Literature Review

# The Prenatal *Yoga* Practice: stress reduction and other findings

# A Prática do *Yoga* no Pré-natal: redução do estresse e outros achados

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**ABSTRACT |** During pregnancy, women are susceptible to several factors that generate recurrent stress. Such factors, described as stressors, are considered triggers of distress symptoms that eventually develop into anxiety and depression (pre and postpartum) and even organic responses, such as increased rates of stress biomarkers like cortisol, the most abundant. *Yoga* was indicated as beneficial to the hypothalamus-pituitary-adrenal system (HPA), affecting the Autonomic Nervous System (ANS), with consequent improvement in physical and mental health. Thereby, the aim of this study was to identify and systematize the knowledge produced by literature on the effects of *yoga* practice by pregnant women on prenatal stress. To this end, an integrative content review was developed in articles from the database of the Medical Literature Analysis and Retrieval System Online (MEDLINE), from 2012 to 2019. Through the search on descriptors - *yoga*; pregnancy; pregnancy; stress - 124 studies were obtained, among which, 13 of them met the inclusion criteria to be reviewed. After the analyzes, the outcomes of the *yoga* interventions were categorized as primary and secondary effects, the primary reflecting the symptoms of stress during pregnancy and the secondary representing their effects with respect to pain and discomfort during pregnancy and childbirth and health markers of the newborn. Conclusion: prenatal *yoga* for pregnant women is considered effective and its benefits place it as an strategy that can be prescribed, both in a preventive and complementary way in the treatment of symptoms and mood disorders during pregnancy. It should be added that, in view of the psychological impacts of the Covid-19 pandemic outbreak, today, the practice of *yoga* can be an important tool for the mental health care of pregnant women.

**KEYWORDS:** *Yoga*. Psychological stress. Pregnancy. Early intervention.

**RESUMO |** Na gestação, a mulher está suscetível a diversos fatores que geram estresse recorrente. Tais fatores, descritos como estressores, são considerados disparadores de sintomas de angústia que, eventualmente, evoluem para quadros de ansiedade e depressão (pré e pós-parto), e mesmo respostas orgânicas, como a elevação das taxas de biomarcadores do estresse como o cortisol, o de maior abundância. O *yoga* foi apontado como benéfico para o sistema hipotálamo-pituitária-adrenal (HPA), repercutindo no Sistema Nervoso Autônomo (SNA), com consequente melhora na saúde física e mental. Assim, o objetivo deste estudo foi identificar e sistematizar o conhecimento produzido pela literatura científica acerca dos efeitos do *yoga* sobre o estresse em mulheres grávidas. Para tanto, foi desenvolvida uma revisão integrativa de conteúdos, em artigos da base de dados do Sistema Online de Busca e Análise de Literatura Médica (MEDLINE), no período de 2012 a 2019. Mediante a busca em descritores – *yoga*; gravidez; *pregnancy*; *stress* – chegou-se a 124 estudos, entre os quais, 13 deles obedeciam aos critérios de inclusão para serem revisados. Depois das análises, os desfechos das intervenções com *yoga* foram categorizados enquanto efeitos primários e secundários, os primeiros refletindo os sintomas do estresse na gestação e os secundários representando os seus efeitos no que tange a dor e desconforto na gestação e parto e marcadores de saúde do recém-nascido. Conclusão: o *yoga* no pré-natal de gestantes foi considerado eficaz e os benefícios levantados colocam-na como uma estratégia que pode ser prescrita, tanto de forma preventiva como complementar no tratamento dos sintomas do estresse na gestação. Acrescenta-se que, tendo em vista os impactos psicológicos do surto pandêmico do Covid-19, na atualidade, a prática de *yoga* pode ser uma importante ferramenta para o cuidado da saúde mental de gestantes neste período.

**PALAVRAS-CHAVE:** *Yoga*. Stress psicológico. Gravidez. Intervenção precoce.

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## Introduction

Stress was first defined in Science by Selye (1950), who presented it as a syndrome, the result of the biological interaction between damage (the product of the stressors) and the defense of the organism defense (biological reactions), as its reaction in the face of situations beyond its comprehension limit and/or action.

Emotional stress is related to an individual's need to deal with external or internal factors to the body, presented as stressors, and capable of creating tensions, demanding answers from the individual (SADIR, Bignotto & LIPP, 2010; Selye, 1950 ).

Such responses occur both at a psychological level, generating anguish and psychological suffering (ARANTES & VIEIRA, 2002) as well as physiological, with automatic activation of the hypothalamic-pituitary-adrenal axis - which interferes with the functioning of the parasympathetic nervous system, leading to an increase in blood cortisol (HPA) rates (LINDSAY & NIEMAN, 2005; MONTENEGRO et al, 2010).

During the gestational period, women are susceptible to several stressors specific to this phase, which can generate recurrent symptoms ofstress (RODRIGUES & SCHIAVO, 2011; GLAZIER et al. , 2004).

Stress in pregnant women is considered a trigger of distress symptoms that eventually evolved into anxiety (GLAZIER et al., 2004; PAMPAKA et al., 2018), recurrent or chronic depression, both pre and postpartum (ROMERO -GONZALES et al., 2020), as well as the risk of damage to the mother-baby affective bond (GLAZIER et al., 2004; PAMPAKA et al., 2018). There are studies that also link stress to suicide and infanticide in pregnant teenagers (FIELD et al., 2013b; FIELD et al., 2012).

Anxiety and depression are recurrent emotional responses in this gestational period, and tend to negatively affect healthy pregnancy progression (SATYAPRIYA et al, 2013). Depression, both pre- and postnatal, is one of the most common complications in this period, affecting up to 60.8% of pregnant women in some populations (PAMPKA et al, 2018). This condition can be made present at any time during the year of pregnancy and its duration varies from woman to woman (PAMPKA et al, 2018). Regarding maternal prenatal anxiety, it is often overlooked due to the difficulty of conceptualizing its representation, as well as the difficulty of evaluating it (NEWHAM et al, 2014). This neglect, in turn, can give rise to an intensification of the adverse effects, as a trigger for other complications, among them depression (NEWHAM et al, 2014).

Some specific stress factors can be listed in this pregnancy period, such as fear of childbirth and the baby's own death, fear of the changes that will occur with motherhood, financial concerns, difficulties in relationships, among others, (RODRIGUES & SCHIAVO, 2011; GLAZIER et al., 2004).

In addition to these factors, hormonal changes typical of pregnancy can serve as amplifiers of this gestational stress (GLAZIER et al, 2004) due to the increase in maternal cortisol - the stress hormone - which is also produced by the placenta from the second trimester of pregnancy (MONTENEGRO et al, 2010).

The rise in the rates of this biomarker has been associated with significant risks of spontaneous abortion (BAYRAMPOUR et al., 2015), premature births and the consequent low birth weight (MONK et al., 2000; GLAZIER et al., 2004). Also changes in neurobehavioral development and physiological patterns related to the child's emotional regulation (KERRY-ANN, MCMAHON & AUSTIN, 2007; ELLMAN et al., 2008; NATH et al., 2017).

Contextualizing with the current moment, when the world is facing the pandemic outbreak of the Covid-19 virus, it should be considered that the stressors present during the gestational period are not only being amplified, but combined with a few others, such as pregnant women's fear of being infected by the virus, the necessary isolation from a social life and the uncertainty about its duration, the amount of inadequate information spread daily regarding the world scenario, as well as the anticipation of a serious economic crisis worldwide (BROOKS et al ., 2020).

It is estimated that approximately 6% of the pregnant population is affected by a high level of pregnancy-specific stress, which can trigger a series of problems (ROMERO-GONZALES et al, 2020) such as those described before.

That said, and based on the consolidation of the Brazilian policies for the use of Integrative and Complementary Practice in Health – named as

Práticas Integraticas e Complementares em Saúde (PICS) in the national Unified Health System (Sistema Único de Saúde - SUS) (MINISTRY OF HEALTH, 2006), this integrative review was designed with the aim to identify and systematize the knowledge produced by the scientific literature on the effects of *yoga* on stress in pregnant women. It is believed that this may be a possible strategy to deal with the stress mechanisms and to avoid their risks.

With the expansion of the use of PICS (MINISTRY OF HEALTH, 2017) also known as Alternative Medicine (WHO, 2002) in global health systems, other practices started to be validated for health care, integrated with traditional medicine practices (TESSER, 2009). One of them was *yoga*, an ancient tradition consisting of a set of physical exercises or asanas, breathing practices or pranayamas, and meditation, which promote a state of relaxation in the human being (FILLA apud RODRIGUES et al., 2006).

*Yoga* can be described as a psycho-physical practice that uses techniques to control bodily and mental functions (BRAZIL, 2018).

The psychophysical effects of this practice, which instructs techniques of physical and mental self-care (GHAROTE, 2007), have been associated with its influence on the mechanisms of the autonomic nervous system, the central nervous system and with direct action on muscles, joints and viscera (GHAROTE, 2007), from the execution of different physical postures, breathing exercises and meditative practices (SILVA, 2009). A literature review of 81 studies published in PubMed (ROSS & THOMAS, 2010) proved the benefits of the practice of *yoga* in activating the hypothalamic-pituitary-adrenal axis (HPA) and the Sympathetic Nervous System (SNS), reflecting on mental health.

In this regard, a line of investigation has advanced with research related to the effects of *yoga* on pregnant women in prenatal care. Controlled clinical studies indicate that carrying out this practice during gestation significantly reduced maternal cortisol rates - a biomarker of stress (Field et al, 2013b; SATYAPRIYA et al., 2013; Araujo 2018; SHAIKH et al., 2013).

Other clinical evidence of reduction in stress scores were associated, also, to this type of intervention (SATYAPRIYA et al, 2008), as well as reducing anxiety and depression symptoms and disorders (Bershadsky et al, 2014; SATYAPRIYA et al., 2013).

Analyzing psychosocial stressors in pregnant women under *yoga* interventions, an association between their participation in *yoga* groups and an increase in the quality of their psychological health and in interpersonal relationships was exhibited (SATYAPRIYA et al 2013; QINXIAN et al 2015; FIELD et al., 2012; RAKSHANY et al . , 2010).

In view of physical health, improvement in discomfort and back pain, considered to be physical stressors, reduction in labor pain (CHUNTARAPAT et al., 2008) and its duration (Qinxian et al, 2015), were also results correlated to the *yoga* practice during pregnancy.

Associated with stress, given their influence, the immunological responses of pregnant women obtained positive results, which were also correlated to the interventions. Likewise, some vital functions of the fetus, such as pulse oximetry, uterine tocometry and heart rate (MOOVENTHAN, 2019). Positive results were also found in the association between interventions with this practice and the reduction in occurrences of pre-eclampsia (Field et al., 2013b).

After the theoretical considerations made here, a contextualization becomes necessary for this study. It reflects the purposes of the Brazilian Academic Consortium for Integrative Health (Consórcio Acadêmico Brasileiro de Saúde Integrativa) recently constituted by the Ministry of Health, which encourages and promotes research on the PICS (BIREME, 2020 ). The initiative of this consortium is linked to the Department of Primary Care of the aforementioned Ministry and proposes as its goals to guarantee the management of the knowledge produced by the aforementioned research projects and their integration into the Sistema Único de Saúde (SUS) (WHO, 2013).

As a result, this review has dual relevance. On the one hand, it meets the demand for investigations that add knowledge to the field of PICS, and on the other, it can serve as a reference for SUS professionals who wish to implement prenatal services, working with *yoga* - a resource that was considered to be effective for the control of stress and promotion of mental health of pregnant women, through this review. Many SUS users could benefit from such initiatives.

## Methods

For this study, which constitutes of a by-product of research with pregnant adolescents (ARAÚJO, 2018), the method of integrative literature review (WHITTEMORE & KNAFL, 2005; SOUZA, SILVA & CARVALHO 2010) was utilized, initiated from a clear definition of its purpose and then with the search for scientific articles using keywords considered descriptors in DeCS (Health Sciences Descriptors) - *yoga* ; "gravidez"; pregnancy and stress.

This search began in 2017 (July-August) and was completed in 2020 (August). Inclusion criteria were: must be original research projects, published since 2012, five years before the start of this study; present intervention results of *yoga* with pregnant women and the effects of this practice on the symptoms or markers of stress; integrate pregnancy-stress-*yoga* into the textual discussion; have the full text available in English or Portuguese and be indexed to the database of the Online System for Search and Analysis of Medical Literature and related health areas ( MEDLINE ).

Having as its guide the aim to identify in the literature the scientific evidence of the effects of *yoga* on stress in pregnant women, the extracted data for this study were organized in a table that included: design of the study, year, authors and country of publication, sample size (intervention and control groups), age group of participants, inclusion criteria in the samples, activity of the control group, duration of interventions and the results or effects of *yoga* on pregnant women participating in empirical research .

A first reading of the articles led to the identification of different categories of responses to interventions with *yoga* in pregnant women within the various experiments. Most of the responses were related to the effects of the practice on symptoms of stress - the subject of this study - that, for theoretical systematization purposes, were designated here as primary effects (Table 1).

However, other effects that were not directly related to the investigated question were raised and analyzed as secondary data which, in Table 1, are described as "side effects".

The impacts of the practice of *yoga* on stress were here interpreted according to the results of each research reviewed in view of the symptoms presented in the pregnant women participants and their respective assessment measures.

Serving as the basis for analysis of the effects of that practice on stress in pregnant women participants, the quantitative results of their scores symptoms were measured by validated tests and/or their reports and questionnaires in qualitative research. Statistical measures of symptoms evaluation were also measured between the control and treatment groups - randomized or no randomized - and individual groups evaluated in T1-T2. In these cases, the effects were assessed here according to comparative measures between and within groups, based on the significance level of $p \leq 0.005$.

## Results

The search resulted in a universe of 124 articles, of which, after exploratory reading of the abstracts, 108 articles were excluded, as they did not not focus on the topic. In the discarded literature, *yoga* was associated with: smoking during pregnancy (1); biological and physiological aspects of pregnancy (40); pharmacology for stress during pregnancy (2); alternative modalities and therapies during pregnancy (7); man's participation during the pregnancy process (4); use and general effects of *yoga* during pregnancy period without the focus on stress (37) or a discussion of stress without being associated with *yoga* or pregnancy (19). Of the 16 articles that showed suitability to the theme, 3 were discarded because they were systematic reviews of the literature, in a way that did not fit the "original research" criterion.

In the end, 13 articles related the practice of *yoga*, pregnancy and the symptoms of stress, were selected for this review. There is a greater concentration of publications in 2015 (4 - 30,77%).

Of the 13 studies selected (Table 1) , 7 (53.84%) were Randomized Controlled Clinical Trials (RCT); 2 (15.38%) Quasi-Experimental Clinical Trials; 2 (15,38%) Clinical Trials Pre and Post-test and 2 (15,38%) Qualitative Studies with focus groups.

**Table 1.** Characterization of empirical studies (to be continued)

| *Study Design* | *Groups I: Intervention C: Control (Nº Pregnant Women)* | *Control Group Activity* | *Age/ InclusionCriterion(s)* | *No. Yoga Sessions* | *Primary Effects Of Yoga (Stress Symptoms )* | *Side Effects Of Yoga (Other Findings) (1st Author , Year, Country )* |
|---|---|---|---|---|---|---|
| ***Randomized Controlled Clinical Trial - Rct*** | GI = 48<br>GC = 46 | Routinepre natalcare | 20 - 45 /<br>Normal pregnancy | 20 weeks<br>2X / s | Reduction of biomarker - cortisol (p <0.001);<br>Increased immunoglobulin (p <0.001- GI;<br>Improved immune functions. | ( Chen et al . [12] , 2017, Taiwan ) |
| ***RCT*** | GI = 23<br>GC = 23 | Routinepre natalcare | 18 - 45 /<br>Depression Anxiety | 8 weeks<br>1X / s | Reduction of symptoms of anxiety and depression - IG and CG (p = 0.000);<br>Significant reduction in negative affect (p <0.011). | ( Davis et al [16] , 2015, USA ) |
| ***RCT*** | GI = 29<br>GC = 22 | Routinepre natalcare | > 18 /<br>Normal pregnancy<br>Primiparous | 8 weeks<br>1X / s | Cortisol reduction (p <0.001);<br>Anxiety symptoms reduction<br>(P <001) - (intra-group - IG). | ( Newham et al [38] , 2014, England ) |
| ***RCT*** | GI = 51<br>GC = 45 | Physicalexe rcise for prenatalcar e | 20-35 /<br>Normal pregnancy | 36 weeks<br>7X / s | Anxiety reduction (IG = 15.6%; CG = 13.76%);<br>Depression reduction (IG = 30.67; CG = 3.57%);<br>Reduced anxiety traits (GI = 8.9%; CG = 5.02%);<br>Reducedestriol, progesterone. | The *Yoga* reduces physical discomfort.<br>( Satyapriya et al [49] , 2013, India ) |
| ***RCT*** | GI = 40<br>GC = 39 | Social supportgro up | 24 (average) /<br>Dysthymia / depression | 12 weeks<br>1X / s | Cortisol reduction - GI and GC;<br>Depression, anxiety - GI - GC;<br>Improves GI - GC interpersonal relationships. | Reduced pain in the legs and back.<br>Both were risk reduction strategies<br>( Field et al [19] , 2013, USA) |
| ***RCT*** | GI = 37<br>GC = 38 | Y waitinglist. | 18-37 /<br>Depression | *Yoga + Tai Chi*<br>12 weeks<br>1X / s | Depression reduction (p <0.001);<br>Anxiety reduction (p <0.01);<br>Reduction in sleep disorder (p <0.05);<br>Reduction of somatic / vegetative symptoms;<br>Reductionof negative affect. | ( Field et al [18] , 2013, USA ) |



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**Table 1.** Characterization of empirical studies (conclusion)

| *Study Design* | *I: Intervention C: Control (Nº Pregnant Women)* | *Control Group Activity* | *Age/ InclusionCriterion(s)* | *No. Yoga Sessions* | *Primary Effects Of Yoga (Stress Symptoms )* | *Side Effects Of Yoga (Other Findings) (1st Author , Year, Country )* |
|---|---|---|---|---|---|---|
| ***RCT*** | N = 84<br>Does not specify groups | Massage | 26 (average) /<br>Depression | Gr *Yoga*<br>*Gr* Massage<br>12 weeks<br>2X / s | **GI** -Yoga<br>Intergroup reduction:<br>depression (p <0.001);<br>anxiety (p <0.001);<br>anger (p <0.001);<br>Improvement in relationships (p <0.001). | Reduction in back and leg pain (Yoga and Massage)<br>Significant difference in gestational age and NB weight ir the intervention and control groups.<br>( Field et al [20] , 2012, USA ) |
| ***ClinicalTrial (Pre-Test)*** | GI = 79 | | 34 (average) /<br>Normal pregnancy<br>Primiparous | 20 weeks 3X / s (DVD)<br>2X / month (in person) | Cortisol reduction (T1: p <0.001 - T2: p = 0.001);<br>Alpha-amylase (T1: p <0.001 - T2: p = 0.006). | Immediate effect of stress reduction after intervention.<br>( Kusaka et al [30] , 2016, Japan ) |
| ***ClinicalTrial (Pre-Test)*** | GI = 22 | Withoutcontrol | > 18 years<br>Normal pregnancy<br>Severe depression | 10 weeks<br>1X / s | Anxiety reduction;<br>Decrease, on average, of severe depression, yoga being more accepted than conventional treatment.<br>Reduction in negative affects and increase in positive affects. | ( Battle et al [4] , 2015, USA ) |
| ***QualitativeStudy*** | GI = 14 | | > 18 years<br>Have practiced yoga (6 months)<br>. | Focus group (sub-groups)<br>1 session | It benefited pregnant women with symptoms of anxiety and depression, being the reason for the search for yoga.<br>Psychological benefits<br>Perception of yoga being better than other practices | Valued as a strategy for physical benefits<br>(Kinser&Masho [30] , 2015, USA) |
| ***QualitativeStudy*** | GI = 17 | - | 14-17 years<br>Afrodescendants | Focus group (subgroups)<br>1 session | Reports of recurrent themes in the subgroups: stress symptoms, depression in daily life, feeling of isolation; importance of a group exclusively for pregnant teenagers and the need for techniques to deal with this, *yoga* being the preferred method. Yoga chosen as a *coping* strategy to deal with everyday stress during pregnancy | ( Kinser&Masho [29] , 2015, USA) |
| ***ClinicalTrial Quasi-Experimental*** | GI = 38<br>GC = 13 | No physicalactivity | > 18 years<br>Normal pregnancy | Yoga<br>1 session (90 min) | Cortisol reduction (p <0.01);<br>Reduction of depressive symptoms in the postpartum period (p <0.5);<br>Depressive symptoms in prenatal care (0.001); GI = GC. | (Bershadsky et al [6] , 2014, USA ) |
| ***ClinicalTrial Quasi-Experimental*** | GI = 23<br>GC = 23 | Routine prenatal care<br>DVD yoga for home | 26 to 40 years<br>*In vitro* fertilization | 12 weeks<br>1X / s | Reduced scores for stress and anxiety states;<br>Improved self-confidence. | Improvement in reports of labor pain .<br>( Shim& Lee [52] , 2012, South Korea ) |


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Table 1 describes the different countries of publication of the original articles - England (1), Taiwan (1), Japan (1), India (1), South Korea (1) and the United States (8), with a concentration in the latter. Thus, there is diversity in the place of origin of publications with the scope of *yoga* practice, with pregnant women from different cultures.

From the perspective of pregnant participants, a total of 754 women composed the control and intervention groups, the latter having the participation of 474 (62.8%) women who attended the *yoga* sessions effectively. The total universe of participants had gestational age between the 2nd and 3rd trimesters of pregnancy, and was in the age group between 14 and 45 years old with predominance between 20 and 35 years old.

From the perspective of the interventions, the *yoga* sessions lasted up to 12 weeks and represented a variation between the experiments in the number of sessions during the week.

There were, however, two exceptions to this pattern of intervention. One research evaluated the effects of *yoga* on mothers who had already had children, and who practiced it in pregnancy on their own (KINSER & MASHO, 2015b). The other one investigated, through a focus group, the self-perception of stress by pregnant teenagers, conducting a survey on stress coping strategy preferences, with *yoga* being the chosen option of the group (KINSER & MASHO, 2015a).

**Primary Effects (symptoms of stress in pregnant women)**

From the identification and analysis of the primary effects of *yoga* in the pregnant women already described (Table 1), two groups of stress symptoms emerged, the responses of which were evaluated after the interventions. One group reflected the breadth of the mental health of the participants, gathering responses on the mood, emotional and relational aspects and general psychological stress. Another group, expressing the physiological dimension of stress, gathering response markers on Autonomic Nervous System and the neurovegetative behavior in pregnant women's organisms.

Concerning the dimension first mentioned - that ofmental health - two states are associated, in the literature, to stress parameters - anxiety and depression ( PAMPKA et al, 2018; NEWHAM et al, 2014). Dataexpressed that symptoms of depression were presented as variable in seven of the thirteen research projects of this review having measured 453 (60%) of participants between the control and intervention groups (Davis et al, 2015;.. BATTLE et al, 2015; BERSHADSKY et al., 2014; FIELD et al., 2013a; FIELD et al., 2013b; SATYAPRIYA et al., 2013; FIELD et al., 2012).

The symptoms of anxiety were similar in scope. The results after the interventions were evaluated in 499 (66.18%) pregnant women in the intervention and control groups , from eight of the thirteen studies (DAVIS et al., 2015; NEWHAM et al., 2014; FIELD et al., 2013a; FIELD et al., 2013b; SATYAPRIYA et al., 2013; FIELD et al., 2012; SHIM & LEE, 2012; BATTLE et al., 2015).

The research projects that included the variables of anxiety and depression in their analysis were clinical trials with a control group, with the exception of only one of them (BATTLE et al, 2015), in which the variables were measured in a single group - before and after the intervention.

The previous diagnosis of these symptoms in the pregnant participants of the studies was not one condition set by most protocols of research. Of those described (Table 1), five defined depression as an inclusion criterion (BATTLE et al 4 , 2015; FIELD et al 20 , 2012; FIELD et al 18 , 2013; FIELD et al 19 , 2013; DAVIS et al 16 , 2015, USA) and only one defined the previous diagnosis of symptoms or anxiety disorder for the investigation samples (DAVIS et al 16 , 2015).

The measures of both variables - anxiety and depression - showed a reduction in all the groups of women who practiced *yoga*, including the average scores of severe depression (BATTLE et al, 2015.) and anxiety disorders (Davis et al., 2015) in pregnant women with a diagnosis.

Comparing the results of the symptoms of mood alteration of women who practiced *yoga*, with those who did not practice - of the control groups -, three of these had equally positive measures, not having a difference with statistical significance between them and the intervention group ( DAVIS et l, 2015 ; FIELD et al a , 2013 ; NEWHAM et al, 2015 ). In these cases, the pregnant women in the control group relied on social support interventions (FIELD et al., 2013b) and guidance, in routine prenatal consultations, to seek

specialized assistance, since they were pregnant women diagnosed with symptoms of anxiety and depression (DAVIS et al., 2015; NEWHAM et al, 2015).

Other symptoms of stress in the dimension of mental health, found among research participants , refer to emotional and relational aspects that favored psychological stress , leading them to negative mood dispositions.

Positive changes were recorded in this perspective after interventions with *yoga* such as: reduction of anger and hostility (KUSAKA et al., 2016; FIELD et al., 2013b), fatigue (KUSAKA et al., 2016) and isolation (KINSER & MASHO, 2015b). Improvement in the affectivity levels of negative affect (FIELD et al., 2013a; DAVIS et al., 2015; BERSHADSKY et al., 2014), increase in the state of contentment (BERSHADSKY et al., 2014), and greater confidence of pregnant women about childbirth (SHIM & LEE, 2012).

It was observed , through an analysis of the speech of pregnant women who participated in focus groups (KINSER & MASHO, 2015b; KINSER & MASHO, 2015a), how present the symptoms of stress and depression are in their daily lives, and which were pointed out, by them, as factors that motivated their choice to practice *yoga* as a strategy in face of that. During pregnancy, the stressors tended to amplify, so that the stress ends up motivating one's interest in this practice in the prenatal stage (Kinser & Masho 2015a).

Some of the studies (CHEN et al., 2017; NEWHAM et al., 2014; SATYAPRIYA et al., 2012; SHIM & LEE, 2012) assessed individually global stress individually and not just its symptoms. There is evidence that *yoga* had an impact on the level of stress at this stage, revealing a reduction in the symptoms of pregnant women in the intervention groups with *yoga* compared to the control groups. While some of the studies point to an immediate reduction in stress after practice (CHEN et al., 2017; KUSAKA et al., 2016), others report its maintenance throughout the interventions (KINSER & MASHO, 2015a; SHIM & LEE, 2012). Its symptoms were significantly reduced (KINSER & MASHO, 2015b).

In the physiological dimension, the focus of some research projects was on gauging cortisol levels of pregnant women, this hormone being the most commonly used biomarker as a symptom of stress , according to the reviewed articles (CHEN et al., 2017; NEWHAM et al., 2014; FIELD et al., 2013b; KUSAKA et al., 2016; BERSHADSKY et al., 20 14), showing a reduction in their measurements in the *yoga* groups, if compared to the control groups, with a variationfrom $p < 0.01$ to $p < 0.001$.

Two of those studies, in addition to cortisol, evaluated other biomarkers: salivary alpha-amylase, with a reduction evaluated in a pre and post-test experiment of $p < 0.001$ (T1) and $p = 0.006$ (T2) (KUSAKA et al., 2016), progesterone and estriol, measured in a controlled and randomized study (FIELD et al., 2013b), indicating a reduction after the last *yoga* session, although not significant, in the intervention group.

The authors of this study (FIELD et al., 2013b) revealed that the relationship between cortisol, progesterone and estriol was still clear, since two of these biomarkers (progesterone and estriol) showed increased levels between the first and last day of intervention, in both control and intervention groups, and a reduction in their levels only after final practice.

The symptoms of sleep disorders, also grouped in this dimension of physiological stress, being a function regulated by the neurovegetative system or the autonomous nervous system , have been reported by Field et al. (2012). This study even used the *yoga* practice associated with *tai chi* as an intervention - both already established as PICS - finding within this group a reduction in sleep disturbance levels, compared to the control group ($p < 0.05$ ).

This prenatal *yoga* practice was identified as an adequate method for stress management, with no adverse effects found in the studies reviewed here.

**Side Effects (pain and discomfort during pregnancy and delivery and health markers of the newborn)**

As previously mentioned, other effects that were not directly related to the stress parameters were also identified in the studies of *yoga*, being considered in this theoretical research as secondary data and identified as secondary/side effects, in its systematization (Table 1).

The most recurrent effects were related to pain and physical discomfort during pregnancy, and in only two research projects, to the measurement of vital indicators of newborn's health.

In the analysis of the studied articles, it was observed that the assessment of physical pain indicated that the practice of prenatal *yoga* causes beneficial physiological effects to the body. Pain reduction in its various domains was mentioned, such as labor pain (SHIM & LEE, 2012) and physical pain - back and legs - during pregnancy (FIELD et al., 2013b; FIELD et al., 2012), as well as an improvement in child-birth parameters (CURTIS et al., 2012).

In line with yet another study using another modality of PICS besides *yoga*, one of the authors (FIELD et al., 2012) presented the positive effect of massage associated with *yoga* with regard to physical pains related to pregnancy - mainly in the lower back and legs - and emphasizes that *yoga*, due to its poses and movements, can be considered as a self-massage practice.

Better results were also found in this investigation, regarding gestational age and newborn weight.

## Discussion

The description and the alignment of results of the effects of *yoga* evaluated in pregnant women, as shown in Table 1, demonstrate a variety of symptoms of stress, which affected both mental health of these women as well as organic aspects considering their physiology . This diversity of symptoms is a characteristic of the attributes of stress, deciphered by Selye (1950) as a syndrome, whose parameters are maintained by science until today. His studies made explicit that the human being can be activated by stressors of physical, mental or environmental vectors provoking the state of stress.

In case of acute or intermittent stress, it can cause changes in the functioning of the autonomic nervous system which regulates the hypothalamus-pituitary-adrenalaxis (HPA) leading to an exacerbated production of the cortisol hormone, which became recognized as the stress hormone, given its abundance in these cases (SELYE, 1950 ).

During pregnancy, the HPA axis shows an increase in its activation, generating a high concentration of cortisol (JURUENA et al. 2004). It was observed, in this review, that the studies that evaluated this hormone associated the practice of *yoga* with the positive functioning of this axis, since a decrease in the level of cortisol concentration was identified in the pregnant women of the intervention groups as mentioned above (CHEN et al. 2017; KUSAKA et al. 2016; BERSHADSKY et al. 2014; NEWHAM et al., 2014; FIELD et al. 2013b).

This is relevant in science, as studies indicate that stress is associated with high levels of cortisol in pregnant women, which can lead to negative pre- and perinatal results, such as: miscarriage (BAYRAMPOUR et al., 2015), premature birth and consequent below average weight (NEWTON et al., 1979; MONK et al., 2000; GLAZIER et al., 2004).

In addition to cortisol, the practice of prenatal *yoga* was also associated with a reduction in the salivary concentration of alpha-amylase (KUSAKA et al., 2016). The ptialin, was also mesured as an alternative biomarker to norepinephrine and which naturally has its reactivity to stress the attenuated during the third trimester, however, with the practice of *yoga*, its concentration reduced considerably at the end of each practice (KUSAKA et al., 2016).

Still in the physiological dimension of stress, the literature points to an increase in the level of immunoglobulin A - an antibody - immediately after the practice of *yoga* (CHEN et al., 2017), which reveals the impact of this practice on the immunological functions of pregnant women, generating an improvement in their immune system. This is especially important today with the pandemic phenomenon of the Covid-19 virus (WHO, 2020), when the pregnant woman was recently placed among groups of risk (PAHO , 2020 ) and stress levels have been increasing exponentially in the population as a whole, due to its impacts (BROOKS et al., 2020).

The positive impact of practice *yoga* in biomarkers of stress in the body of the pregnant woman reinforces the association between this practice with improved functioning of the HPA and hence the functioning of the autonomic nervous system (LRS TIS et al. 2012). It is possible for that practice to also be associated with a lower incidence of prenatal disorders, in agreement with other authors (CHEN et al. 2017; CURTIS et al. 2012; FIELD et al. 2013a; QINXIAN et al., 201 5 ).

Theoretical studies that retrieve the origin of *yoga* (GHAROTE, 2007; SILVA, 2009) describe its psychophysical effects, resulting from the execution of specific physical poses, controlled breathing exercises and meditation practices, and claim that they are able to interfere with autonomous mechanisms of the neurovegetative system (GHAROTE, 2007) that act on the hypothalamus-pituitary-adrenal (HPA) axis. It is in this association between the *yoga* practice system and the functioning of the autonomic nervous system that the positive effects identified in pregnant women reside after the interventions.

In the context of mental health, the results revealed that the symptoms of stress identified as most prevalent in pregnant women in empirical studies - anxiety and depression - became significantly lower after interventions with *yoga*. In this sense, it was found, in the literature, a high prevalenceranging from 12.6 to 19,6% in the comorbidity of these inconveniences throughout the pregnancy (Lee et al. 2007), which probably explains them being variable in analysis in eleven of the thirteen surveys in this review.

They revealed some advantages of practicing *yoga* in pregnant women with depressive conditions or symptoms of depression. The data also indicated, in addition to a reduction in all groups with the interventions,correlated positive effects of *yoga*, and more specifically , of its modalities - *Hatha Yoga* - with the reduction of symptoms of postpartum depression (BERSHADSKY et al ., 2014), proving to be efficient for participants already clinically diagnosed.

According the literature that stress and depression have a high incidence in the daily lives of pregnant women, so that they have been associated by some authors as factors that encourage many women to seek and adhere to prenatal *yoga*. (KINSER & MASHO, 2015a; KINSER & MASHO, 2015b).

There is a demand for this type of practice that offers space for the development of integrative group activities, the control of stress, depression and improvement of interpersonal relationships (KINSER & MASHO, 2015a; KINSER & MASHO, 2015b; BERSHADSKY et al. , 2014; NEWHAM et al., 2014).

The results indicated that women diagnosed with depression credited to the practice in the *yoga* group the improvement of their depressive conditions, indicating, equally, their high level of satisfaction with this practice (KINSER & MASHO, 2015a). It was also associated with high levels of credibility and satisfaction as an intervention for anxiety and stress during pregnancy, felt by the subjects as a benefit, both in the psychological and in the physical scope (KINSER & MASHO, 2015a; QINXIAN et al., 2015).

Still in the context of mental health, through this study, it was found that pregnant women in some intervention groups reported an improvement in their interpersonal relationships (QINXIAN et al., 2015; FIELD et al., 2013b ; CURTIS et al., 2012 ; FIELD et al., 2012). Probably because of the reduction of negative aspects of mood, an improvement in their quality of life (CURTIS et al., 2012) and greater self-confidence (SHIM & LEE, 2012). One of the studies, however, revealed improvement in interpersonal relationships in the control group also, which consisted of a social support group (FIELD et al., 2013b), revealing the importance of this factor. This signals the importance of social grouping with other pregnant women, which promotes a feeling of belonging, thus strengthening their self-esteem.

In addition to the discussion of the primary effects related to symptoms of stress that were found, it becomes relevant to emphasize here the importance of the side effects caused by the practice of *yoga* on pain and physical discomfort in pregnant women.

Although the etiology of such symptoms does not reside in stress, but in an anatomic-physiological condition, they can constitute in stressors and trigger the stress mechanism. This mechanism arises from the individual's need to deal with factors external or internal to the organism - which may be physical pain - which, while stressors are capable of creating tensions and consequences identified as primary effects (SADIR, BIGNOTTO & LIPP, 2010; SELYE, 1950).

According to Sperandio et al. (2004), 50% to 75% of pregnant women experience back pain during pregnancy that can vary according to types, areas and intensity, reaching such intensity that it becomes disabling for them, in certain situations. In the literature, the pains most commonly cited were spine, lumbar, pelvis and legs, as well as pain during childbirth (FIELD et al., 2013ª; FIELD et al., 2013b; FIELD et al. 2012; SHIM & LEE, 2012).

Pregnancy is a time in a woman's life when the mind and body must adapt to new demands. In the articles one can find reports of pregnant women about how it goes through their daily lives generating symptoms in different dimensions - both physical and psychic (KINSER & MASHO, 2015a; KINSER & MASHO, 2015b; KUSAKA et al., 2016) .

Being *yoga* a system of body/mind practice that favors homeostasis through control of organic and mental functions, including systems, muscles and viscera (SILVA, 2009) , it is believed to have been this scope of reach of the human being that made it a favorable strategy to the control of symptoms of stress among pregnant women, reducing their risks.

## Conclusion

*Yoga* is a practice that integrates body and mind, so that it affects the physiological - of body functioning - and emotional issues of the individual, following the current trend of health care, as discussed by the World Health Organization (WHO), that care must be comprehensive and the individual must be seen and understood through a holistic perspective.

This article demonstrates the efficacy and effectiveness of prenatal *yoga* practice, with no adverse effects found. The benefits raised, especially those related to clinical conditions of depression and anxiety, place it as a strategy that can be prescribed, both in a preventive and complementary way in the treatment of symptoms and mood disorders during pregnancy.

As mentioned earlier, the world is currently experiencing an atypical moment. With the Covid-19 pandemic outbreak, the consequent social detachment and social isolation - as security measures, the incidence of disorders such as anxiety and depression, as well as their symptoms and traits have been increasing exponentially.

This may be enhanced in the pregnant women population, since they need to use health care services - considered to be at high risk for contamination - to carry out their prenatal and future delivery. This fact can increase the uncertainty about the future, which prior, concentrated on the expectations of the pregnancy, and now encompasses a whole social, economic and environmental instability of the world.

It should be noted here that among this population of pregnant women, there is a portion of adolescents whose condition of early pregnancy, sometimes at risk, favors the condition of persistent stress.

In view of this, it is suggested that further research be developed aiming to evaluate the intervention of *yoga* in pregnant patients infected by Covid-19, making use of virtual technologies, as well as by pregnant women in general, in the same virtual modality, as an instrument for control of the psychological impacts of confinement and social isolation.

It is also recommended the development of randomized clinical trials with pregnant women with depressive and anxiety disorders, evaluating the control of symptoms, both with the practice of *yoga* and with the necessary psychoactive substances of prescription. In addition, it is suggested that studies be carried out to assess the viability of prenatal *yoga* groups in public health services, and that this work constitutes yet another contribution to the body of knowledge that the Brazilian Academic Consortium of Integrative Health has generated to support the practices of care in Primary Care, being able, with this, to benefit SUS users.

### Study Limitations

The study was carried out using only one database. This is a preliminary study that analyzed the effects of *yoga* for pregnant women from other studies published during 2012-2019. To resolve these limitations, it is suggested that a systematic review of the theme be carried out, presenting an expansion of the results, including later years.

### Author contributions

Araújo MAN conceived the matrix research that directed the elaboration of this review that was constituted in a work plan of a Scientific Initiation student. Defined the format of the search for articles for review, guiding the collection and creation of the tabulation instrument for data treatment. Guided their interpretation as well as the writing of the article. Prado BGL prepared, as a student of Scientific Initiation, the initial work plan for this review. The student performed the searches in the databases collecting the articles following the inclusion criteria established in the plan, tabulated and organized all the material collected for the interpretation of the results, actively participated in the analysis of the latter and in the writing of the scientific article.

**Competing interests**

No financial, legal or political conflicts involving third parties (government, companies and private foundations, etc.) have been declared for any aspect of the submitted work (including, but not limited to, grants and funding, participation in advisory council, study design, preparation of manuscript, statistical analysis, etc.).

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