted: human-dog attachment has neuroendocrine bases strongly mediated by OT; OT is related to pro-social behaviour; OT participates in immune-mediated responses that increase the resilience and resistance to diseases; human-dog attachment influences cross-immunity and OT, which increase resilience and resistance to COVID-19.

The affective relationship between humans and dogs has been considered as an adjunct to people’s health, although much remains to be discovered in the coming years. The role of dogs in human society has changed and helped to shape the civilization, including a sociality and affection. It seems that this vital role continues and will continue for years to come, as long as people need affective bonds with dogs.

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V. B. has contributed in a, b, c, d, e; I. O. S. in a, b, c, d, e.

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