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SALIVARY CORTISOL ANALYSIS AS A RESOURCE IN THE EVALUATION OF OCCUPATIONAL STRESS: A SYSTEMATIC REVIEW OF THE LITERATURE

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Abstract

Stress at work has long been a reason for studies and concerns. In this context, ergonomics presents itself as the science that studies the adaptations of activities in the work environment, to the physical, physiological, biomechanical and psychological characteristics of individuals (NASCIMENTO and MORAES, 2000). Recent research shows that a series of variables influence the intensity of worker stress. The present systematic review sought to verify the main results obtained in research with analysis of salivary cortisol in different occupations. A search was carried out in journals published between 2005 and 2015, in the following databases: BIREME (Virtual Health Library); MEDLINE (US National Library of Medicine); PUBMED (National Library of Medicine and The National Institute of Health); Scopus and Science Direct. Thirty-two publications met the requirements and were included in the work. We analyzed whether the authors considered the analysis of salivary cortisol effective as a measure for identifying stress levels. Few studies compared the difference between genders, but those that did, found that women, married, with children, of low purchasing power, had high concentrations of cortisol. More than half of the studies did not show a comparison between work shifts and rest days. In addition, the main category investigated consisted of health professionals. Research indicates that salivary cortisol is an important biomarker in the investigation of stress-causing agents, and its analysis, if methodologically well-founded and described, can be implemented as a resource in the ergonomic analysis of work.

Keywords: Physiology, Ergonomics, Stress, Cortisol, Work.

1. INTRODUCTION

The term work, according to some etymological dictionaries, derives from the Latin *tripaliare* (three-stick torture instrument), that is, it is linked to the idea of suffering. In a more generic sense, it is the activity through which man consciously and voluntarily modifies the world to satisfy his basic needs (JAPIASSÚ and MARCONDES, 2001).

According to Silva et al. (2010), since Antiquity, the form of work has been a reason for studies and concerns for society. The evolution of tools and the organization of work were of great importance for the advancement of contemporary civilizations. The new technologies and management methods developed in recent decades have intensified the work, modifying the

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profile of illness and suffering of workers. This profile is demonstrated by the increase in the incidence of work-related diseases, the appearance of new exhausting situations such as stress, physical and mental fatigue, among other manifestations of work-related suffering (BRASIL, 2001). Many risk factors can cause occupational diseases, whether physical, chemical, biological, ergonomic or psychosocial (MURTA, 2004).

For Iida (2005) "ergonomics" can have several definitions, however, all of them seek to highlight the interdisciplinary character and the objective of its study, which is the interaction between man and work in the man-machine-environment system. More frequently, we find the definition of ergonomics as: the science that studies the adaptation of work activities in the work environment to the physical, physiological, psychological and biomechanical characteristics of the individual. It should aim at the well-being of the worker and his safety, resulting in professional efficiency (NASCIMENTO and MORAES, 2000).

1.1. Physiology of stress

In general, when a person is exposed to stressful conditions, the neuroendocrine systems are activated and secrete substances such as the hormone cortisol and catecholamines (adrenaline and noradrenaline) promoting physiological reactions in response to stress. When the restoration of balance is compromised due to chronic stress, the concentration of these substances in the bloodstream changes (PACAK and McCARTY, 2000).

According to Low et al (2010), the pathways through which stress influences health are mediated by the hypothalamic-pituitary-adrenal (HPA) axis, which regulates the body's stress in the short and long term.

In short-term or acute stress, the sympathetic nervous system is dominant. In this stage, also called the alert phase, there is a discharge of catecholamines throughout the body, in order to prepare it to fight or flee. At this time, the heart rate increases, the blood vessels of the muscles of the legs and arms dilate (vasodilation), the liver increases the production of glucose (glycogenolysis) to provide energy for muscle contraction, as well as several other mechanisms that prepare the body for a moment of greater activity are activated (MOLINA, 2014). If the stressor persists, the body can enter the resistance phase: where the adrenal gland decreases the release of adrenaline and starts to produce and release cortisol (MARTINS, 2007). The exhaustion phase occurs when the stressor lasts longer, or when other stressors act simultaneously. In this phase, psychological and physical fatigue sets in, where symptoms such

as insomnia, dermatological and gastrointestinal problems, emotional instability, anxiety, hypertension and hyperglycemia, among others, can be observed.

1.2. Influence of cortisol

Cortisol is a glucocorticoid secreted by the cortex of the adrenal gland, and which exerts important effects that increase the blood concentration of glucose. Virtually any type of physical or neurogenic stress causes an immediate and sharp increase in cortisol secretion. High levels of hormones and catecholamines (adrenaline and noradrenaline) in the bloodstream can lead to harmful health effects, such as diabetes, obesity, hypertension, and suppression of the immune system (GOODMAN, 2009).

Currently, salivary cortisol is considered the most promising biomarker to verify the response to stress and has an important role in occupational health research due to its potential use to assess the physiological response in work groups exposed to occupational overload and stress (KUDIELKA et al 2012).

According to Castro and Moreira (2003), saliva samples are obtained by simple, non-invasive procedures that do not cause stress, and can be performed by untrained people. Samples can be collected several times a day, which allows for dynamic assessment of free cortisol secretion. However, laboratory analysis should be critical, taking into account the circadian rhythm, the presence or absence of disease, and the individual's work shift (VILAR et al, 2013).

Rocha et al (2013a) sought to evaluate salivary cortisol concentration as a physiological index for stress level in nurses, comparing a workday with a day off. The results suggested that on days off the presence of stress is less evident, since the concentration of salivary cortisol maintains lower values when compared to working days.

In a second study, Rocha (2013b) found that subjects on the night shift had changes in the circadian rhythm during the workday, and the older the workers, the lower the salivary cortisol value, which was attributed to a possible adaptation of the individual to stressful situations present at work.

The analysis of salivary cortisol seems to be a useful resource in the identification of stress at work, and a systematic review of the studies that used this technique can not only confirm this hypothesis, but also point out ways to develop more precise studies on the subject.

2. METHODOLOGY

A systematic search of journals published between 2005 and 2015 (pre-pandemic Sars-Cov-2) was carried out. This chronology is justified by the high global prevalence of depressive and anxiety disorders (stresses) due to the COVID-19 pandemic. This variable could influence the results of the research, since the subjects would already be subjected to stressful conditions (social isolation, use of masks, fear) which could interfere with the analyses of the work environment (SANTOMAURO et al. 2021). Thus, the searches were carried out in the following databases: BIREME (Virtual Health Library); MEDLINE (US National Library of Medicine); PUBMED (National Library of Medicine and The National Institute of Health); Scopus and ScienceDirect. To carry out this search, the following keywords and phrases were used: "workload and cortisol levels"; "workload and cortisol levels"; "salivary cortisol in workers"; "salivary cortisol workers", where only studies carried out in humans, case studies, and studies with pre- and post-ergonomic intervention were included. The articles were selected after reading their respective title and abstract. To verify the quality of the research, with regard to the adequacy, clarity and detail of the methodologies, the STROBE (Strengthening the Reporting of Observational Studies in Epidemiology) scale was used, which consists of a checklist of 22 items that, according to Malta et al. (2010), should be present in a scientific article. These items consider information present in the title, abstract, introduction, methodology, results and discussion. In addition, we quantified the articles included in the study in terms of:

- number of annual publications during the period considered;
- professions and genres objects of study;
- job characteristics, such as shifts, days off, and physical and mental loads;
- use of complementary analyses, such as glycemic level and others;
- evaluation by the author(s) of the efficacy of salivary cortisol analysis as a biomarker of stress at work.

Publications that were presented in more than one database were counted only once. Review articles were not part of this study.

During the search, 55 publications were identified. Of these, after the analysis of their respective titles, objectives and methods, within the criteria pre-established by the present review, 33 investigations met the necessary requirements to be part of the present study, thus having their texts read in full. The main reasons for the exclusion of articles were: salivary

cortisol was not the main variable analyzed (n=6), lack of relationship with the theme investigated in this study (n=6) and literature review (n=10).

3. RESULTS AND DISCUSSION

3.1. Bibliometric Indicators

Considering the 33 articles selected according to the established requirements, we observed that most of the studies were published in 2014 (8 papers), with emphasis also on the years 2009 and 2012, with the remaining years having 3 or fewer papers published (Figure 1).

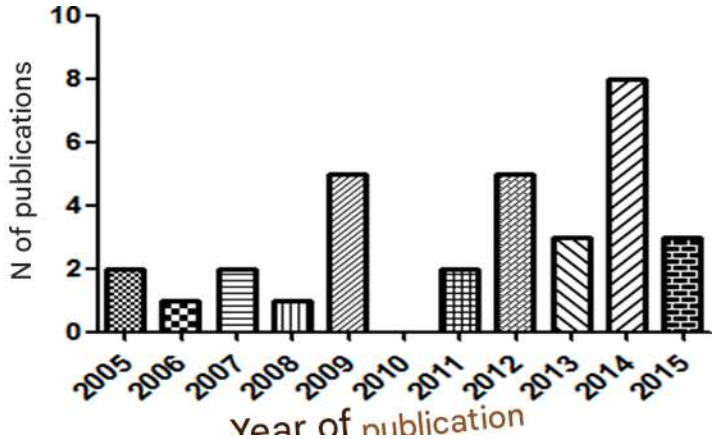

Figure 1: Number of publications considered in the study, by year, from 2005 to 2015.

According to Paschoal and Tamayo (2004), the interest in the study of stress at work has been growing in the scientific literature. One of the reasons for the increase in research on the subject is due to the fact that occupational stress has a negative impact on the health and well-being of workers and, consequently, on the functioning of an organization. For Florentino et al. (2015), it is of great relevance that research be carried out seeking to expand the study and provide professionals with more efficient mechanisms to cope with the stress generated in the occupational environment. Health research is an indispensable component for the advancement and development of peoples and nations. Regardless of the source of funding, health research contributes directly and indirectly, through the potential impact on economic activity, creating and maintaining a culture of evidence and reason (BRASIL. 2004).

3.2. Top professionals surveyed

Regarding the analysis of the population sample, it was found that the main area of investigation consisted of health professionals (34%) (Figure 2).

According to Brasil (2004), there are many requirements to work in the health area, as it is often a reflective work, with technical, ethical and political dimensions. Health professionals, especially nurses working in hospitals, often live with anxiety, feelings of loss, patient fragility, uncomfortable and embarrassing, invasive and painful care procedures (ATHAYDE 2005). In addition, low salaries and flexible schedules have often been pointed out as causes for these professionals to accumulate functions in more than one job, subjecting themselves to an overload of schedules with shifts, increased functions and responsibilities, which can impair the performance of their activities (SILVA; PINTO 2012).

Studies on education professionals (6%), security (6%), aviation (3%) and unspecified ones were also described (50%), including studies with the public in the industrial, space, civil service, communication and also students sectors (Figure 2).

For Oiticica and Gomes (2004), considering the competitive demands in which schools are inserted, the teacher is charged for constant and rapid updating and adaptation to the social values that are renewed every day. However, reality does not offer sufficient conditions for educational practices, whether in terms of materials, audiovisual resources, the physical environment of the classrooms, as well as the salary, which often does not match the responsibility of the educator, promoting dissatisfaction and contributing to increase the level of stress. Thus, it can be said that teachers are among the professionals who suffer the most from stress (MARTINS, 2007).

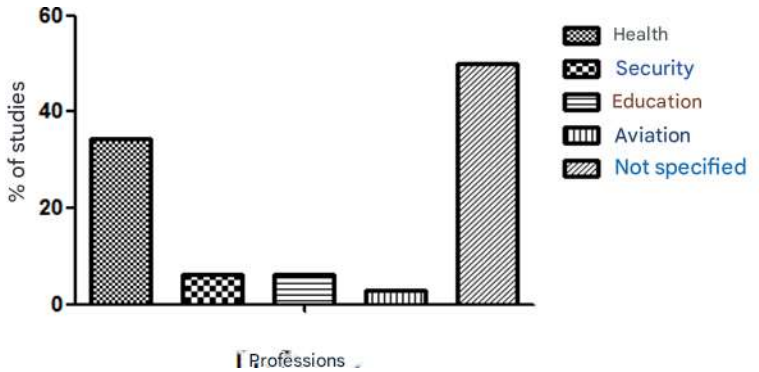

Figure 2: Main areas of activity addressed in the studies.

According to Catarina (2010), the scientific literature that deals with indicators of occupational stress in police officers and their relationship with work is considered scarce. Some authors understand that this is due to a tradition that studies in occupational health are focused on industrial sectors (SOUZA et al. 2007). One hypothesis is that the possible historical relationship between intellectuals and security professionals, especially in the years of dictatorship, may have resulted in a distance between these professionals. According to

Catarina (2010), it is also important to carry out occupational surveys with safety professionals, to improve knowledge and understand the potential risk factors for their health.

With regard to aviation professionals, it is notable that the growth of air transport in recent decades shows the importance of this sector for the economy, both for passenger transport and freight transport. Along with this development, changes in the forms of organization and management are also necessary (ITANI, 2009). For Silveira et al (2011), the need to make quick and accurate decisions in a complex activity such as flying further increases the importance of the topic, since stress and fatigue can affect the decision process. Therefore, research on working conditions in aviation should show how health is managed and how it is considered in management practices (ITANI, 2009).

3.3. Quality of observational research

As for the information that should be present in the studies, according to the STROBE initiative, we can observe that, in general, the research is adequate with regard to the clarity and detail of the studies (Table 1). However, for an item as important as the description of objectives and hypotheses, a relatively low percentage was observed (64.7%).

Table 1. Percentage of STROBE check items that were addressed in the studies published between 2005 and 2015.

Item	Recommendation	Not applicable	Not described	Described
1st	In the description of the study in the title or abstract, with a term commonly used	0 (0.0)	4th (17.6)	28th (82.3)
1b	The summary contains an informative and balanced summary of what was done and found	0 (0.0)	2 (11.7)	30 (88.2)
Introduction				
2	Explains scientific and rational research	0 (0.0)		32 (100)
3	It describes the specific objectives, including what is the case.	0 (0.0)	10 (35.2)	22 (64.7)
Methods				
4	At the beginning of the article, it presents the key elements related to the study	0 (0.0)	3 (14.7)	29 (85.3)
5	Describes the pier	1 (3.0)	7(26,5)	24 (70.5)
5	Describes the recruitment minutes	0 (0.0)	12 (41.2)	20 (58.8)
5	Describes p erío d o s de aço mp an h amen to	0 (0.0)	10 (35.3)	22 (64.7)
6a	Ap resen ta os criterion de eleg ibilid ad e	0 (0.0)	3(14.7)	29th (85.3)
6a	Describes the methods of steel mp an h amen to	0 (0.0)	9 (32.3)	23 (67.6)
6b	Ap resen ta criterion s cor rresp o n d en tes	0 (0.0)	9(32,3)	23 (67.6)
6b	Ap resen ta number of exp o s s e n o exp o s to the study	0 (0.0)	4th (17.6)	28th (82.3)
7	Clearly defining the	0 (0.0)	6 (23.5)	26 (76.4)
7	Clearly define the exp o tions	0 (0.0)	6 (23.5)	26 (76.4)
7	Definition of the p red ito res	0 (0.0)	6 (23.5)	26 (76.4)
7	Clearly define the facts of the	0 (0.0)	10 (35.2)	22 (64.7)
7	Clearly defined the modificad o res of effect	0 (0.0)	8 (29.4)	24 (70.5)
8	Ap resen ta fo n te de d ad o s	0 (0.0)	4th (17.6)	28th (82.3)
8	Method of measurement	0 (0.0)	0 (0.0)	32 (100)
9	Describes that the effort to be made by the	0 (0.0)	10 (35.3)	22 (64.7)
10	Explain how the size of the study	0 (0.0)	8 (29.4)	24 (70.5)
11	Explain how variables that were addressed in the analysis.	0 (0.0)	5 (20.5)	27 (79.5)
12a	Describes all statistical methods	0 (0.0)	3 (8.8)	29 (91.2)
12a	Describes the statistical OS	0 (0.0)	3 (8.8)	29(91,2)
12b	Describe how you can use your s to examine your subg rup s and introduction	4th (11.7)	4th (11.7)	24th (76.6)
12c	Explains how the lack of d ad o s fo i abo rd ad a	0 (0.0)	13 (44)	19 (56)
12d	Explain how to follow a p erd a to fo i abo rd ad a	1 (3.0)	7th (26.5)	24 (70.5)
12e	Describes an analysis of sensibilid ad e	32(100)		
Findings				

13th	Ap resen ta number of in d ivíd uo s in each phase of the study	0 (0.0)	4th (17.6)	28th (82.3)
13b	Ap resen ta reasons for not p articip ation in each phase	2 (5.8)	5 (20.5)	25 (73.5)
13c	Co n sid was the use of a flow branch	26th (82.3)	0 (0.0)	6 (17.6)
14th	Ap resents the characteristics of the participants of the study	1 (3.0)	1 (3.0)	30 (94)
14b	Indicates the number of participants with a lack of data for the interest variable	1 (3.0)	12 (41.2)	19th (55.8)
14c	Summarizes the time of following	1 (3.0)	11 (38.2)	20 (55.8)
15	Report of results or summary of measures	0 (0.0)	3 (8.8)	29 (91.2)
16a	Present estimates not adjusted	4th (11.7)	24th (73.5)	4 (14.7)
16a	Estimates adjusted to the common fund	0 (0.0)	3 (14.7)	29 (85.3)
16b	Ap resenta estimates of interest in the financial	0 (0.0)		32 (100)
16c	Co n sid was estimates of relative risk in risk abso bereavement	0 (0.0)	4th (17.6)	28th (82.3)
17	In fo rma o utra an analysis done	1 (3.0)	12 (41.2)	19th (55.8)
Discussion				
18	It summarizes the results of the study of the objective	0 (0.0)	1 (3.0)	31 (97)
19	Discusses limitations of the study	0 (0.0)	6 (23.5)	26 (76.4)
20	Ap resenta a cautious intersection of the results of the objective	0 (0.0)	2 (5.8)	30 (94.2)
20	Explains the results of similar studies	0 (0.0)	2 (8.8)	30 (91.2)
21	It discusses the g eneralization of the results of study	0 (0.0)	4th (11.7)	28th (88.2)
Other information				
22	Ap resen ta a fo n te de fin an ciamen to e o p ap el dos fin an ciad o res	0 (0.0)	15 (44.1)	17 (47)

The general item "discussion" was the one that had the highest percentage of compliance with the requirements, with an average of 89.4% in the sub-items. In this item, the least contemplated sub-item was the one referring to the discussion of the study's limitations, which can be considered essential in this type of approach, as most of the studies present confounding factors or limitations inherent to the methodology, such as the self-collection of the analysis material (saliva) by the collaborator, who must follow a protocol for the exact execution, which is difficult for the authors to verify.

It was also observed in some studies the omission of the description of methodological items with regard to the participants, such as characteristics of the population and also the description of statistical methods.

For Bosi (2012), the critical evaluation of studies means discerning the validity of their results and understanding how much the possible defects of the studies affect the results. This critical evaluation includes the relevance of the study, that is, the clinical importance, internal and external validity of the research.

In scientific research, validity is the extent to which a measurement correctly represents the concept of the study. Therefore, issues such as design, paradigms, theoretical concepts, researchers' expectations, methodological and analytical procedures, presentation and discussion of results should be part of the validity verification (GIANDONI et al 2012).

The STROBE initiative is suggested by the Department of Science and Technology of the Ministry of Health as a tool to guide the construction of observational epidemiological studies and systematic reviews, in addition to being able to be used as a support bibliography for undergraduate and graduate students in the training of researchers (BRASIL, 2013).

An important component of a thorough systematic review is therefore a primary assessment of the methodological quality of the research. It is important, however, to

distinguish between the quality of the reports and the quality of what was actually done in the design, conduct and analysis of a study. For Sanderson et al. (2007) a high-quality report ensures that all relevant information about a study is available to the reader, but does not necessarily reflect a low susceptibility to bias.

According to Malta et al. (2010), the STROBE initiative should be seen as an ongoing process and open to reviews, recommendations, criticisms, and new evidence.

3.4. Variables considered in the studies

As shown in Table 2, with regard to the variables analyzed, it is observed that 78% of the studies did not compare genders; 60% did not present a comparison between work shifts; 69% did not correlate working days with days off; In addition, although 60% analyzed the physical or mental workload, 72% did not mention whether they considered salivary cortisol as an effective measure in the analysis of occupational stress, as can be seen in Table 2.

3.4.1. Gender comparisons

According to Eller et al. (2006), the feeling of stress assessed by cortisol release has a positive exponential curve in the first hours of the day, with a drop after eight hours, both in men and women. However, the feeling of pressure combined with high effort seems to influence women more.

In athletes, higher cortisol concentrations were also observed in women, but this increase was not considered statistically significant (SEGATO et al 2010).

In a study carried out by Susoliakova et al. (2014), the authors sought to evaluate salivary cortisol levels in two different occupations (teachers and firefighters), where it was observed that the salivary cortisol pattern throughout the workday seemed to be similar in both genders.

Levi (1999) found that some groups were at greater risk for occupational stress, and among the determining factors for this occurrence he cites the combination of being a woman, having overwork and a less favored economic situation.

Areias and Guimarães (2004) demonstrated that married women with children are more subject to work overload and occupational demands, which can contribute to high levels of stress. Other authors also found that women report more negative characteristics at work than men.

The investigated population attributed this to differences in learning opportunity and monotony at work (MATTHEWS et al 1998).

The data obtained by Areias and Guimarães (2004) show that mental health and support factors are interrelated, and that psychosocial risk factors for stress are higher for female participants. However, the author mentions that other research should be conducted, aimed at reducing the effects of other variables regarding the specific issue of gender.

For Laberg et al. (2020), the evaluation and quantification of the impact of the production process on the work environment must consider the analysis of gender in decision-making and ergonomic interventions. According to Fulvio et al. (2021), organizational work analysis is a variable that should be considered and adjusted to suppress exposure to physical and psychosocial stress factors in this population.

3.4.2. Comparisons between shifts

Shift work has been shown to be of great importance in health, with regard to physical, emotional and social aspects. According to Simões et al. (2010), shift work alters the circadian rhythm, promoting negative implications in the biological processes of self-regulation. Among the problems evidenced then are sleep disorders.

The most frequent occupational losses associated with sleep disorders are absenteeism, decreased quality of work, productivity and increased risk of accidents (LITTNER et al 2003).

Carev et al. (2011) evaluating anesthesiologists' shifts, identified that the stress caused by sleep deprivation can result in increased sympathetic activity, blood pressure, and circadian rhythm disruption.

A study that explored the differences in salivary cortisol profile between nurses working the night shift and regular shift, found that nurses working at night took at least four days to adjust the circadian rhythm of cortisol secretion (NIU et al. 2015).

3.4.3. Comparisons between workday and day off

Seeking to investigate how much work shifts influence cortisol rhythm, Bostock and Steptoe (2013) identified that days worked, regardless of the shift, were associated with greater stress and fatigue when compared to rest days. These results are similar to those of Da Rocha et al. (2013), who observed that salivary cortisol concentrations on a day off remained lower

when compared to days worked. However, the author points out that a correlation with stress questionnaires is important to complement physiological results.

Only one-third of the studies correlated salivary cortisol from days worked with days off, which indicates the need for more research to support and possibly highlight the hypothesis of the cortisol-work stress relationship.

3.4.4. Correlation with physical or mental workload

According to Frutoso and Cruz (2005), the term workload is a theoretical construction resulting from the need to understand that, for a given work situation, there is a permanent tension between the demands of the process and the biological and psychological capacities of the workers to respond to them. According to the author, workload plays a prominent role in the discussion about health and job satisfaction.

Broadly speaking, workload can be divided into two dimensions: mental and physical. The mental dimension refers to subjective aspects, such as feelings, affections, emotions, motivations, and cognition. The physical dimension is related to postures (static and dynamic), gestures and displacements (FRUTOSO and CRUZ 2005).

There are three groups of measures to measure workload: measures of execution (performance and performance), physiological measures and subjective measures (usually questionnaires) (FRUTOSO and CRUZ, 2005).

For Cardoso and Gontijo (2012), the complexity of the tasks can interfere with the performance of the worker and the mental demands imposed by the work, which justifies the theoretical-methodological study on the mental and physical load imposed by work, mainly because, in Brazil, there are still few studies in which such characteristics are investigated in real situations based on studies in ergonomics.

As already mentioned and shown in figure 2, the most researched area of activity consisted of health professionals. It is also possible to observe research in the areas of security, education, communication, civil service, food and automotive industry sectors.

It was noted that in addition to salivary cortisol, variables such as mood, sleep, tiredness, stress, circadian rhythm, among others, were analyzed in the various studies included in this review, as can be seen in Table 3.

3.4.5. Other variables considered

The stress response is the result of the interaction between the characteristics of the individual and the demands of the environment, that is, the disparities between the external and internal environment. This response comprises cognitive, behavioral and physiological aspects, aiming to process the available information and select appropriate behaviors for the organism. Margis et al. (2003) mention that different stressful situations and responses to them vary among individuals and in their form of presentation, and therefore it is interesting that other variables are considered in the analysis of stress.

Table 2: Frequency of the variables considered in the analyzed articles

	Variables analyzed				
Authors	Co mp araçõ es en tre g ên ero s	Co mp pation en tre Shifts	Co mp aration en tre d ia d e work the day vs lg a	Relationship with the physical or mental work	Evaluation of the efficacy of salivary chorthysis analysis as a measure of stress
Amirian et al. (2015)	No	Yes	No	Yes	I don't report u
Anjum et al. (2011)	No	Yes	No	No	Yes
Atri et al. (2015)	No	No	No	Yes	I don't report u
Bostock; Steptoe (2013)	No	Yes	Yes	Yes	I don't report u
Fields; David (2014)	No	Yes	No	No	Yes
Carev et al. (2011)	No	Yes	No	Yes	Yes
Da Rocha et al. (2013)	No	No	Yes	No	Yes
Dahlgren et al. (2005)	No	No	Yes	Yes	I don't report u
Dahlgren et al. (2009)	No	No	Yes	Yes	I don't report u
De Schipper et al. (2009)	No	No	No	No	I don't report u
Eller et al. (2006)	Yes	No	Yes	No	Yes
Eller et al. (2012)	Yes	No	No	No	I don't report u
Griefahn; Robens (2008)	No	Yes	No	Yes	I don't report u
Hansen et al. (2012)	No	No	Yes	No	I don't report u
Harris et al. (2007)	No	Yes	No	Yes	Yes
Hébert; Lupien (2009)	No	No	No	No	Yes
Lindholm et al. (2012)	No	Yes	No	No	I don't report u
Marchand et al. (2014)	Yes	No	No	Yes	I don't report u
Marrelli et al. (2014)	No	No	No	Yes	I don't report u
Martinez De Tejada et al. (2013)	No	Yes	Yes	Yes	I don't report u
Metzenthin et al. (2009)	No	Yes	No	Yes	I don't report u
Minelli (2014)	No	No	No	No	Yes
Neylan et al. (2005)	No	No	No	No	I don't report u
Niu et al. (2015)	No	Yes	Yes	No	I don't report u
Rai et al. (2012)	No	No	No	Yes	Do not reato u
Rai; Kaur (2012)	No	No	No	Yes	Yes
Scholey et al. (2009)	No	No	No	No	I don't report u
Sjörs et al. (2014)	Yes	Yes	Yes	Yes	Non Latvian u
Stokholm et al. (2014)	No	No	No	Yes	I don't report u
Susoliakova et al. (2014)	Yes	No	No	Yes	I don't report u
Uhde et al. (2007)	No	Yes	Yes	Yes	Yes
Vangelova; Stanchev (2014)	No	No	No	Yes	I don't report u
	No (78%)	**No (60%)**	**No (69%)**	**No (40%)**	**Did not report (72%)**

Table 3: Main areas of activity, variables analyzed complementary to salivary cortisol analysis, and types of intervention.

Authors	Area Acting	Variables considered in addition to salivary cortisol					Intervention	
		Mood	sleep	Tiredness or stress	Change in circadian rhythm (yes, no, or not reported)	Other	Type or NA (not applicable)	Efficacy (yes, no or x)
Amirian et al. (2015)	Health and	yes	-	-	NR	Pain and melate n in a	IN	-
Anjum et al. (2011)	Health and	-	yes	-	yes	Phantom Assassin and FC	IN	-
Atri et al. (2015)	No Esp ecificad o	-	-	yes	NR	Perid o n tite	IN	-
Bostock; Steptoe (2013)	Aviation	yes	yes	yes	NR	-	IN	-
Fields; David (2014)	Health and	-	-	yes	NR	-	IN	-
Carev et al. (2011)	Health and	-	yes	yes	NR	PA	IN	-

4. FINAL CONSIDERATIONS

Ergonomics is a science that has been increasingly explored by professionals and researchers from different areas. Therefore, knowing the physiological phenomena of the human organism is extremely important to be able to act as an interventionist in health and work organization.

We can observe with this study that salivary cortisol is an important biomarker in the investigation of stress-causing agents, and its analysis, if methodologically well founded and described, can be implemented as a resource in the ergonomic analysis of work. And since the ergonomics professional is the one who analyzes, quantifies, diagnoses and intervenes in possible risks to the worker's health, this is an important tool, as it brings with it objective and reliable data for decision-making in favor of the worker.

REFERENCES

ALVES, S.A; QUEIROZ, F.R.C; SILVA, J.C.P; PASCHOARELLI, L.C. A arte do trabalho: Jules Amar. In: SILVA, J.C.P; PASCHOARELLI, L.C. **A Evolução Histórica da Ergonomia no Mundo e Seus Pioneiros.** 1 ªed. São Paulo: Editora UNESP, 2010, p 50. https://doi.org/10.7476/9788579831201

AMIRIAN, I.; ANDERSEN, L. T.; ROSENBERG, J.; GÖGENUR, I. Working night shifts affects surgeons' biological rhythm. **American journal of surgery**, p. 389–395, 2015. https://doi.org/10.1016/j.amjsurg.2014.09.035

ANJUM, B.; VERMA, N. S.; TIWARI, S.; SINGH, R.; MAHDI, A. A. Association of salivary cortisol with chronomics of 24 hours ambulatory blood pressure / heart rate among night shift workers. **BioScience Trends**, v. 5, n. 4, p. 182–188, 2011. https://doi.org/10.5582/bst.2011.v5.4.182

AREIAS, M. E. Q.; GUIMARÃES, L. A. M. Gender and stress in workers of a public university of São Paulo state. **Psicologia em Estudo**, v. 9, p. 255–262, 2004. https://doi.org/10.1590/S1413-73722004000200011

ATHAYDE, M. Christophe Dejours: da psicopatologia à psicodinâmica do trabalho. **Cadernos de Saúde Pública**, v. 21, n. 3, p. 989–990, 2005. https://doi.org/10.1590/S0102-311X2005000300039

ATRI, M.; SRIVASTAVA, D.; KHARBANDA, J.; et al. Occupational Stress, Salivary Cortisol, and Periodontal Disease: A Clinical and Laboratory Study. **Journal of international oral health : JIOH**, v. 7, n. 9, p. 65–9, 2015.

BOSI, P. L. Saúde Baseada em Evidências. p. 38, 2012. BOSTOCK, S.; STEPTOE, A. Influences of early shift work on the diurnal cortisol rhythm, mood and sleep: Within-subject variation in male airline pilots. **Psychoneuroendocrino** CAMPOS, J. F.; DAVID, H. M. S. L. Analise de cortisol salivar como biomarcador de estresse ocupacional em trabalhadores de enfermagem. **Revista Enfermagem**, v. 22, n. 4, p. 447–453, 2014.

CARDOSO, M. D. S.; GONTIJO, L. Avaliação da carga mental de trabalho e do desempenho de medidas de mensuração: NASA TLX e SWAT. **Gestão & Produção**, v. 19, n. 4, p. 873–884, 2012. https://doi.org/10.1590/S0104-530X2012000400015

logy, v. 38, n. 4, p. 533–541, 2013. https://doi.org/10.1016/j.psyneuen.2012.07.012

BRASIL - NORMA REGULAMENTADORA DE ERGONOMIA – NR17: portaria MTPS n° 3.751, de 23 novembro de 1990. Disponível em: http://portal.mte.gov.br/data/files/FF8080812BE914E6012BEFBAD7064803/nr_17.pdf Acesso em: 12/12/2015.

BRASIL. **Ministério da Previdência e Assistência Social**. Lista de Doenças Relacionadas ao Trabalho. Brasília: MTE/ SIT; MPAS; 2001.

BRASIL. HumanizaSUS. **Ministério da Saúde, secretaria executiva, núcleo técnico da política nacional de Humanizaçã. Brasília**, p. 1–19, 2004.

BRASIL**. Ministério do Trabalho e do Emprego** 2011. Disponível em: www.mte.gov.br. Acesso em 06/02/16.

BRASIL. MINISTÉRIO DA SAÚDE. SECRETARIA DE CIÊNCIA, T. E. I. E. D. D. C. E. T. **DIRETRIZES METODOLÓGICAS: Elaboração de revisão sistemática e metanálise de estudos observacionais comparativos sobre fatores de risco e prognóstico**. p.99, 2013.

CAMPOS, J. F.; DAVID, H. M. S. L. Analise de cortisol salivar como biomarcador de estresse ocupacional em trabalhadores de enfermagem. **Revista Enfermagem**, v. 22, n. 4, p. 447–453, 2014.

CARDOSO, M. D. S.; GONTIJO, L. Avaliação da carga mental de trabalho e do desempenho de medidas de mensuração: NASA TLX e SWAT. **Gestão & Produção**, v. 19, n. 4, p. 873–884, 2012. https://doi.org/10.1590/S0104-530X2012000400015

CAREV, M.; KARANOVIĆ, N.; BAGATIN, J.; MATULIC,N.B; PECOTIC, R; VALIC, M; MARINOVIC-TERZIC, I; KARANOVIC, S; DOGAS, Z. Blood pressure dipping and

salivary cortisol as markers of fatigue and sleep deprivation in staff anesthesiologists. **Collegium antropologicum**, v. 35 Suppl 1, p. 133–138, 2011.

CATARINA, E. D. E. S. Relatório de Pesquisa Mapeamento das Fontes de Estresse em Profissionais da Segurança Pública do Estado de Santa Catarina. , 2010.

DA ROCHA, M. C. P.; DE MARTINO, M. M. F.; GRASSI-KASSISSE, D. M.; DE SOUZA, A. L. Stress among nurses: An examination of salivary cortisol levels on work and day off. **Revista da Escola de Enfermagem**, v. 47, n. 5, p. 1187–1194, 2013. https://doi.org/10.1590/S0080-623420130000500025

DAHLGREN, A.; KECKLUND, G.; AKERSTEDT, T. Different levels of work-related stress and the effects on sleep, fatigue and cortisol. **Scand J Work Environ Health**, v. 31, n. 4, p. 277–285, 2005. https://doi.org/10.5271/sjweh.883

DAHLGREN, A.; KECKLUND, G.; THEORELL, T.; ÅKERSTEDT, T. Day-to-day variation in saliva cortisol-Relation with sleep, stress and self-rated health. **Biological Psychology**, v. 82, n. 2, p. 149–155, 2009. https://doi.org/10.1016/j.biopsycho.2009.07.001

DOUGLAS, C.R. **Tratado de Fisiologia Aplicado as Ciências Médicas.** 6 ed. Rio de Janeiro: Guanabara Koogan, p 80, 2006.

ELLER, N. H.; NETTERSTROM, B.; HANSEN, Å. M. Psychosocial factors at home and at work and levels of salivary cortisol. **Biological Psychology**, v. 73, n. 3, p. 280–287, 2006. https://doi.org/10.1016/j.biopsycho.2006.05.003

ELLER, N. H.; NIELSEN, S. F.; BLOND, M.; NIELSEN, M.L; HANSEN, A.M; NETTERSTROM, B. Effort reward imbalance, and salivary cortisol in the morning. **Biological Psychology**, v. 89, n. 2, p. 342–348, 2012.https://doi.org/10.1016/j.biopsycho.2011.11.007

FLORENTINO, S.; CARLOS, B.; CHIACHIA, S; REIS, M.C; TEIXEIRA,R.F. QUALIDADE DE VIDA NO TRABALHO E ESTRESSE OCUPACIONAL : Uma análise junto a profissionais do setor de tecnologia da informação. **Revista eletrônica de ciências sociais aplicadas,** n. 5, p. 104–125, 2015.

FRUTOSO, J. T.; CRUZ, R. M. Mensuração da carga de trabalho e sua relação com a saúde. **Revista Brasileira de Medicina do Trabalho,** v.3, n.1, p.31, 2005.

FULVIO, M.C.M; LAZZARATO, R.F; ERRICO, A. Impact of different work organizational models on gender differences in exposure to psychosocial and ergonomic hazards at work and in mental and physical healt. **International Archives of Occupational and Environmental Health.** v.94, 1989-1904, 2021. https://doi.org/10.1007/s00420-021-01720-z

GIANDONI, L.; HENRIQUE, O.; ZILLER, M.; OLLAIK, L. G. Conceptions of validity in qualitative studies. **Educação e Pesquisa,** v. 38, n. 1, p. 229–241, 2012. https://doi.org/10.1590/S1517-97022012005000002

GOODMAN, H.M. **Basic Medical Endocrinology.** 4ed – California : Academic Press, p.75, 2009.

GRIEFAHN, B.; ROBENS, S. The cortisol awakening response: A pilot study on the effects of shift work, morningness and sleep duration. **Psychoneuroendocrinology**, v. 33, n. 7, p. 981–988, 2008. https://doi.org/10.1016/j.psyneuen.2008.04.004

HANSEN, Å. M.; THOMSEN, J. F.; KAERGAARD, A.; KOLSTAD, H.A; KAERLEV, L; MORS, O; RUGULIES, R; BONDE, J.P; ANDERSEN; J.H; MIKKELSEN, S. Salivary cortisol and sleep problems among civil servants. **Psychoneuroendocrinology**, v. 37, n. 7, p. 1086–1095, 2012. https://doi.org/10.1016/j.psyneuen.2011.12.005

HARRIS, A.; URSIN, H.; MURISON, R.; ERIKSEN, H. R. Coffee , stress and cortisol in nursing staff. **Psychoneuroendocrinology**, v. 32, p. 322–330, 2007. https://doi.org/10.1016/j.psyneuen.2007.01.003

HÉBERT, S.; LUPIEN, S. J. Salivary cortisol levels, subjective stress, and tinnitus intensity in tinnitus sufferers during noise exposure in the laboratory. **International Journal of Hygiene and Environmental Health**, v. 212, n. 1, p. 37–44, 2009. https://doi.org/10.1016/j.ijheh.2007.11.005

IIDA, I. **Ergonomia Projeto e Produção**. 2 ed. Editora Edgard Blucher LTDA. São Paulo: 2005.

ITANI, A. Saúde e gestão na aviação: a experiência de pilotos e controladores de tráfego aéreo. **Psicologia & Sociedade**, v. 21, n. 2, p. 203–212, 2009. https://doi.org/10.1590/S0102-71822009000200007

JAPIASSÚ, H; MARCONDES, D. **Dicionário Básico de Filosofia.** 3 ªed. Rio de Janeiro: Zahar, p 185, 2001.

JOSEPH, J; HURRELL, Jr. Occupational Stress. In: LEVY, B.S; WEGMAN, D.H; BARON,

S. L; SOKAS, R.K. **Occupational and Environmental Health: recognizing and preventing disease and injury**. 6 ed. Oxford: Oxford University Press, p.297, 2011.

KUDIELKA, B.M; GIERENS, A; HELLHAMMER, D.H; WOST, S; SCHLOTZ, W. Salivary Cortisol in Ambulatory Assessment Some dos, Some Don'ts, and Some Open Questions. **Psychosomatic Medicine.** v.74, p 418-431, 2012. DOI: 10.1097/PSY.0b013e31825434c7

LABERGE, M; CAROLY, S; RIEL, J; MESSING, K. Considering sex and gender in ergonomics: Exploring the hows and whys. **Applied Ergonomics.** v. 85, p 1-3, 2020. https://doi.org/10.1016/j.apergo.2019.103039

LEVI, L. Guía sobre el estrés relacionado con el trabajo: La "sal de la vida" o el "beso de la muerte?" **Barcelona: Dirección General de Empleo y Asuntos Salud, Sociales de la Comisión Europea de Seguridad y Trabajo,** p. 1–146, 1999.

LINDHOLM, H.; AHLBERG, J.; SINISALO, J.; HUBLIN, C; HIRVONEN, A; PARTINEN, M; SARNA, S; SAVOLAINEN, A. Morning Cortisol Levels and Perceived Stress in Irregular Shift Workers Compared with Regular Daytime Workers. **Sleep Disord**, v. 2012, p. 1–5, 2012. https://doi.org/10.1155/2012/789274

LITTNER, M.; HIRSHKOWITZ, M.; KRAMER, M.; KAPEN, S; ANDERSON, W.M; BAILEY, D; BERRY, R.B; DAVILA, D; JOHNSON, KUSHIDA, C. Practice parameters

for using polysomnography to evaluate insomnia: an update. **Sleep**, v. 26, n. 6, p. 754–760, 2003. https://doi.org/10.1093/sleep/26.6.754

LOW, M.J. Neuroendrocrinologia. In: KRONENBERG, H.M; MELMED, S; POLONSKY, K.S; LARSEN, P.R. **Williams Tratado de Endocrinologia.** 11 ªed. Rio de Janeiro: Elsevier, p 95, 2010.

MALTA, M.; CARDOSO, L. O.; BASTOS, F. I.; MAGNANINI, M,M,F. Iniciativa STROBE : subsídios para a comunicação de estudos observacionais STROBE initiative : guidelines on. , v. 44, n. 3, p. 559–565, 2010. https://doi.org/10.1590/S0034-89102010000300021

MARCHAND, A.; DURAND, P.; JUSTER, R. P.; LUPIEN, S. J. Workers' psychological distress, depression, and burnout symptoms: Associations with diurnal cortisol profiles. **Scandinavian Journal of Work, Environment and Health**, v. 40, n. 3, p. 305–314, 2014. https://doi.org/10.5271/sjweh.3417

MARGIS, R.; PICON, P.; COSNER, A. F.; SILVEIRA, R. D. O. Relação entre estressores, estresse e ansiedade. **Revista de Psiquiatria do Rio Grande do Sul**, v. 25, n. suplemento 1, p. 65–74, 2003. https://doi.org/10.1590/S0101-81082003000400008

MARRELLI, M.; GENTILE, S.; PALMIERI, F.; PADUANO, F.; TATULLO, M. Correlation between Surgeon ' s Experience , Surgery Complexity and the Alteration of Stress Related Physiological Parameters. **Plos One**, v. 9, n. 11, p. 1–8, 2014.https://doi.org/10.1371/journal.pone.0112444

MARTINS, M. Sintomas de Stress em Professores Brasileiros. **Revista Lusófona de Educação**, v. 10, p. 109–128, 2007.

MARTINEZ DE TEJADA, B.; JASTROW, N.; PONCET, A.;SCOUEZEC, I.L ; IRION, O; KAYSER, B. Perceived and measured physical activity and mental stress levels in obstetricians. **European Journal of Obstetrics Gynecology and Reproductive Biology**, v. 171, n. 1, p. 44– 48, 2013. https://doi.org/10.1016/j.ejogrb.2013.08.020

MATTHEWS, S.; HERTZMAN, C.; OSTRY, A.; POWER, C. Gender, work roles and psychosocial work characteristics as determinants of health. **Social science e medicine**, v. 46, n. 11, p. 1417–24, 1998. https://doi.org/10.1016/S0277-9536(97)10141-1

METZENTHIN, P.; HELFRICHT, S.; LOERBROKS, A.; TERRIS, D. D.; HAUG, J.; SOBRAMANIAN, S.; FISCHER, J. A one-item subjective work stress assessment tool is associated with cortisol secretion levels in critical care nurses. **Preventive Medicine**, v. 48, n. 5, p. 462–466, 2009. https://doi.org/10.1016/j.ypmed.2009.02.001

MOLINA, P.E. **Fisiologia Endócrina.** 4 ed, Porto Alegre : AMGH, p.140, 2014.

MINELLI, A. Brief training of psychoneuroendocrinoimmunology-based meditation (PNEIMED) reduces stress symptom ratings and improves control on salivary cortisol secretion under basal and stimulated conditions. **Explore (New York, N.Y.)**, v. 10, n. 3, p. 170–179, 2014. https://doi.org/10.1016/j.explore.2014.02.002

MURTA, S.G. Avaliação de intervenção em estresse ocupacional. **Psicologia: Teoria e Pesquisa.** v. 8, n.1, p 39-47, 2004. https://doi.org/10.1590/S0102-37722004000100006

NAVARRO, A.; NAVARRO, F. Cortisol e Exercício: Efeitos, Secreção e Metabolismo. **Revista Brasileira de Prescrição e Fisiologia do Exercício**, v. 5, n. 29, p. 435–445, 2011. https://doi.org/10.33233/rbfe.v10i3.3443

NASCIMENTO, N. M; MORAES, R.A.S**. Fisioterapia nas empresas**. 2 ed. Taba Cultural. Rio de Janeiro: 2000.

NEYLAN, T. C.; BRUNET, A.; POLE, N.; BEST, S.; METZLER, T.; YEHUDA, R.;

MAEMAR, C. PTSD symptoms predict waking salivary cortisol levels in police officers. **Psychoneuroendocrinology**, v. 30, n. 4, p. 373–381, 2005. https://doi.org/10.1016/j.psyneuen.2004.10.005

NIU, S. F.; CHUNG, M. H.; CHU, H.; TSAI, C.; LIN, C.; LIAO, M.; KENG, L.; ANTHONY, C; KUEI, R. Differences in cortisol profiles and circadian adjustment time between nurses working night shifts and regular day shifts: A prospective longitudinal study. **International Journal of Nursing Studies**, v. 52, n. 7, p. 1193–1201, 2015. https://doi.org/10.1016/j.ijnurstu.2015.04.001

OITICICA, M. L. G. R.; GOMES M. L. B. O estresse do professor acentuado pela precariedade das condições acústicas das salas de aula. In: XXIV Encontro Nacional de Engenharia de Produção, p. 1–8, 2004.

PASCHOAL, T.; TAMAYO, Á. Validação da escala de estresse no trabalho. **Estudos de Psicologia**, v. 9, n. 1, p. 45–52, 2004. https://doi.org/10.1590/S1413-294X2004000100006

PACAK, K; McCARTY, R; Acute stress response: experimental. In: FINK G **. Encyclopedia of stress**. New York: Academic Press; p. 8-17, 2000.

PINTO, J. G. **Corticoesteróides e Problemas Psiquiátricos**. p 7, Dissertação (Mestrado Integrado em Medicina) - Faculdade de Medicina Universidade do Porto, Cidade do Porto, 2010.

RAI, B.; KAUR, J. Mental and physical workload, salivary stress biomarkers and taste perception: Mars desert research station expedition. **North American Journal of Medical Sciences**, v. 4, n. 11, p. 577–581, 2012. DOI: 10.4103/1947-2714.103318

RAI, B.; KAUR, J.; FOING, B. H. Stress, workload and physiology demand during extravehicular activity: A pilot study. **North American Journal of Medical Sciences**, v. 4, n. 6, p. 266–269, 2012. DOI: 10.4103/1947-2714.97205

ROCHA, M.C.P. **Análise do cortisol salivar como indicador do estresse e a relação com a qualidade do sono em enfermeiros.** Tese (Doutorado em Enfermagem) – Faculdade de Enfermagem, Universidade Estadual de Campinas, Campinas, 2013.

SADIR, M. A.; BIGNOTTO, M. M.; LIPP, M. E. N. Stress e qualidade de vida: influência de algumas variáveis pessoais. **Paideia**, v. 20, n. 45, p. 73–81, 2010. https://doi.org/10.1590/S0103-863X2010000100010

SANDERSON, S.; TATT, I. D.; HIGGINS, J. P. T. Tools for assessing quality and susceptibility to bias in observational studies in epidemiology: A systematic review and annotated bibliography. **International Journal of Epidemiology**, v. 36, n. 3, p. 666–676, 2007. https://doi.org/10.1093/ije/dym018

SAPOLSKY, R. M. Depression, antidepressants, and the shrinking hippocampus. **Proceedings of the National Academy of Sciences of the United States of America**, v. 98, n. 22, p. 12320– 2, 2001. https://doi.org/10.1073/pnas.231475998

SANTOMAURO, D.F. et al. Global Prevalence and burden of depressive and anxiety disorders in 204 countries and territories in 2020 due to the COVID-19 pandemic. **The Lancet,** v.398, n.6, 2021. https://doi.org/10.1016/S0140-6736(21)02143-7

DE SCHIPPER, E. J.; RIKSEN-WALRAVEN, J. M.; GEURTS, S. A. E.; DE WEERTH, C. Cortisol levels of caregivers in child care centers as related to the quality of their caregiving. **Early Childhood Research Quarterly**, v. 24, n. 1, p. 55–63, 2009. https://doi.org/10.1016/j.ecresq.2008.10.004

SCHOLEY, A.; HASKELL, C.; ROBERTSON, B.; KENNEDY, D.; MILNE, A.; WETHEREL, M. Chewing gum alleviates negative mood and reduces cortisol during acute laboratory psychological stress. **Physiology and Behavior**, v. 97, n. 3-4, p. 304–312, 2009. https://doi.org/10.1016/j.physbeh.2009.02.028

SEGATO, L.; BRANDT, R.; LIZ, C. M.; VASCONCELLOS, D. I. C.; ANDRADE, A. Estresse psicológico de velejadores de alto nível esportivo em competição. **Motricidade**, v. 6, n. 3, p. 53–62, 2010.

SILVA, D.C; SILVA, J.C.R.P; CARNEIRO, L.P; SILVA, J.C.P; PASCHOARELLI, L.C. Contribuições científicas de Bernard Forest de Bélidor para o estudo da organização do trabalho. In: SILVA, J.C.P; PASCHOARELLI, L.C. **A Evolução Histórica da Ergonomia no Mundo e Seus Pioneiros.** 1 ªed. São Paulo: Editora UNESP, p 17, 2010.

SILVA, C. D. DE L. E S.; PINTO, W. M. Riscos ocupacionais no ambiente hospitalar: fatores que favorecem a sua ocorrência na equipe de enfermagem. **Saúde Coletiva em Debate**, v. 2, n. 1, p. 4–6, 2012.

SILVEIRA, J. L. H. DA; FÁTIMA, M. DE; ROSA, B. **Fatores Humanos e Aspectos de Medicina Aeroespacial**. 1 ªed. Palhoça: Editora UnisulVirtual, p 107, 2011.

SIMÕES, M. R. L.; MARQUES, F. C.; ROCHA, A. DE M. O trabalho em turnos alternados e seus efeitos no cotidiano do trabalhador no beneficiamento de grãos. **Revista Latino-Americana de Enfermagem**, v. 18, n. 6, p. 1070–1075, 2010. https://doi.org/10.1590/S0104-11692010000600005

SJÖRS, A.; LJUNG, T.; JONSDOTTIR, I. H. Diurnal salivary cortisol in relation to perceived stress at home and at work in healthy men and women. **Biological Psychology**, v. 99, n. 1, p. 193–197, 2014. https://doi.org/10.1016/j.biopsycho.2014.04.002

SOUZA, E. R. DE; FRANCO, L. G.; MEIRELES, C. DE C.; FERREIRA, V. T.; SANTOS, N. C. DOS. Sofrimento psíquico entre policiais civis: uma análise sob a ótica de gênero. **Cadernos de Saúde Pública**, v. 23, n. 1, p. 105–114, 2007. https://doi.org/10.1590/S0102-311X2007000100012

STOKHOLM, Z. A.; HANSEN, A. M.; GRYNDERUP, M. B.; BONDE, J.P; CHRISTENSEN; K.L; FREDERIKSEN; T.W; LUND, S.P; VESTERGAARD, J.M; KOLSTAD, H.A. Recent and long-term occupational noise exposure and salivary cortisol level. **Psychoneuroendocrinology**, v. 39, n. 1, p. 21–32, 2014. https://doi.org/10.1016/j.psyneuen.2013.09.028

SUSOLIAKOVA, O.; SMEJKALOVA, J.; BICIKOVA, M.. Salivary cortisol in two professions: Daily cortisol profiles in school teachers and firefighters. **Neuroendocrinology Letters**, v. 35, n. 4, p. 314–321, 2014.

UHDE, A.; WU, S.; KUDIELKA, B. M. Circadian cortisol profiles and psychological self - reports in shift workers with and without recent change in the shift rotation system. **Biological Psychology**, v. 74, p. 92–103, 2007. https://doi.org/10.1016/j.biopsycho.2006.08.008

VILAR, L; FARIA, M.S; COELHO, C. E; BRUNO, O.D. Diagnóstico e diagnóstico diferencial da Síndrome de Cushing. In: VILAR, L. **Endocrinologia clínica.** 5 ªed. Rio de Janeiro: Guanabara e Koogan, p 448, 2013.

VANGELOVA, K.; STANCHEV, V. Stress, visual and musculoskeletal com- Plaints in open plan office staff. **Acta Medica Bulgarica**, v. 41, n. 1, p. 50–56, 2014. https://doi.org/10.2478/amb-2014-0007