

RESEARCH ARTICLE

Cognitive Health of Pregnant Women in Kano, Nigeria: A Comparative Study between Primigravidae and Multigravidae

*Kurawa M.I.¹, Asiat J.M.¹

¹Department of Human Physiology, Faculty of Basic Medical Sciences, College of Health Sciences, Bayero University Kano, Kano State, Nigeria.

¹Department of Human Physiology, Faculty of Basic Medical Sciences, College of Health Sciences, Bayero University Kano, Kano State, Nigeria.

Abstract

Background: In Nigeria, mental health in pregnant women is often overlooked during antenatal care, with more emphasis given to physical health. This neglect of cognitive aspects can have serious consequences for both mothers and children. Unfortunately, there is limited and non-comprehensive research on the area. **Aim and Objectives:** This study aims at evaluating the cognitive functions of primigravidae and multigravidae attending the antenatal clinic of Murtala Muhammad Specialist Hospital Kano. **Materials and Methods:** This descriptive cross-sectional study included 120 primigravidae and 180 multigravidae. Vital signs were measured and cognitive function was assessed using the Mini-Mental State Examination in their third trimester of pregnancy. **Results:** Multigravidae were typically older (26 years) and had a higher proportion of individuals with secondary (81%) education compared to primigravidae (22 years). Most women in both groups have no cognitive impairment; However, severe cognitive impairment was more prevalent in multigravidae (17%) than in primigravidae (1%). The results of the chi-square test reveal a significant and strong association between gravidity and the severity of cognitive impairment ($p < 0.001$). Primigravidae experiences a higher frequency of miscarriages at the 8th and 12th weeks compared to multigravidae at the 8th and 16th weeks. Multigravidae have significantly higher blood pressure [(BP) 119/79 mmHg] than primigravidae (116/77 mmHg), higher pulse rate [(PR) 84 bpm vs. 82 bpm], and an elevated respiratory rate [(RR) 14 cpm vs. 12 cpm]. Both groups have similar body temperatures. **Conclusion:** The majority of participants do not have cognitive impairment. Among those who do, the impairment was more severe in multigravidae. The severity of cognitive impairment was significantly and strongly linked to the number of pregnancies. Additionally, multigravidae have significantly higher BP, PR, and RR.

Keywords: primigravida; multigravida; cognitive functions; pregnancy; Kano-Nigeria.

Introduction

Cognitive function encompasses a broad spectrum of mental processes crucial for acquiring, processing, retaining, and utilizing information, encompassing memory, attention, language skills, executive functions (e.g., planning and decision-making), reasoning, and spatial awareness (Bayne *et al.*, 2019). These cognitive abilities fundamentally influence daily life, shaping learning, communication, and adaptation to changing circumstances (Greenfiel *et al.*, 2022). Cognitive impairment is prevalent, as evidenced by research

conducted by Meena *et al.* (2016), Mukhlis *et al.* (2020), and Pais *et al.* (2020). Various factors, including genetics, age, lifestyle, and health, exert influence over cognitive function.

Pregnancy represents a unique phase in a woman's life characterized by significant physical and hormonal changes. Researches indicate that cognitive function is affected during pregnancy, with memory changes commonly reported (Brown and Schaffir, 2019; Kumari, 2019). Some women experience forgetfulness and

difficulty concentrating, while others may notice improved memory, especially for emotionally-related events.

Numerous factors contribute to cognitive changes during pregnancy. Significant hormonal changes, including elevated estrogen and progesterone levels (Strauss and Mesiano, 2020) can influence neural processes and, consequently, cognitive function in both the mother and the baby (Marchese *et al.*, 2018). Emotional and psychological factors, such as stress, anxiety, and mood swings can also impact on cognitive function, with higher stress levels often associated with greater cognitive changes. Sleep disturbances, which is common during pregnancy, can lead to sleep deprivation. This negatively affects cognitive performance, including memory and concentration (Janes *et al.*, 1999). Physical discomfort, such as morning sickness, back pain, and fatigue, can divert a woman's attention and focus away from cognitive tasks. Additional factors include changes in thyroid functions, gestational age, physical exercise, co-morbid medical conditions, and differences in personality traits (Smiley-Oyen *et al.*, 2008; Li *et al.*, 2016; John *et al.*, 2018; Barda *et al.*, 2021; Klein *et al.*, 2019; Pop *et al.*, 2019; Casey *et al.*, 2000).

Animal studies, exemplified by Kinsley *et al.* (1999) and Bodensteiner, have demonstrated improved spatial learning and memory during pregnancy in rats. The existing literature on cognitive changes during pregnancy presents conflicting findings. Several studies (Sharp *et al.*, 1993; Brett *et al.*, 2001; Groot *et al.*, 2003; de Groot *et al.*, 2006; Davies *et al.*, 2018) indicate a decline in cognitive functioning during pregnancy, while others (Christensen *et al.*, 1999) report improved performance or no significant effect (Christensen *et al.*, 2010). Human studies have demonstrated that hormonal fluctuations impact cognitive performance (Casey *et al.*, 2000; Henry *et al.*, 2007; Rendell *et al.*, 2008). Moreover, evidence suggests that elevated levels of sex hormones during the second and third trimesters affect cognitive functions. Consequently, our study focused on participants in their third trimester, as hormonal changes may not sufficiently impact on cognitive processes during the first trimester.

Understanding cognitive changes during pregnancy is crucial for the well-being of expectant mothers and has implications for maternal and child health outcomes.

Cognitive function can influence how women manage pregnancy, make health-related decisions, and prepare for childbirth and motherhood. Research has shown links between maternal cognition during pregnancy and its effects on child development, affecting parenting skills, early childhood interactions, and a child's cognitive development (Lacy *et al.*, 2015; John *et al.*, 2021).

Pregnancy is a transformative and challenging journey for women, both physically and emotionally. In our area, much attention is given to the physiological changes and well-being of the mother and the developing fetus, while the cognitive aspect of pregnancy is often overlooked. However, cognition, plays a crucial role in a woman's ability to navigate the complexities of pregnancy and anticipate the demands of motherhood. This study addresses the lack of awareness and comprehensive research on cognitive aspects during pregnancy in our area. While many mothers elsewhere report cognitive issues, it is unclear whether it affects pregnant women in this environment and to what extent. Our study, therefore, aims to assess cognitive function in both primigravidae and multigravidae. By comparing these two groups, the study seeks to uncover any significant differences in order to contribute to understanding cognitive changes during pregnancy. Ultimately, the findings can benefit healthcare professionals and pregnant women by identifying potential cognitive challenges impacting on maternal and child health outcomes.

Materials and Methods

Study Setting and Design: The study is a descriptive cross-sectional one, conducted at the antenatal clinic (ANC) of Murtala Muhammad Specialist Hospital (MMSH) in Kano, Nigeria. The research focuses on primigravidae and multigravidae in their third trimester of pregnancy during their last ANC visit before delivery.

Inclusion/ Exclusion Criteria: The study includes pregnant women who provided an informed consent and excludes those with a history of mental conditions and cognitive disorders based on their hospital file records.

Sample Size: The minimum sample size was set at 300 participants, chosen through simple random sampling (Krejcie and Morgan, 1970).

Ethical Consideration: Approval was obtained from the Ethics Committee of Bayero University Kano and ethical clearance granted by the Kano State Ministry of Health with the approval number NHREC/17/03/2018, dated 20th January 2023. The procedures used in this study adhere to the tenets of the Declaration of Helsinki (as revised in Edinburgh 2000).

Data Collection: Data collection occurred between February and March 2023, utilizing a comprehensive questionnaire covering demographic information, clinical data, vital signs, and the Mini-Mental State Exam (MMSE-30) assessment. Following the questionnaire interview, vital signs were measured using appropriate instruments. The MMSE was administered and the scores were categorized to indicate the level of cognitive impairment.

Data Analysis: The data were presented using tables, and statistical analyses were performed using Microsoft Office Excel version 2013 and SPSS version 25.0. Parametric or nonparametric tests were chosen based on normality testing. The significance level was set at $P < 0.05$. The MMSE demonstrates sensitivity and specificity in detecting cognitive impairment, adjusted for patient characteristics (Davey and Jamieson, 2004).

Results

Sociodemographic Characteristics

Among the participants, 52% of primigravidae and 42% of multigravidae were between 22-26 years old. Additionally, around 5.8% of primigravidae and 17% of multigravidae were in the 27-31 age range. All multigravidae are married, while only one primigravida is single. All the participants are Muslims. Among primigravidae, 1% has primary, 64% have secondary, and 42% have tertiary education. Among multigravidae, 81% have secondary, and 19% have tertiary education. The majority of both primigravidae (58%) and multigravidae (57%) are full-time housewives. Around 19% of primigravidae and 30% of multigravidae are engaged in petty trading. About 9% of the primigravidae and 5% of the multigravidae are students. Additionally, 9% of the primigravidae and 4% of the multigravidae work as civil servants. A small percentage (approximately 2% of primigravidae and 3% of multigravidae) identified as businesswomen. Among

primigravidae, majority belong to the Hausa ethnic group, followed by Fulani, Yoruba, Egbira, Igala, Nupe, and Bari. A similar pattern was observed among the multigravidae, with the exception that Yoruba and Bari who have higher representation compared to Fulani and Nupe respectively (Table 4.1).

Obstetric and Gynecologic Characteristics

The majority of both primigravidae (83%) and multigravidae (87%) are right-handed. Most of the women in both groups have had no cognitive impairment. However, a higher percentage of the multigravidae (17%) have severe cognitive impairment compared to the primigravidae (1%). Majority of both primigravidae and multigravidae have no history of surgery, road traffic accidents, or injuries. About 14% of primigravidae had 1 or 2 pregnancies prior to the current one, while 40% of multigravidae had at least one previous pregnancy. Approximately 85% of primigravidae and 84% of multigravidae had no prior miscarriage. Among those who had miscarriage, majority in both groups had at least one miscarriage in the past. Miscarriages were more frequent at the 8th and 12th weeks of pregnancy for primigravidae and 8th and 16th weeks of pregnancy for multigravidae. Majority of multigravidae (93%) had a normal Spontaneous Vaginal Delivery (SVD) in their last delivery, followed by Cesarean Section (CS) delivery (4%) and Assisted Delivery (AD) (2%). About 99% of primigravidae and 97% of multigravidae are carrying a single gestation (Table 4.2).

Vital Signs and Pregnancy

The multigravidae were significantly older (mean age of 26 years) than the primigravidae (mean age of 22 years) with a p-value of 0.001 (Table 4.3). Systolic and diastolic blood pressure (SBP and DBP) were significantly higher in multigravidae (119/79 mmHg) compared to primigravidae (116/77 mmHg) (Table 4.3). The PR was significantly higher ($p = 0.001$) in multigravidae (84 bpm) compared to primigravidae (82 bpm) (Table 4.3). There was no significant difference ($p = 0.352$) in temperature between the two groups (primigravidae and multigravidae). The RR significantly increased ($p = 0.001$) in the multigravidae (12cpm) compared to the primigravidae (12 cpm) (Table 4.3).

Table 4.1: Socio-demographic Characteristics of the Participants

BIODATA	CATEGORIES	PRIMIGRAVIDA		MULTIGRAVIDA	
		Frequency	%	Frequency	%
Age (years)	17 – 21	48	40	31	17
	22 – 26	63	52	76	42
	27 – 31	7	9	32	18
	32 – 36	2	2	33	18
	37 – 41	1	.8	8	4
Occupation	Fulltime House Wife (FTHW)	71	59	102	57
	Civil Servant	11	9.1	8	4
	Business Woman	3	3	6	3
	Petty Trader	24	20	55	31
	Student	12	10	9	5
Religion	Muslim	120	100%	180	100.0
	Christian	0	0%	0	0%
Highest Educational Level	Primary Education	2	2	0	0%
	Secondary Education	77	64	145	81
	Tertiary Education	42	35	35	19
Tribe	Bari	0	0%	2	1
	Egbira	3	3	6	3
	Fulani	10	8	19	11
	Hausa	96	79	126	70
	Igala	2	2	3	2
	Nupe	1	0.8	0	0%
	Yoruba	9	7	24	13

Frequency Distribution Table. Primigravida n= 120; multigravida n=180.

Cognition and Pregnancy

Table 4.4 presents the relationship between gravidity (primigravida and multigravida) and the severity of cognitive impairment. Majority of primigravidae (83%) and multigravidae (70%) were not affected by cognitive impairment. However, among those who experienced

severe cognitive impairment, 94% were multigravidae, while only 6% were primigravidae. The results of the chi-square test reveal a significant and strong association between gravidity and the severity of cognitive impairment ($p < 0.001$) (Table 4.4).

TABLE 4.2: DESCRIPTIVE STATISTICS OF THE PREGNANCY-RELATED CLINICAL DATA

VARIABLES	CATEGORIES	PRIMIGRAVIDA		MULTIGRAVIDA	
		Frequency	%	Frequency	%
MMSE Scores	Severe Cognitive Impairment	1	2	31	17
	Mild Cognitive Impairment	19	16	23	13
	No Cognitive Impairment	100	83	126	70
Ever Had Miscarriage Before?	No	102	85	151	84
	Yes	18	15	29	16
Number of Miscarriages	Miscarriage 0x	102	85	151	84
	Miscarriage 1x	15	12	20	11
	Miscarriage 2x	3	3	7	4
	Miscarriage 3x	0	0%	2	1
Weeks of Miscarriage	No miscarriage	103	85	166	92
	Miscarriage at 1 st Week	3	3	2	1
	Miscarriage at 3 rd Week	0	0%	1	.6
	Miscarriage at 4 th Week	1	.8	2	1
	Miscarriage at 8 th Week	7	6	4	2
	Miscarriage at 9 th Week	0	0%	1	.6
	Miscarriage at 12 th Week	6	5	0	0%
	Miscarriage at 16 th Week	0	0%	4	2
	Loss of Pregnancy at 24 th Week	1	.8	0	0%
Last Form of Delivery	Nil	120	100	1	0.6
	Spontaneous Vaginal Delivery (SVD)	0	0%	168	93
	Assisted Delivery (AD)	0	0%	4	2
	Caesarian Section (CS)	0	0%	7	4

Frequency Distribution Table. Primigravida n= 120; multigravida n=180.

TABLE 4.3: Comparison of the Age, Systolic and Diastolic Blood Pressure, Pulse Rate, Respiratory Rate, and Temperature Between Primigravida and Multigravida.

VARIABLE	PRIMIGRAVIDA (MEAN±S.E.M)	MULTIGRAVIDA (MEAN±S.E.M)	z-value	P value
Age (years)	22.71 ± 0.284	26.34± 0.39	-6.402	0.001**
Systolic BP (mmHg)	116.86 ± 0.56	119.67 ±0.46	-3.713	0.001**
Diastolic BP (mmHg)	77.69± 0.55	79.28 ±0.46	-2.388	0.017*
Pulse Rate (bpm)	82.06± 1.45	84.34 ±1.09	-3.528	0.001**
Temperature (°C)	36.01± 0.05	36.09 ±0.03	-0.931	0.352
Respiratory Rate (cpm)	12.51 ± 0.11	13.65 ±0.13	-6.206	0.001**

Mann-Whitney U Test. Primigravida n= 120; multigravida n=180. * Indicates statistical significance and its absence indicates insignificance. S.E.M.= standard error of the mean. P ≤ 0.05.

Table 4.4: Relationship Between Gravidity and the Severity of Cognitive Impairment

		Cognitive Impairment			P value
		No	Mild	Severe	
Gravidity	Primigravida	100 (44.2%)	19 (45.2%)	2 (6.1%)	0.001**
	Multigravida	126 (55.8%)	23 (54.8%)	31 {93.9%}	

Chi-Square Test (Fisher’s Exact Test=21.108). Primigravida n= 120; multigravida n=180. *Indicates statistical significance and its absence indicates insignificance. P ≤ 0.05.

Discussion

The age distribution among the participants shows that about half of primigravidae and multigravidae fell within the age range of 22-26 years. Kassaw, *et al.*, 2023 also got the mean age of respondents as 26 years old (Kassaw *et al.*, 2023). Additionally, 5.8% of primigravidae and 17% of multigravidae belong to the age range of 27-31 years. Multigravidae are found to be significantly older, with a mean age of 26 years, compared to primigravidae, who have a mean age of 22 years. Acheanpong *et al.*, 2022 however found that a higher percentage of pregnant women are much older than our pregnant women here (Acheanpong *et al.*, 2022). This is not surprising since ladies here tend to marry early in accordance with their religious beliefs and sociocultural background. All of the multigravidae are married, indicating a higher prevalence of marital status among this group. In contrast, only one primigravida is single (single, divorced, widowed). This is in line with Kassaw, *et al.*, 2023 who reported 76% of the participants to be married and only 24% as single. In both groups, all participants identified as Muslims, indicating a religious homogeneity within the participants. Among the primigravidae, only 1% have primary education as their highest level of education, while 64% had completed secondary education, and 42% have attained tertiary education. This indicates that 99% of primigravidae pursue education beyond the primary school level. In

contrast, among the multigravidae, 81% had completed secondary education, and 19% have attained tertiary education. Multigravidae have a higher proportion of individuals with a higher level of education likely because they were older than the primigravidae. Kassaw and colleagues also found that 37.3% have attended secondary school. Yarube *et al.*, 2019 found that 80% of the primigravida have attended at least secondary school education. Contrary to our findings, Acheanpong, *et al.*, 2022 found smaller percentages of (13.7) and (6.1) who attended senior high school and tertiary education. Majority of both primigravidae (58%) and multigravidae (57%) were full-time housewives, indicating a significant proportion of women primarily engaged in domestic responsibilities. Approximately, 19% of primigravidae and 30% of multigravidae are engaged in petty trading, suggesting some involvement in small-scale businesses. Additionally, a small percentage of both groups are students, civil servants, or businesswomen. Also, Yarube *et al.*, 2019 found that 68% of the primigravidae are fulltime housewives. Majority of primigravidae belong to the Hausa ethnic group, followed by the Fulani, Yoruba, Egbira, Igala, Nupe, and Bari. A similar pattern was observed among the multigravidae, with the exception that the Yoruba and Bari have a higher representation compared to the Fulani and Nupe respectively. These findings highlight

the ethnic diversity within the participants, with certain ethnic groups being more prevalent than others.

Majority of both primigravidae (83%) and multigravidae (87%) are right-handed, indicating a prevailing right-handedness among the participants. Most women in both groups have no cognitive impairment. However, the data reveal that a higher percentage of multigravidae (17%) have severe cognitive impairment compared to primigravidae (1%). This suggests a greater likelihood of experiencing cognitive impairment among the multigravidae. Majority of primigravidae and multigravidae have no history of surgery, road traffic accidents, or injuries, indicating relatively healthy participants. This suggests that the participants are generally free from major medical interventions or traumatic events in their lives. Approximately, 85% of primigravidae and 84% of multigravidae have no prior history of miscarriage. Among those who had experienced a miscarriage, majority in both groups had at least one miscarriage in the past. The data also indicate that miscarriages were more frequent at the 8th and 12th weeks for primigravidae and the 8th and 16th weeks for multigravidae. These findings provide insights into the prevalence and timing of miscarriages among the participants. Vaginal delivery was the most common mode of delivery among multigravidae. Majority of primigravidae and multigravidae had single gestation; this is in line with the findings of Yarube *et al.*, 2019.

In this study, multigravidae showed significantly higher SBP and DBP compared to primigravidae. Multigravidae also had a higher PR compared to primigravidae. Additionally, there was an elevated respiratory rate among the multigravidae compared to the primigravidae. However, there was no significant temperature difference between the groups, indicating similar body temperatures.

The analysis of cognitive function in relation to gravidity (primigravida and multigravida) shows that most participants have had an intact cognitive function, with 83% of primigravidae and 70% of multigravidae showing no cognitive impairment. However, a severe cognitive impairment was significantly more prevalent in multigravidae. This finding implies that gravidity is a crucial factor influencing the occurrence and severity of cognitive impairment during pregnancy. Yarube *et al.*, 2019 found that 58% and 30% of the primigravida have mild and severe cognitive impairment. Barda *et al.*, 2021

also demonstrates an impairment in memory among pregnant women.

Memory loss during this crucial phase of a woman's life may be attributed to hormonal changes or lifestyle adjustments associated with concerns about delivery, post-natal period, adapting to motherhood, and alterations in sleep patterns, which can potentially induce anxiety or depression. A recent study found reduced memory function in pregnant women displaying depressive symptoms (Ouelette and Hampson, 2019), suggesting that hormonal changes primarily contribute to cognitive decline, as reported in previous studies (Sherwin, 2012; Farrar *et al.*, 2014).

Conclusion

In conclusion, multigravidae are typically older and have a higher proportion of individuals with secondary education compared to primigravidae. Multigravidae display a higher percentage of severe cognitive impairment, which could potentially be linked to multigravidity. Primigravidae experience a higher frequency of miscarriages at the 8th and 12th weeks, while multigravidae experience them at the 8th and 16th weeks. Multigravidae show elevated SBP and DBP, PR, and RR compared to primigravidae. However, no significant difference was observed in the temperature between the two groups.

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