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Prenatal Effectiveness of Gentle Yoga on Increasing Serotonin Levels in Pregnant Women <20 and >35 Years Old in PKM Area, Makassar City

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ABSTRACT

Yoga plays a role in reducing anxiety, depression and increasing serotonin levels in pregnant women. Yoga techniques aim to establish and maintain a healthy balance between all aspects of the body and mind. Prenatal Gentle Yoga is a solution that supports the safe and comfortable process of pregnancy to delivery.

This research was conducted at Bara Baraya Health Center, Antang Health Center, Kapasa Health Center, and Mamajang Health Center. The research design used in this study is a Quasi Experiment with the Nonequivalent Control Group Design approach. Sampling using a purposive sample technique. The instrument used was ELISA (Enzyme Linkedlimmuno Sorbent Assay). The sample in this study consisted of 24 respondents, 12 intervention groups and 12 control groups. Criteria in this study; pregnant women 20 years and 35 years, pregnant women in the II-III trimester with a gestational age = 20 to 31 weeks, pregnant women without complications in pregnancy.

Based on the statistical test (Mann Whitney test) the levels of serotonin in the intervention group increased (p=0.033) there was a significant difference, the control group showed no statistical significance (p=0.908). thus Prenatal gentle yoga is effective in increasing levels of the hormone serotonin.

KEYWORDS: Serotonin; Pregnancy; Prenatal Gentle Yoga

ARTICLE DETAILS

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INTRODUCTION

The midwife as a health service provider has an important role, namely as an *agent of change* who is very close to the community who mingle directly in people's lives, and plays a role in empowering women and society. Thus, the problem of maternal and infant health is the hottest issue in Indonesia and is homework for the Indonesian people and especially midwives as spearheads in maternal and child health services. The maternal mortality rate in Indonesia is still quite high. *World Health Organization* (WHO), in 2011 the Maternal Mortality Rate (MMR) in South Asia was 188/100,000 live births, Southeast Asia 35/100,000 in Singapore 14/100,000 live births, in Malaysia 62/100,000 live births, Thailand 110/100,000 live births, Vietnam 150/100,000 live births, the Philippines 230/10 0,000 live births and Myanmar 380/100,000 live births. Maternal Mortality Rate is an indicator of successful development in the health sector. AKI in the number of maternal deaths starting from the period of pregnancy, childbirth and postpartum. Based on the data, there was a decrease in MMR from 390 in 1991 to 305/100,000 live births in 2015 (Ministry of Health, Republic of Indonesia, 2018) .

During pregnancy, special attention is needed, because this period will determine the quality of life for the child or baby being conceived (Taufan, 2012) . Pregnancy causes changes throughout the body that are quite basic. So that these changes will affect the process of growth and development of the fetus in the womb. These changes include physical and psychological changes in pregnant women (Mochtar, 2012) . Physical changes and physiological adaptations in pregnant women include changes in the reproductive system, breasts, metabolic system, musculoskeletal system, cardiovascular system, integumentary system, gastrointestinal system, hematological system, urinary system, endocrine system, nervous system, and respiratory system (Somma-Pillay, Piercy-Nelson, Tolppanen, & Mebazaa, 2016) .

Pregnant women are very susceptible to psychological disorders such as complex mood disorders which describe a condition in which an individual is unable to relieve the pressure that occurs within him which refers to emotional

disturbances showing loss of energy and interest, feelings of guilt, difficulty concentrating, experiencing loss of appetite, to thinking of death or suicide followed by other symptoms of changes in activity, cognitive abilities, speech, and vegetative functions (including sleep, sexual activity, and other biological rhythms) (Elvira & Hadisukanto, *2013*) .

Serotonergic neurons are widely distributed throughout the human brain and the serotonergic system is the largest single system in the brain. The nine groups of serotonergic cell bodies are located mainly in the brainstem region of the raphe nuclei. Serotonergic nerve terminals can be found in almost all regions of the central nervous system. Serotonin has an important role in the physiological functions of the body, and also plays a role in the growth of the central nervous system in the developmental process (Eler, 2011) . Serotonin is one of the most powerful neurotransmitters and can affect many systems, it is generally thought to regulate emotions and feelings of happiness. Abnormal serotonin levels can cause anxiety to depression, the resulting effects include neurobiological disorders, namely impaired neuro-chemical function, neuro-endocrine function, and neuro-immunological function (Saldanha, Kumar, Ryali, Srivastava, & Pawar, 2009) , (Marchocki, Russell, & Donoghue, 2013) . In pregnant women serotonin contributes to the development of the prenatal stage of the central nervous system, acting as a morphogen in the embryo and later as a neurotransmitter (Butkevich, Khozhai, Mikhailenko, & Otellin, 2003) .

This neurotransmitter is secreted through sympathetic nerve activity and the response of the sympathetic nerves is influenced by neurovascular response to anxiety and stress (Reyes, Usselman, Davenport, & Steinback, 2018) . Sympathetic nerve activity per minute in pregnant women is higher than in non-pregnant women, even in the resting phase (Schmidt et al., 2018) . Increased nervous activity during pregnancy causes an increase in neurotransmitter release, prompting sympathetic nerves to produce neurotransmitter release (Pablo Huidobro-Toro & Verónica Donoso, 2004) . Norepinephrine and serotonin are the neurotransmitters most involved in depression. This is associated with adrenocortical activity which indicates anxiety at high norepinephrine levels, and at low serotonin levels indicates depression (Field et al., 2003) .

Currently, many researchers have used metabolism to identify potential diagnostic biomarkers for neuropsychiatric disorders, such as schizophrenia and major depressive disorder. Researchers focused on changes in metabolism in patients with depression and anxiety disorders by looking at changes in metabolism in the urine (J. jun Chen et al., 2018) . A study using first morning urine samples collected from pregnant women which were then frozen and sent to *Saul Schanberg at Duke University Medical School* with the results of analysis: 1) norepinephrine as a correlation of sympathetic activation is high in depression and anxiety but higher in anxiety; 2) low dopamine in depression and high anxiety; 3) low serotonin in depression; and 4) cortisol as a measure of stress was high but higher in the depression group, as it is a predictor of prematurity for stressed (depressed) women (Field et al., 2003) . A number of studies have collected data regarding the adverse effects of antenatal depression (Deana B, Yadon, & Hope C, 2012) . Compared with pregnant women who are not depressed, and pregnant women who are depressed the incidence of pre-eclampsia is higher (Cripe, Frederick, Qiu, & Williams, 2011) , and complications during pregnancy (Bitew, Hanlon, Kebede, Honikman, & Fekadu, 2017) , and babies of depressed mothers have a higher risk of being born prematurely and having low birth weight (Mochache, Mathai, Gachuno, Stoep, & Kumar, 2018) .

Midwifery care to minimize disturbances during pregnancy is physical exercise, such as pregnancy exercise, lamazze method, meditation or prenatal yoga or yoga relaxation. according to research (Fitriani, 2018) that pregnant yoga is more effective than pregnancy exercise in reducing back pain. It can be seen from the mean value of pregnant yoga which is greater than the mean value of pregnancy exercise. This is also in line with research conducted by (Field et al 2014) which states that yoga has a more positive effect on pregnant women.

Yoga, a type of mind-body-mind relaxation exercise, is defined as an intervention that has the potential to reduce anxiety. Yoga movements can be modified to suit the condition of a pregnant woman. Yoga exercises are carried out to modulate the HPA axis as a response to stress in pregnant women (PJ Chen et al., 2017) . In general (hatha yoga) and yoga practice during pregnancy provide the same benefits as pregnant women. Prenatal yoga should include core components, namely sections of meditation, breathing exercises, standing poses, and *chair squats* . The practice of meditation supports internal focus, increased self-control, and mindfulness. Breathing exercises increase lung capacity and oxygenation, which promotes increased energy and alertness. Learning to take deep breaths by relaxing the abdominal muscles provides a strategy for stress management (Bonura, 2014) .

RESEARCH METHODS

The research design is *a Quasi Experiment* with the *Nonequivalent Control Group Design approach.* This study aims to determine the effectiveness of Prenatal Gentle Yoga on Increasing Serotonin Levels in Pregnant Women 20 years and 35 years. The intervention that will be carried out in this study is to provide prenatal gentle yoga to respondents in the intervention group at the Makassar City Health Center . The sample for this study was determined using purposive sampling based on inclusion and exclusion criteria. The instruments used for laboratory tests are vacutainer tubes to store urine samples, sample cups and ELISA kits.

. The data analysis used is univariate and bivariate analysis presented in the frequency distribution table. For statistical tests, the significance level used is p 0.05. To test the comparative hypothesis of normally distributed numerical variables in the two paired groups for intra-group analysis using the paired T test, if the data distribution is not normal using the Wilcoxon test.

RESULTS

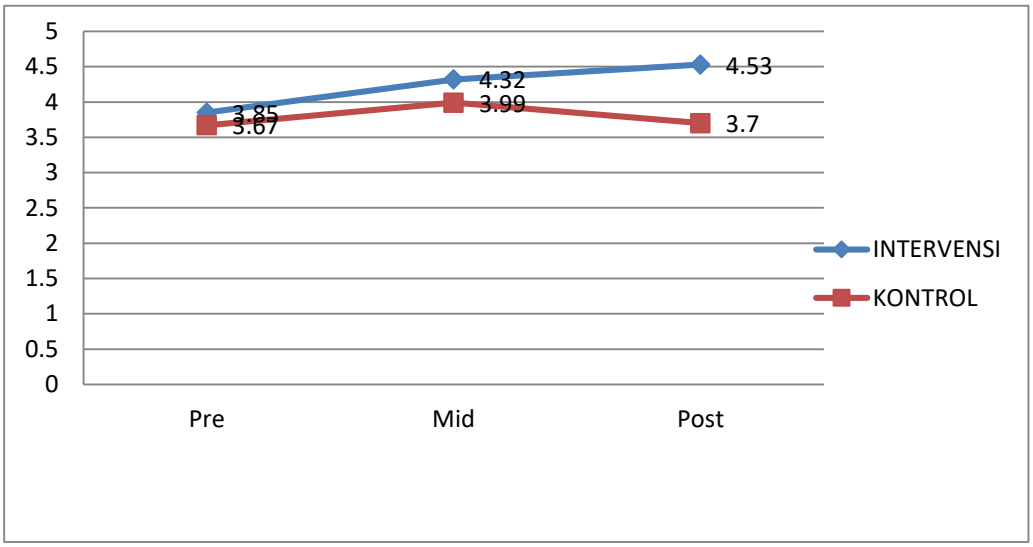
Table 1. Frequency distribution of the characteristics of respondents in the Work Area of the Makassar City Health Center

characteristics	Intervention(n)	Percentage(%)	control(n)	Percentage(%)
Age				
20 years	6	(50%)	5	(41.66%)
35 years	6	(50%)	7	(58.33%)
Gestational Age				
20-25 Weeks				
26-31 Sunday	4	(33.33%)	8	(66.66%)
	4	(33.33%)	8	(66.66%)
Gravida				
Primigravida	5	(41.66%)	4	(33.33%)
Multigravida	7	(58.33%)	8	(66.66%)
Education				
Tall	5	(41.66%)	7	(58.33%
Low	7	(58.33%)	5	(41.66%))
Work				
Work	6	(50%)	6	(50%)
Doesn't work	6	(50%)	6	(50%)
Religion				
Islam	9	(75%)	10	(83.33%)
Christian	3	(25%)	2	(16.66%)

Source: Primary Data

The data above shows that a total of 24 respondents were studied, there were respondents with age 20 years in the intervention group by 6 (50%) and control 5 (41.66%) , and respondents with age35 years in the intervention group by 6 (50%) and control 7 (58.33%) . 20-25 weeks of gestation in the intervention group were 4 (33.33%) and 8 controls (66.66%), 26-31 weeks of gestation in the intervention group were 4 (33.33%) and 8 controls (66.66%) . The primigravida gravid intervention group was 5 (41.66%) and the control 4 (33.33%) the multigravida intervention group was 7 (58.33%) . and control 8 (66.66%) . The high education intervention group was 5 (41.66%) and the control group was 7 (58.33%), the low intervention group was 7 (58.33%) and the control group was 5 (41.66%) . Respondents who worked in the intervention group were 6 (50%) and control 6 (50%) and did not work in the intervention group by 6 (50%) and control 6 (50%). Islamic religion intervention group by 9 (75%) and control 10 (83.33%) and Christian intervention group by 3 (25%) and control 2 (16.66%).

Graph 3.1. Comparison of serotonin levels in the intervention group before and after PGY



The graph above shows that in the intervention group the mean pretest was 3.85, mid test was 4.32 and post test was 4.53, so it was concluded that there was an increase in serotonin levels in the pretest, midtest and posttest. Meanwhile, the control group showed an increase in the mean pretest value of 3.67, midtest 3.99 and a decrease in the post test 3.77, so it can be concluded that there was an increase in the pretest-midtest median value, but decreased in the midtest-posttest. Based on the statistical test *(Wilcoxon test)* in the pretest-mid test intervention group (p=0.034) there was a significant difference, but in the midtest-posttest (p=0.556) there was no significant difference. On the other hand, the control group showed no statistical significance at the pretest-midtest (p=0.060) or midtest-posttest (p=0.272).

Table of Comparison of Serotonin Levels in Intervention and Control Groups Pretest and Posttest PGY

Serotonin	**Pre**	**Post**	***p=value***
Intervention	3.85 (2.96-4.58)	4.53 (3.46-6.37)	**0.028
Control	3.67 (2.68-4.73)	3.70 (3.02-4.91)	**1,000
p-values	*0.470	*0.005	

*Mann Whitney test **Wilcoxon test

From table 3.5, it can be seen that the initial serotonin levels (pre test) in the intervention group and the control group were not significantly different (p=0.470). This shows that both groups have homogeneous initial serotonin levels. After the end (post test) there is a significant difference (p = 0.005). This shows that there is a significant difference after being given the Prenatal Gentle Yoga treatment. In the intervention group, there was a statistically significant difference (0.028) between serotonin levels before and after the *Prenatal Gentle Yoga class* , while in the control group there was no significant difference (p=1.000) .

DISCUSSION

The results of the SPSS test on the effectiveness of prenatal gentle yoga on improving serotonin levels in pregnant women 20 years and 35 years, namely the initial serotonin levels (pre-test) in the intervention group and the control group were not significantly different (p = 0.470). This shows that both groups have homogeneous initial serotonin levels. After the end (post test) there is a significant difference (p = 0.005). This shows that there is a significant difference after being given the Prenatal Gentle Yoga treatment. In the intervention group, there was a statistically significant difference (0.028) between serotonin levels before and after the *Prenatal Gentle Yoga class* , while in the control group there was no significant difference (p=1.000) .

This is in line with the fact that in the last few decades, there has been a rapid development of science that studies fear, anxiety, and depression based on *neurobiological sciences.* The neurochemical and neuropeptide systems have been known to have an important role in dealing with fear responses, and stimuli that cause anxiety to depression affect areas of the cortex, consisting of: the noradrogenic system, the hypothalamic pituitary adrenal axis, corticotropin-relating hormone, neurosteroids, the dopaminergic system, serotonin, and the benzodiazepine *system* . Long-term dysregulation of these systems contributes to the development of anxiety disorders to depression (Nemuister, A.2005). Depression is a leading cause of mental disability and is a major contributing disease worldwide. Globally, the prevalence of depression and depressive symptoms has increased in recent decades. Depression is one of the most common disorders affecting

women during pregnancy (Coll et al., 2017) . Depression in pregnant women is influenced by several factors, besides hormonal, it is also influenced by the mother's age during pregnancy. Mothers with pregnancies aged 20 years are very vulnerable to psychological disorders that can trigger complications in pregnancy. Meanwhile, complications during pregnancy are one of the leading causes of death among women aged 15-19 years (WHO, 2004) . And, the risk for pregnant women over 35 years of age, especially for primigravidas, is related to medical risks with an aging reproductive system and an aging body (Lampinen et al., 2009) . The perinatal period of motherhood is a challenging period, thus involving significant psychological, social and biological changes, and has been considered a window of increased vulnerability for the development of mental illness (MacLeod Hall et al., 2019) .

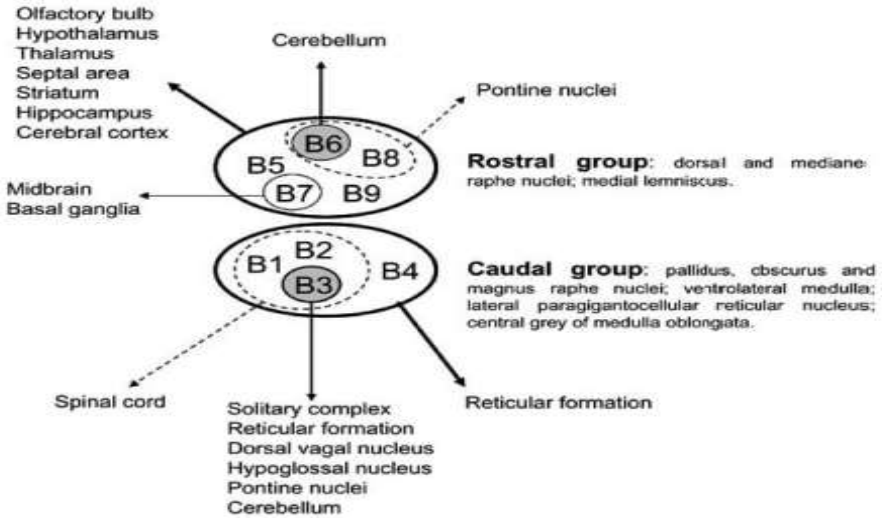


Figure 3.4 Serotonin System

Serotonin is a neurotransmitter that has a major function in the brain. The serotonergic neurons of the CNS are localized in clusters in the raphe nucleus, gray center and reticular formation and have been classified into nine groups named B1B9. The nerve fibers arising from the caudal group of serotonergic neurons (B1-B4) form a descending system that is directed to the spinal cord and also project the structures of the cerebellum, pontine and midbrain, while the ascending fibers originate from the rostral group of serotonergic neurons (B5-B9) and affect almost all areas of the brain (Ciranna, 2006)

In addition, other studies mention the link between serotonin and depression through the *hypothalamic-pituitary-adrenal* (HPA) axis. *The HPA Axis* and the serotonin system have a complex two-way relationship. This relationship is potentially important in the pathogenesis of mood disorders, since major depressive episodes are associated with abnormalities in serotonin systems, including 5-HT 1A receptor upregulation (Parsey et al., 2006) and with a state-dependent hyperactive HPA axis response to stress (Miller & Lovell, 2011) . More severe depressive episodes, as characterized by psychomotor agitation or psychotic features, hyperactivity to the HPA axis as indicated by more severe adrenal glands, higher levels of Corticotropin Releasing Factor (CRF) releasing factor *in* brain tissue and cerebrospinal fluid, lower binding of CRF receptors (Steinberg et al., 2019) .

Other studies have also suggested a link with GABA, that lower levels of GABA receptors are associated with increased levels of anxiety, and that this state modulates serotonin depletion. Where serotonin, plays a major role in mood regulation. Serotonin deficiency is associated with depressive events. (Field et al., 2012) .

The link between low levels of the hormone serotonin and the incidence of major depression is of concern to researchers, in connection with the effects of depression in pregnancy which have been linked to an increased incidence of pregnancy complications such as pre-eclampsia, premature, impaired fetoplacental function, decreased fetal growth, and neonatal complications (Olivier et al., 2013) . Currently, a complementary therapy has been developed, namely pregnant yoga with the aim of restoring the body's physiological functions by regulating the balance between the body and mind (Taso et al., 2014) . Yoga for pregnant women is a generally accepted and accessible combination of postures that unite mind-body that focuses on physical and mental health (Patricia Anne Kinser, Lisa Goehler, 2012) .

Yoga movements include a combination of physical postures and spiritual practices that aim to relax the body so that the body and mind become calm and comfortable. *Prenatal Gentle Yoga* , a form of yoga designed to be safe, gentle, and especially helpful for pregnant women, is an excellent strategy for the treatment of maternal depression. One way of prenatal yoga is to increase attention, empower and focus on the well-being of the mind of pregnant women (L. Sheng, M. Christopher, 2016) .

This is in line with previous research on the benefits of meditation and *mindfulness* in prenatal gentle yoga.

Meditation and *mindfulness* are focusing attention consciously on an object or stimulus, so that the direction of attention is consciously fixed on an object or stimulus. Research has proven that focusing techniques have helped reduce anxiety levels, because subjects are able to divert their attention from threatening stimuli (Lang et al., 2012) . Another study conducted on 26 patients with GAD comparing the effectiveness of *Mindfulness Based Stress Reduction* (MBSR) and *Stress Management Education* (SME) using fMRI, found from the Blood Oxygen Level Dependent (BOLD) response that meditation resulted in more connectivity between the amygdala, and the dorsolateral PFC compared to *Stress Management Education* (SME). And scores from the Beck Anxiety Inventory showed a lower reduction in depression in the *mindfulness yoga practice group* than in the stress management education group (Hölzel et al., 2013) .

The positive effects of yoga for pregnant women are; reduced stress, reduced anxiety and physical complaints during pregnancy, reduced pregnancy discomfort, minimized labor pain with pregnant yoga physical exercises, and accelerated the opening of the birth canal during labor (Tiffany Field, Miguel Diego, Jeannette Delgado, 2008) . *Prenatal Gentle Yoga*, is considered to improve nervous system regulation and physiological system function (immunity, endocrine, neurotransmitter, and cardiovascular) and improve well-being in order to achieve a balance between mind and body, thus reducing complications such as hypertension in pregnancy, premature labor, and reducing Sectio Caesaria (SC) births (Curtis, Weinrib, & Katz, 2012)

CONCLUSIONS AND SUGGESTIONS

Based on the results of research at PKM Makassar City, it can be concluded that giving *Prenatal Gentle Yoga classes* is effective for increasing serotonin levels in pregnant women 20 years and 35 years. This is indicated by the results of urine serotonin levels of pregnant women who experience increased levels of the hormone serotonin.

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