A study of working memory and postpartum depression

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Abstract—Postpartum depression is a common mood disorder affecting newly delivered mothers. Women with postpartum depression reveals the symptoms of depressed mood, low energy level, unable to feel the pleasure, low self-esteem, poor concentration, impaired working memory, anxiety, and social isolation. For these, most of the women are diagnosed within first six month after delivery. Previous studies showed that depressed patient suffer from cognitive difficulties i.e. working memory. The present study examines working memory deficits during the postpartum period in mothers. For this study we had randomly selected 30 newly mothers from different families and hospital in Lucknow, Uttar Pradesh. In this study the participants were evaluated during home and hospitals visits using Edinburg Postnatal Depressive Scale (EPDS), as screening for depressive symptoms and using the digit span test as a measure of cognitive ability specifically verbal working memory. SPSS software was used for statistical analysis. The result revealed that postpartum depression affects the verbal working memory of newly delivered women. ≥ 13, and the word span scores were evaluated as discrete variable

Keywords: Working memory, postpartum depression, and cognitive deficits.

I. INTRODUCTION

Post-partum depression is a general mood disorder in newly delivered women. It is characterized by low energy, irritability, lack of interest, feeling of hopelessness and guilt, social isolation, persistent sadness and feeling of being a bad mother. In severe cases, maternal distress may become severe that some mothers commit to suicide. PPD affects the mothers daily functioning and mental and physical well-being. According to recent studies approximately 13-20 % newly delivered women affecting with post-partum depression (Mughal, Azhar & Siddiqui, 2023). It is an important concern to deal with public health professionals. Post-partum period is a crucial time for both mothers and babies. During this period maternal care is very important for newly delivered mothers and newborn mental and physical wellbeing. In maternal care including various aspects such as giving supportive and nurturing environment, emphasizing healthy daily routine, promoting breastfeeding, and considering the mother's mental wellbeing.

Post-partum depression may lead to impairment of various cognitive functions including, memory, language, intelligence, thinking and problem solving (Grace et al, 2003). On these one of the important function which is expressed as an impaired in memory. Two categories can be used to describe memory: qualitative and temporal. The quantitative portion can be used to describe what is generally remembered, how we acquire memories, and whether or not those memories are accessible to consciousness. Declarative memory is the term for memories that are brought to consciousness and can be expressed through language, such as when someone remembers a phone number, which is a reference to information and facts. The ability to dial a phone number is a type of non-declarative memory that involves associations and skills.

The temporal categorization comprises three subgroups and is based on the duration of its effectiveness. The ability to retain ongoing experiences in the mind for brief moments is known as immediate memory. Working memory refers to the capacity to store, manage, and manipulate information for brief periods of time—from seconds to minutes—in order to apply it to accomplish intricate tasks or behavioral objectives. One method to test this is to repeat a random order of numbers and in this test, the normal "digit span" is only 7–9 numbers. As a result, practicing will significantly increase this capacity. Long-term memory is the final type, where data can be stored in a more permanent form for days, weeks, or even a lifetime (Neuroscience, 2009).

Working memory can be assessed using the Digit span test. This test allows for the collection of information about the patients' working memory, with depressed patients typically scoring lower. We postulate that factors such as high cortisol levels and low BDNF levels that eventually result in depression first impact the structure and function of the brain, including working memory. Consequently, women who have poor working memory would be more likely to experience depression.

Previous studies show the relation between working memory and post-partum depression. Previous clinical findings indicated that newly delivered mothers expressed as an impairment of recall the object and inability to flow of thought. The patients frequently complain the forgetfulness of objects (Danion et al, 1991; Lacerda, et al., 2009). Further studies also demonstrated that changes in cognitive processes affect the reasoning and the ability to understanding the verbal memory objects (Kaneda, Y.,2009; Lyche et al.,2011). On the basis of these studies it is demonstrated that mental health of the mothers and babies is extremely important. When mothers suffer any mental or physical problems consequently babies received poor attention and care. (Hrdin et. al. 2021) reported that another change that may occur is a reduction in affectionate touch. Post-partum depression affected mothers may not give their babies as much physical affection such as hugs, cuddles with babies, and soft touch. In order to foster a mothers and her baby's emotional bonding, tender touch is essential. The lack of in this type of touch as a result of post-partum depression can impede the development of a stable bond, which is important for the emotional health of the baby. Mother-infant bonding can be severely impacted by reduced responsiveness, decreased affectionate touch, and negative self-perceptions. Consistent, perceptive, and receptive interactions between infants and their care givers foster security, trust, and emotional health. When any of these components stumbles post-partum depression may make it more difficult to build a safe and supportive bond between a mother and her child (Bornstein et.al 2012). Furthermore, some studies reported that post-partum depression in infancy may also have an impact on social relationships. These kids might find it challenging to build and keep positive relationships with their family, friends, and peers. Their social development may be further hampered by behavioral issues they display, such as aggression, social disengagement, and emotional instability (Santona, 2015). In addition, children who are exposed to post-partum depression run the risk of mental health issues. As they age, they become more susceptible to mood disorders, such as depression, anxiety disorders, and other psychological issues. Developing mental health issues can be aggravated by early exposure to a caregiving environment that is less supportive and emotionally adaptable (Terroni et. al. 2023).

In this way post-partum depression has a significant negative impact on the child's mental, emotional, social as well as intellectual development. If left it untreated, the later have long term complications.

II. RATIONAL

Previous studies showed the cognitive impairment during pregnancy and sixth month of postpartum. But the understandings of exact mechanism involved are still not to be revealed. In this study using digit span test which is the measure of working memory more specifically verbal working memory was used to determine the working memory processing during postpartum depression. This study will give a theoretical basis on working memory and postpartum depression.

III. OBJECTIVE

The main objective of this study is to assess the working memory in postpartum period with the help of digit span test. Previous studies shown that impaired working memory during post-partum period.

IV. HYPOTHESIS

The performance of working memory would be different under digit span test in newly delivered women and normal women.

V. Method

PARTICIPANTS

Thirty participants (15 newly delivered mothers and 15 women) who were randomly selected from Lucknow had given their consent to participate in the study. All the participants were checked for normal or corrected to normal visual acuity with the help of Snellen chart and were having no prior information about the Task and purpose of the experiment. Participants that fulfilled these criterions were given the experimental task. For screening of depressive symptoms, Edinburg post natal depressive scale (EPDS) was used.

TOOLS/EQUIPMENT AND SOFTWARE

Dell 15.6 inches display was used to present the task to the participants, with refresh rate of the monitor 65Hz. Inquisite Lab version 4.0 software was used to design the experiment.

EXPERIMENTAL TASK

DIGIT SPAN TEST

Digit span test is a measure of cognitive ability specially the verbal working memory. The experiment was divided in to two parts. First is the forward recall and second one is backward recall. Digits 1-9 used as stimuli in the experiment. All participants received forward condition first. In this condition, participants recall the same digits which were presented first i.e. 12749 orders of digits presented and the participants recall the same order. After completion of first part of the experiment, participants were received second part where digits were presented backward recall i.e. 12749 presented as a stimuli and participants were recalled reversed order 94712. Both parts of the experiment contain 30 trials (15 trials each).

EDINBURG POSTNATAL DEPRESSIVE SCALE

Edinburg post depressive scale is a self-rating scale. It was used as the screening of the post- partum depressive symptoms. The scale was designed of 10 statements. The women marked the closest to how she felt during the last seven days. Every statements of the scale mark the 0-3 points. In this scale 3 indicated the most depressive and 0 indicated the normal state. Total score is 30 with a cut-off of 12 points for being at high risk of postpartum depression (wikberg,1996).

VI. PROCEDURE

In the present experiment, participants had to recall digits forward and backward order. Every participant was briefed about the task and how to respond. They were told to type digits on the keyboard. Demonstration of the experiment was given for two minute. After completion demonstration of task main experiment was presented. Leading the main experiment both forward and backward order was presented in increasing order of difficulty. All participants received practice of 18 trials before performing on the real task in the experiment.

VII. RESULT

The mean and standard deviation were calculated for reaction time measure under each experimental condition. To examine the main effect, the data were subjected to t-test. The alpha .05 was used for all statistical analyses unless otherwise stated. Reaction time performance was taken as dependent measure across control and experimental condition.

The mean reaction time performance of backward condition indicated that control group performs better under TE_ML (total error maximal length) (M=6.30, SD=2.11) than experimental group (M=4.80, SD=1.54). Further control group perform better under forward mean span (M=6.71, SD=1.75) than experimental condition. On the other hand mean reaction time performance of forward condition indicated that control group performs better under TE_ML condition (M=6.50, SD=2.36) than experimental group (M=4.30,SD=1.25).Further control group perform not good under backward mean span condition (M=6.02, SD=2.04) than experimental condition (M=4.99, SD=1.35).

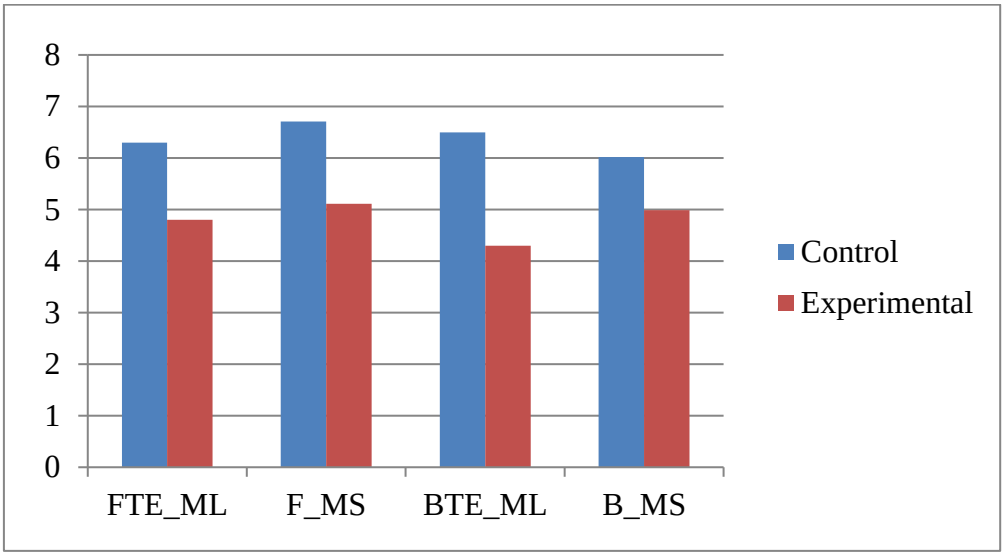
Table1.

Showing mean and standard deviation on forward and backward digit span test under control and experimental group

GROUP	N	Mean (SD)	Mean (SD)	Mean (SD)	Mean (SD)
		FTE_ML	F_MS	BTE_ML	B_MS
Control	15	6.30, (2.11)	6.71(1.75)	6.50(2.36)	6.02(2.04)
Experimental	15	4.80, (1.54)	5.11(1.00)	4.30(1.25)	4.99(1.35)

Figure 1

Graphical representation of forward and backward digit span test under control and experimental group



The data were further subjected to 2 (group: control, experimental) X 2 (condition: forward, backward). T-Test measures were used to analysis of data. The t-Test result revealed that control and experimental group perform marginally significant under FTE_ML (t-Test=1.81, p=.08). This finding indicated that participants (both control and experimental group) perform almost similar under this condition. Further t-Test result found that control group findings significant under F_MS (t-Test=2.50. p=.02) than experimental group. This finding indicated that participants with post-partum depression impaired their cognitive functions therefore control group perform slower under mean span. Furthermore, t-test finding also fond significant under control group on BTE_ML (t-Test=2.59, p=.01), which indicated that the performance of experimental group impaired due to depression.

VIII. DISCUSSION

The objective of the present study was to investigate the processing of working memory under post-partum depression in newly delivered women. Working memory is cognitive function of encoding, storage and retrieval of information. On the other hand post-partum depression is a condition where patients are unable to properly take care of new born baby and impaired daily normal functions. In the present study, an association was found in the low scoring and post-partum depression. Previous studies has also been shown that women in the last three month of pregnancy and in the first six months postpartum have remarkably decreased serum brain derived neurotropic factors (BDNF) levels suggesting a crucial role in the development of mood disorders in the post-partum periods (Lommatch,2006). Researchers demonstrated that the BDNF levels significantly increased after 8 weeks of antidepressant treatment (Dwivedi 2003). In this study we empirically examine the working memory performance on newly delivered women using digit span test. The finding of the present study indicated that newly delivered mothers perform poor under digit span test. They make more errors to recall the digits under digit span test. However, the time of recall the digits are almost similar under forward and backward condition. This result finding indicated that post-partum depression inhibit the responses of newly delivered mothers. These findings support the hypothesis that poor working memory performance associated during post-partum depression in newly delivered mothers but the understanding of the exact mechanism is still not clear. This indicated that more researches are needed to working memory and post-partum depression. The large sample size is also taken for further studies.

IX. CONCLUSION

The aim of the present study was to explore the association between working memory and post- partum depression. In the present study we use the digit span test to investigate the processing of working memory. The findings of the present study revealed that the newly delivered women make more errors to recall the digits under forward and backward conditions. On the other hand they have taken almost same time to recall the digits under digit span test. These findings supported by the previous studies i.e. Danion et al, (1991); Lacerda,et al., (2009). The findings of these studies indicated that newly delivered mothers expressed as an impairment of recall the object and inability to flow of thought. The finding of the present study we concluded that working memory impaired during post-partum period. Further studies we also included the neuroimaging measure to understand the exact mechanism of working memory and post-partum depression. Large sample size also included for further studies.

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