

The Role of Ultrasound in Enhancing Maternal – Fetal Bonding in Kaduna Metropolis, Nigeria

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Abstract

Maternal-fetal attachment or bonding is a natural phenomenon that develops gradually throughout pregnancy and peaks in the few weeks after the birth of the child. The mutual maternal-child relationship is one of the important determining factors in children's normality or abnormality through which the physical, emotional, and psychological needs of the mothers and children would be fulfilled. Ultrasound is also known to be a reassuring tool, showing that the life-form carried inside the expectant mother is indeed a baby. It has been shown that ultrasound decreases maternal partaking in risky behaviors during pregnancy, such as alcohol intake. The study aims at evaluating the role of ultrasound in enhancing maternal – fetal bonding in Kaduna metropolis. The study design was prospective, cross sectional conducted in four hospitals in Kaduna metropolis from May 2019 to September 2019. Using convenience sampling method, four hundred and thirty subjects participated in the study. An ethical approval to conduct the study was sought and obtained from the Human Research and Ethics Committee of the Kaduna State Ministry of Health, and informed consent was obtained from all the selected participants. A structured questionnaire was used as an instrument for data collection. The questionnaire was validated by experienced colleagues, using a pilot study the reliability was tested and the chronbach's alpha reliability coefficient was found to be 0.89. The obtained data was analyzed using SPSS version 22.0. Ninety-nine (25.9%) of the participants were not really excited about their pregnancy before ultrasound scan, but only 30 (7.9%) were not really excited after ultrasound scan. 207 (54.2%) of the participants were very excited when they saw their babies on ultrasound screen, and 219 (57.3%) indicated being closer to their babies after ultrasound scan. Ultrasound scan played an important role in enhancing maternal – fetal bonding in Kaduna metropolis.

Keywords: Ultrasound, maternal – fetal bonding, Kaduna metropolis.

INTRODUCTION

Maternal-fetal attachment or bonding is a natural phenomenon that develops gradually throughout pregnancy and peaks in the few weeks after the birth of the child. It is regarded as an essential process in the development of good and loving motherly behavior. In about 8% of women, this process is sub-optimal, with potentially damaging effects on the mother-infant relationship and on the emotional development of the child (Campbell, 2006). The attachment starts when the mother finds out about her pregnancy and this is the real start point for fetus's dialog with his/her surrounding world. The mutual maternal-child relationship is one of the important determining factors in children's normality or abnormality through which the physical, emotional, and psychological needs of the mothers and children

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would be fulfilled. The bond between mother and child can cause a favorable attachment and promote the children's cognitive, emotional, and social growth. Maternal affection (within pregnancy) can cause postpartum satisfaction (Ghodрати & Akbarzadeh, 2018). However, the implication of not having good maternal-fetal bonding is that, the important determining factors in children's normality through which the physical, emotional, and psychological needs of the mothers and children would not be fulfilled (Ghodрати & Akbarzadeh, 2018). Inappropriate development of attachment would have an adverse effect on the regulating part of the child's brain; different related studies have reported lower emotional and mental development, weak social interactions, school refusal, and more aggressive and hostile behaviors during childhood, behavioral disorders during adolescence and more tendencies toward drug abuse during adulthood (Kohan & Salehi, 2017).

Ultrasound has been shown to give parents a confirmation of a new life, through two components: ultrasound provides a visualization of the baby and a realization that the unit will soon become a family. Ultrasound is also known to be a reassuring tool, showing that the life-form carried inside the expectant mother is indeed a baby. It has been shown that ultrasound decreases maternal partaking in risky behaviors during pregnancy, such as alcohol intake. Such positive attributes of ultrasound in pregnancy should not be overlooked. The bond that has been shown to start before the birth of the baby is enhanced when the mother can be aware of the growing baby inside her. There is no denying that ultrasound techniques in the obstetric field can be powerful in enhancing and shaping the maternal-fetal bonding and attachment that is underway (Atluru *et al.*, 2012). The findings of the studies conducted by Atluru *et al.* (2012); Sedgmen *et al.* (2006) and Ji *et al.* (2005) reported positive role of ultrasound in the enhancement of maternal – fetal bonding. However, there is paucity of data on the role of ultrasound in enhancing maternal – fetal bonding in Kaduna metropolis. The findings of the study are expected to serve as a baseline for making recommendations, also serve as a guide to sonographers and sinologists. The study aims at evaluating the role of ultrasound in enhancing maternal – fetal bonding in Kaduna metropolis.

MATERIALS AND METHODS

The study design was prospective, cross sectional conducted in four hospitals; Barau Dikko Teaching Hospital, Yusuf Dantsoho Memorial Hospital and Gwamna Awan General Hospital, and General Hospital Sabo in Kaduna metropolis from May 2019 to September 2019. Using convenience sampling method, four hundred and thirty subjects participated in the study. An ethical approval to conduct the study was sought and obtained from the Human Research and Ethics Committee of the Kaduna State Ministry of Health, and informed consent was obtained from all the selected participants. A structured questionnaire was used as an instrument for data collection. It consists of three sections; A, B and C; section A is the demographic information of the participants, section B contain question on maternal – fetal bonding without ultrasound, and section C maternal – fetal bonding with ultrasound. The participants were asked to answer section A and B before ultrasound scan and section C after ultrasound scan. The questionnaire was validated by experienced colleagues, using a pilot study the reliability was tested and the chronbach's alpha reliability coefficient was found to be 0.89. Four hundred and thirty questionnaires were administered to the consented pregnant women in Kaduna metropolis. During the ultrasound scan every participant was made to see the images of the developing baby on the ultrasound screen. The obtained data was analyzed using SPSS version 22.0.

RESULTS

Out of the 430 (100%) administered questionnaires, 403 (93.4%) were returned and 381 (88.6%) were properly filled.

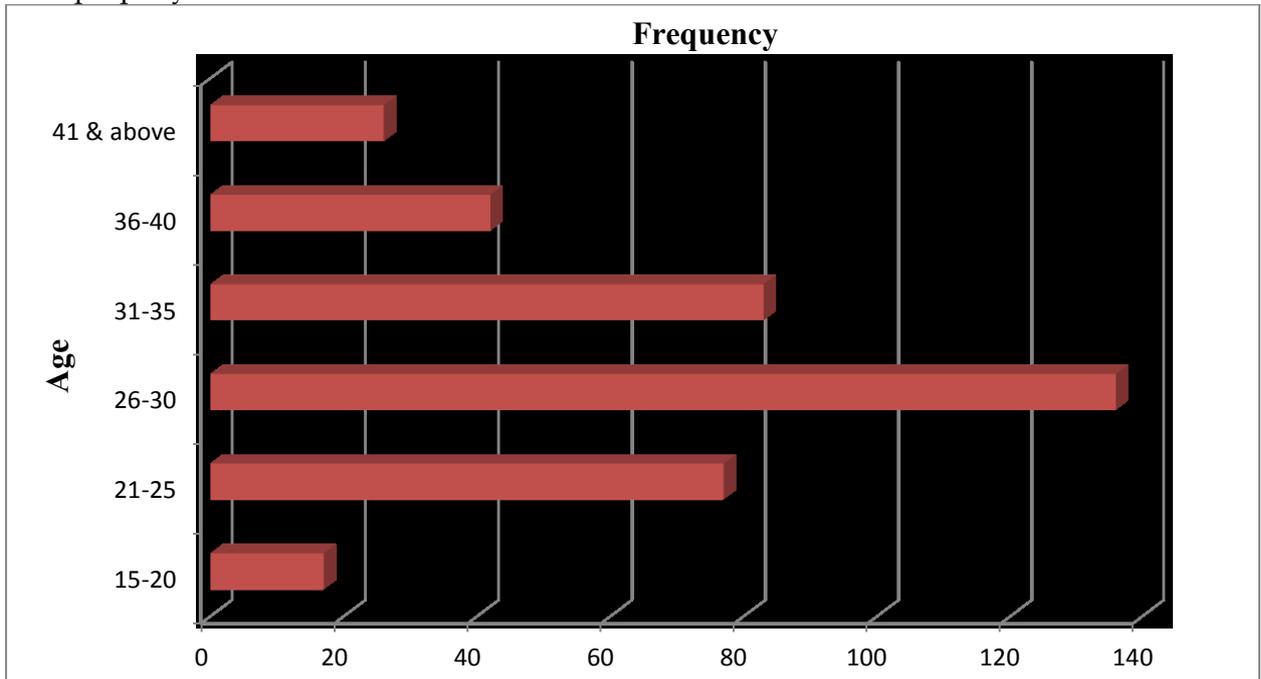


Figure 1: Age of the participants

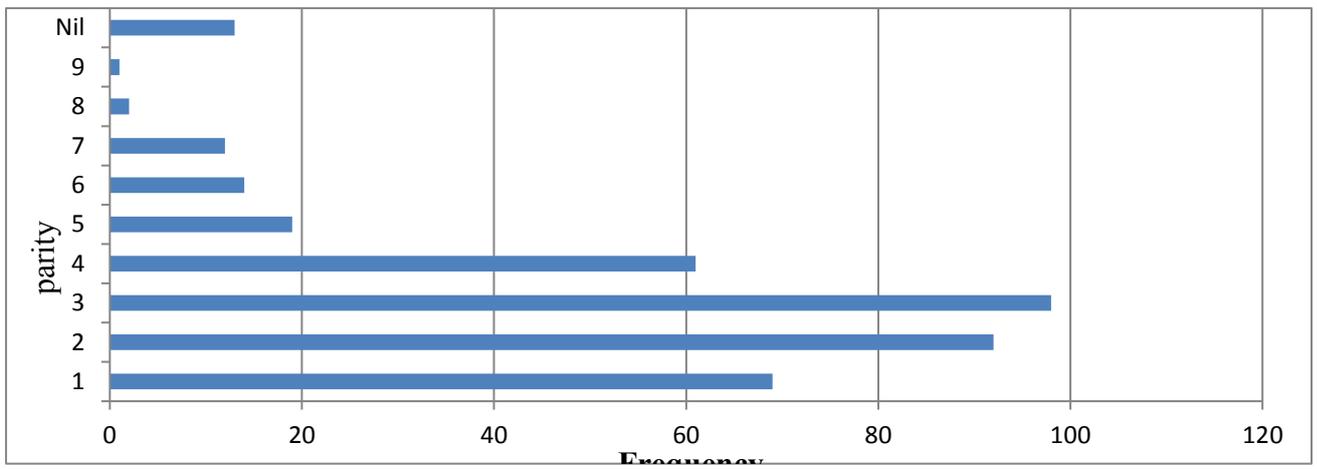


Figure 2: Parity of the participants

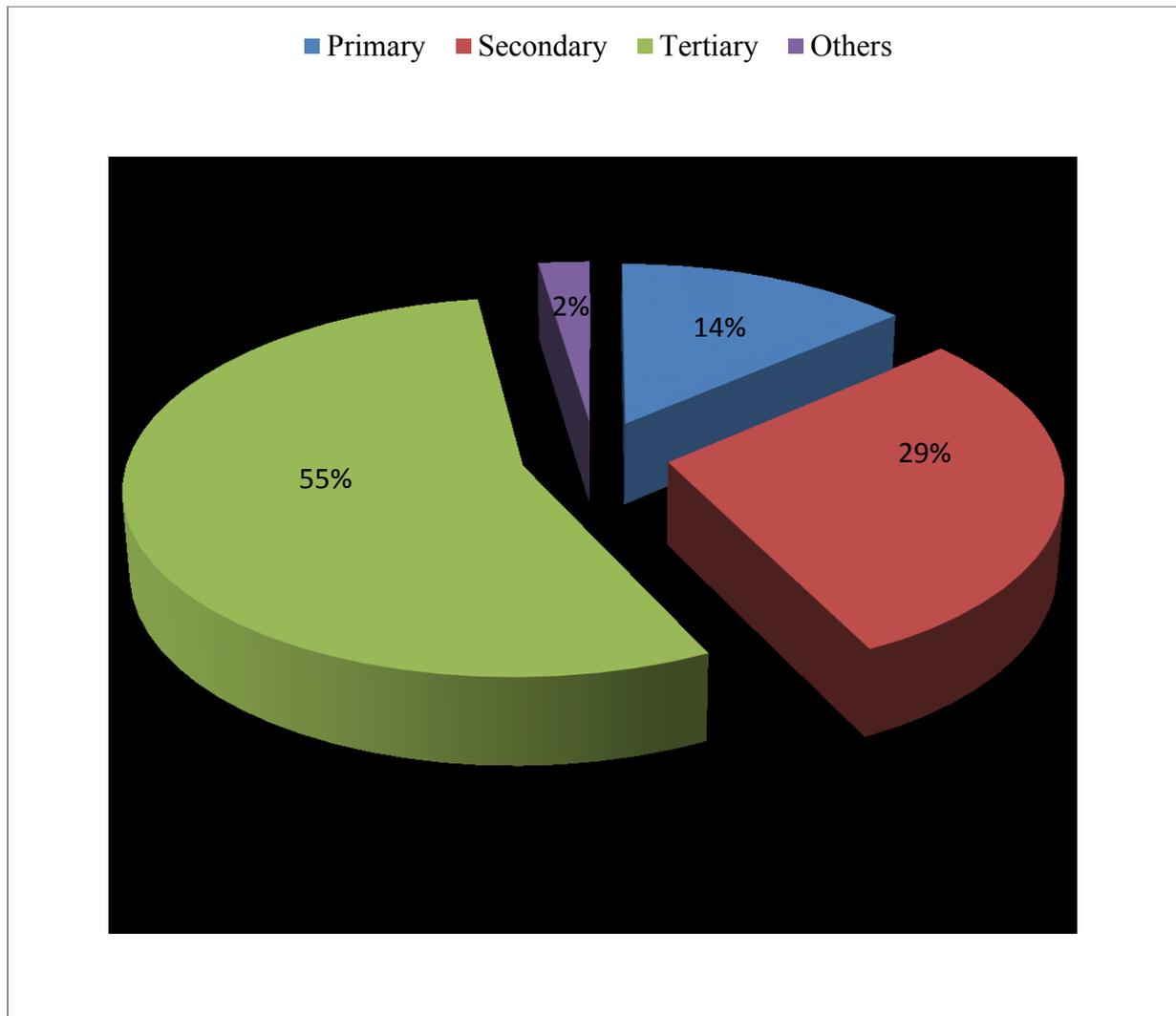


Figure 3: Educational status of the participants

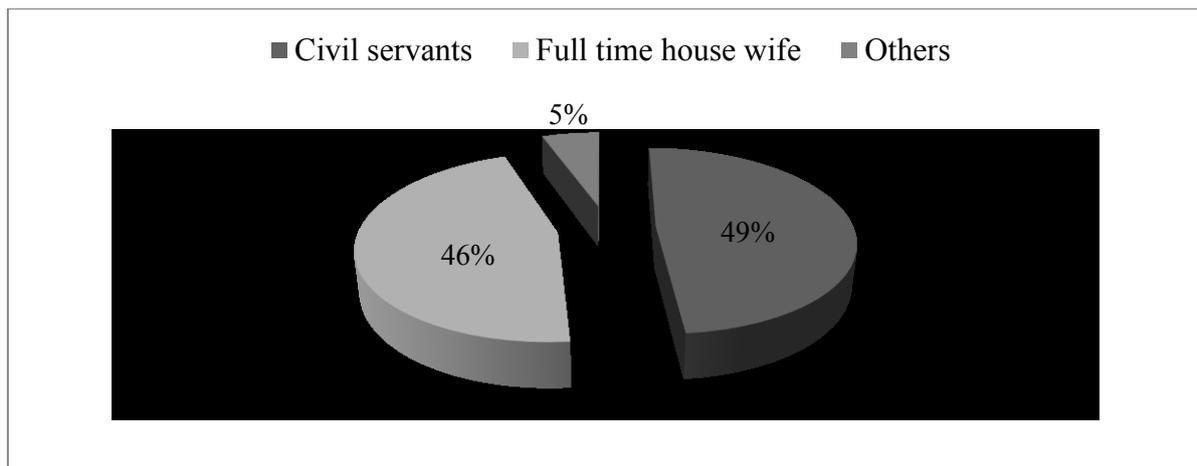


Figure 4: Occupation of the participants

Table 1: Maternal-fetal bonding without ultrasound

Questions	Answers	Frequency	Percentage (%)
5. I feel about my pregnancy without ultrasound scanning.	Not really excited	99	25.9
	Excited	151	39.5
	Very excited	131	34.3
6. At what stage of the pregnancy do you feel very excited about your baby even without ultrasound scanning?	First trimester (0-13weeks)	178	46.6
	Second Trimester (14- 27 weeks)	112	29.3
	Third trimester (28- 27weeks)	46	12.0
	None of the stages	45	11.8
7. What makes you feel very excited about your baby?	When I feel the baby moves or tickles	173	45.3
	When I think about how my baby will look like.	99	25.9
	Only when I saw my baby on ultrasound machine monitor	109	28.5
8. How will you feel carrying your pregnancy without doing ultrasound screening?	Not really excited	184	48.2
	Excited	92	24.1
	Very excited	105	27.5

Table 2: Maternal-fetal bonding with ultrasound

Questions	Answers	Frequency	Percentage (%)
9. How do you feel attending this ultrasound examination for your baby?	Not really excited	30	7.9
	Excited	167	43.7
	Very excited	184	48.2
10. At what stage of the pregnancy do you feel very excited about your baby during ultrasound scanning?	First trimester (0-13weeks)	106	27.7
	Second Trimester (14- 27 weeks)	109	28.5
	Third trimester (28- 27weeks)	82	21.5
	None of the stages	84	22.0
11. How do you feel looking at your baby on the ultrasound screen?	Not really excited	49	12.8
	Excited	125	32.7
	Very excited	207	54.2
12. How do you describe your relationship with your baby after looking at the pictures on the ultrasound screen?	Neutral	43	11.3
	Closer than before	219	57.3
	Very close	119	31.3
13. Any time I want to go for ultrasound scanning for my baby, I feel.....	Not really excited	31	8.1
	Excited	181	47.4
	Very excited	169	44.2
14. I tell my husband and neighbor how..... am, when I saw my how my baby moves on the ultrasound monitor	Not really excited	36	9.4
	Excited	179	46.9
	Very excited	166	43.5

Factors that affects maternal-fetal bonding with ultrasound findings

One hundred and twenty-nine (33.8%) participants had contrary expected gender as a factor that affected maternal – fetal bonding and sixty two (16.2%) indicated fetal presentation as a factor. Eighty (20.9%) responded that, ultrasound findings suggested for surgical operation, 65 (17.0%) responded that, ultrasound findings suggested disease associated with my pregnancy and 45 (11.8%) responded none of the above.

DISCUSSION

The findings of the study show that 99 (25.9%) of the participants were not excited with their pregnancy without ultrasound scanning, while 151 (39.5%) were excited about their pregnancy and 131 (34.3%) of the participants were very excited with their pregnancy without ultrasound scanning. Based on the finding, pregnant women who feel happy about their pregnancy even without ultrasound scanning had the highest number of participants (73.8%) as shown in table 1. It shows that they have a good emotional and psychological state in relation to maternal-fetal attachment despite the risk associated with not knowing the wellbeing of the fetus and themselves. The findings of the study show that 178 (46.6%) participants feel very excited about their pregnancy at the first trimester (0 to 13 weeks) without ultrasound examination, which was the highest number of participants, followed by 112 (29.3%) participants at second trimester (14 to 27 weeks.) However, 45 (11.8%) of the participants did not feel excited about their pregnancy as shown in table 1. Although, there was a limited number of published research on the level of excitement of pregnant women at first trimester without the ultrasound examination, even though the findings of the study are similar to the findings of the study conducted by Lou *et al.* (2017) a longitudinal study, the interviewed showed that, “all women expressed joy and excitement about being pregnant.

Although, the first trimester is characterized by unstable emotional feelings such as nausea, morning sickness and hormonal changes that may interfere with the emotional state of the pregnant women. Based on the findings, it shows that women feel very excited in the first trimester of pregnancy. However, 11% participants did not feel excited in all the three stages of pregnancy, these showed that there are women with different physiological changes in their emotional state who do not experience significant changes even during pregnancy. The findings of the study show that 173 (45.5%) of the participants feel very excited about their pregnancy without ultrasound examination, when they feel the baby moves or tickles which was the highest respondents, followed by 109 (28.5%) participants, which responded that, it was only when they saw their baby on ultrasound screen, they felt very excited about their pregnancy and 99 (24.9%) participants responded that when they think about how their babies will look like even without the ultrasound examination as shown in table 1. The current finding is in agreement with the findings of the study conducted by Moussa *et al.*, (2011) which showed that 90% of the expectant mothers enjoyed watching their tummy jiggle and 98% were looking forward to seeing how their baby looks like. Based on the findings of the study, a high number of pregnant women feel very excited about their pregnancy event without ultrasound examination. The findings of the study concurred with the finding of the study conducted by Murakami *et al.* (2012) which showed that 234 (98.3%) of the participants agreed that ultrasound scans mostly gives feelings of pleasure and 232 (97.5%) of the participant agreed that it increased attachment to their fetus. However, a few participants do not feel very excited without ultrasound confirmation, probably due to the fact that women are generally emotionally inclined irrespective of the region or race. The findings of the study show that 184 (48.2%) of the participants did not really feel excited, carrying their pregnancy without doing ultrasound scanning as against the highest number that was either excited or very excited about their pregnancy without ultrasound examination as shown in table 1. The findings of the study, nearly agreed to the findings of the study conducted by Moussa *et al.* (2011) which showed that 33% of uncertainty was regarding the implication behind the fetus kicking and 24% of the participants were not certain on the ability to guess the baby’s personality from the way he/she moved around, which make them unhappy, even though others are happy with it, rather, they are probably conscious of the complication that may be associated with the pregnancy. The findings of the study show that 184 (48.2%) of the participants responded that they were very excited attending ultrasound examinations for their babies while 167 (43.7%) participants feel excited. However, 30 (7.9%) of the participants

responded they were neutral (neither excited nor not excited) as shown in table 1. This implies that the high number of pregnant women feel happy attending ultrasound examination (91.9%) compared to without having an ultrasound examination (51.6%) for several reasons.

The findings of the study concurred with the study conducted by Murakami *et al.* (2012) on Japanese women's reasons for and views of ultrasound, the finding shows that, for social reasons, 203 (85.3%) participants wanted a photo of their fetus and 234 (98.3%) participants' views of ultrasound scans mostly identified were feelings of pleasure. However, those participants that had a neutral feeling about attending an ultrasound scanning in this study, shows that few pregnant women come for ultrasound examination with mixed feelings until probably after the scanning when ultrasound finding shows positive (normal scan). This finding also agreed with the finding of the study conducted by Murakami *et al.* (2012) that the majority of 171 (71.8%) worried about the detection of abnormalities or problems with their fetuses. Only half 118 (49.6%) believed that no abnormality found by ultrasound. However, almost all 235 (98.7%) wanted to know if their fetus had any abnormality or disease. Therefore, the proper explanation should be given to pregnant women by the sonographers, sonologists and well-trained personnel during ultrasound scanning so that those who may probably come with mixed feelings may go back happy about their pregnancy which increases maternal-fetal bonding.

The current finding of the study showed that 109 (28.5%) of the participants feel very excited about their pregnancy with ultrasound examination at second trimester (14 to 27weeks), closely followed by 106 (27.7%) participants who responded that they feel excited about their pregnancy with ultrasound examination at the first trimester as shown in table 2. However, 84 (22.0%) of the participants responded that in none of the stages they were not very excited about their pregnancy with ultrasound examination. The finding shows a competing opinion among the participants between the first trimester and second trimester of pregnancy, without and with ultrasound examination. With ultrasound examination, the second trimester has the highest participants presumably due to the fact that the participants were shown their babies and other features (heartbeats, gender) of their babies. While in the case of the first trimester, probably, the confirmation of pregnancy, expected date of delivery and well being of the fetus that gives the mother's joy as compared to carrying their pregnancy without ultrasound examination. However, others seem not to be excited in either of trimesters of the pregnancy, possibly due to variation in physiological changes which could be associated with psychosocial factors such as depression or unplanned pregnancy and other emotional imbalance related factors which could affect the feeling of happiness of the pregnant women, especially during ultrasound scanning. The finding of the current study seems to agree with the finding of the study conducted by Öhman & Waldenström, (2008) on Second-trimester routine ultrasound screening: expectations and experiences in a nationwide Swedish sample.

The finding of the study showed that "94% had a positive experience of the scan and those who had not had more ambivalent feelings about their pregnancy. Women with negative feelings about the scan were more often single and of non-Swedish background, and emotional problems were more common in this group, although, very few wrote about the examination as an exciting and joyful experience". Based on the current finding, pregnant women experienced the excitement in both the first and second trimester of their pregnancy during ultrasound examination, which is higher than the experiences without ultrasound examination and third trimester, without and with ultrasound examination comparatively. Therefore, women should be given proper education in their antenatal clinic days on the importance of ultrasound examination in each of the trimesters. The findings of the study showed that 207 (54.2%) of the participants felt very excited looking at their babies on the

ultrasound screen, while the 125 (32.7%) felt excited about it as shown in table 2. However, 49 (12.82%) of the participants responded neutral (neither excited, very excited nor not excited) seeing their babies on the ultrasound screen, still this implies that image presentation during ultrasound examination has a powerful mental picture in the life of pregnant women, which can create a process of imagination of how their baby looks like, consequently enhancing the maternal-fetal bonding. The current finding of the study strongly agreed with the finding of the study conducted by Ji *et al.* (2005) on the effects of ultrasound on maternal-fetal bonding: a comparison of two- and three-dimensional imaging, shown “the majority of the mothers in both 2DUS (83%) and 3DUS (88%) groups felt that seeing their baby during the ultrasound scan or looking at the pictures of the ultrasound image created a closer relationship between them and their child” it’s proven that women create a mental picture of their babies after seeing it on the ultrasound screen in a study conducted by (Ji *et al.*, 2005). Also a study conducted by Murakami *et al.* (2012) showed that pregnant women go for ultrasound examination for “just to see the baby,” “pleasure,” “feel more secure,” and “believe that normal findings suggest the baby has no abnormality”. The findings of the study show that 207 (57.3%) of the participants described the relationship with their fetus as being closer than before after looking at the picture of their babies on the ultrasound screen, followed by 119 (31.2%) responded as very close while 43 (11.3%) responded as neutral (neither closer than before no very close). It shows that the ultrasound examination further connects a high number of mothers to their unborn babies more strongly. The findings of the study agreed with the findings of the study conducted by Murakami *et al.* (2012) which showed that 232 (97.5%) of the participants, responded that ultrasound examination increased attachment to their fetus while 234 (98.3%) of the participants responded that ultrasound examination gives feelings of pleasure, the study is similar probably due to the fact that, women are generally emotionally attached to babies irrespective of region, culture, and race. Some feelings already existed, but it was hoped these would be strengthened by being able to see the baby on the screen” (Molander *et al.*, 2008). However, 11.3% of the participants’ responded neutrally about their relationship with their babies, even after seeing the picture on the ultrasound screen, this could likely be due to individual differing temperament and other emotional and social factors. Therefore, pregnant women should be encouraged to actively attend their routine ultrasound examination as stated by Bashour *et al.* (2005) that “the visualization of the fetus was a major source of pleasure, comfort, and reassurance for pregnant women. The findings of the study show that 181 (47.4%) of the participants responded that they feel excited any time they want to go for ultrasound examination for their babies, while 169 (44.2%) of the participants responded that, they feel very excited as shown in table 2. However, 31 (8.7%) of the participants responded neutrally. This indicates that pregnant women generally feel happy whenever they want to go for ultrasound scanning, except in some few individuals, probably due to a known abnormality that requires a follow-up ultrasound examination, in such women certainly feeling of excitement may not be there. It also implies that ultrasound examination can be a source of happiness in pregnant women during ultrasound examination as stated by Molander *et al.* (2008) that “the ultrasound would visually confirm the existing pregnancy and help remove feelings of unreality. Watching the pregnancy on the screen along with feeling pregnant would make it possible to really believe in the pregnancy. This would help the women to grasp the pregnancy and to release their feelings for the baby”. On the other hand, pregnant women who responded neutral, it’s not a surprise as agreed still by Molander *et al.* (2008) that “an adverse pregnancy was a worrisome possibility, variation between levels of ‘there isn’t anything’, ‘it’s not right’ to ‘it’s dead’. The examination could result in an unpleasant and undesired answer, but the main thing was not for it to be some form of fetal diagnosis”. Therefore, pregnant women should develop a positive desire toward their fetus. The findings of the study show that 179 (46.9%) of the respondents tell their husbands and neighbors how excited they are when they saw their babies moves on the

ultrasound screen, followed by 166 (43.5%) of the participant responded that they were very excited, while 36 (9.4%) of the participant responded neutrally as shown in table 2. It implies that pregnant women extend their joy beyond them to their husbands and neighbors, except in some few among the respondents who do not. This finding agreed with the finding of the study conducted by Türk *et al.* (2017) that the levels of happiness of the pregnant women were higher during pregnancy in their study and that could result in most of the pregnant women to extend their joy to their husbands and neighbors also couple with ultrasounds impact on the pregnancy. Therefore, there should be good communication skills between the ultrasound operators and the pregnant women so that women can freely express themselves about their pregnancy and their anxiety will be relieved during an ultrasound examination.

The findings of the study identified a number of factors that can negatively affect maternal-fetal bonding with ultrasound findings. However, the highest respondents among other factors show that 129 (33.8) of the participants, responded that when ultrasound findings or results showed a different gender (male or female) from the one they expected before will affect the maternal-fetal bonding. This implies that women are gender affinitive; they have a higher preference for a particular gender than the other (male or female). The findings of the study, nearly agree with the findings of the study conducted by Moussa *et al.* (2011) on the correlates of antenatal bonding among Egyptian women, the finding of the study showed that 19% of the mothers desired boys, while 27% desired girls and 20% of the mother have no preference, however, 29 % did not state their desires. The finding of the current study happened to be slightly different from the findings by Moussa *et al.* (2011) in few variables, the current finding only identified factors that can negatively affect maternal-fetal bonding with ultrasound findings, while, their study evaluates the mother desired gender. Also, both studies were conducted in different regions; however, their finding further delineates the gender preference of women. In another study by Erdemoglu & Yesim, (2018) on the correlation of the gender of the fetus with prenatal attachment and perceived social support level, concluded that “female gender of the fetus in primigravid women positively affected prenatal attachment, males, gender of the fetus in multigravida women enhanced both prenatal attachment and perceived social support level” however, in a study conducted by Janbakhishov, (2013) showed that gender of the fetus did not affect the prenatal attachment, which disagreed with the current finding. Based on the current finding, gender preference has a high influence on maternal fetal bonding. This may probably be due to differences in culture and region as supported by Erdemoglu & Yesim, (2018) which stated that “ it is clear that the gender of the fetus is culturally important in many countries of the world, and the universal gender preference in both developed and developing countries is for males”. Therefore, information about gender determination should be handled with caution during the ultrasound examination so that it will not result in conflict between couples and as such gender of the fetus should be disclosed only on request by the mother or father.

CONCLUSION

Pregnant women are more excited with their pregnancies, fell more closer to their developing babies after ultrasound scan, and more excited after seeing their developing babies on the ultrasound screen. In Kaduna metropolis ultrasound enhanced maternal – fetal bonding, however, some factors negatively affect the bonding. Further studies shall consider effect of socio-demographic variables on maternal-fetal bonding

REFERENCES

- Atluru, A., Appleton, K., & Kupesic Plavsic, S. (2012). Maternal-Fetal Bonding: Ultrasound Imaging's Role in enhancing This Important Relationship. *Donald School Journal of Ultrasound in Obstetrics & Gynecology*; 6, 408–411.
- Bashour, H., Hafez, R., & Abdulsalam, A. (2005). Syrian Women's Perceptions and experiences of Ultrasound Screening in Pregnancy: Implications for Antenatal Policy. *Reproductive Health Matters*, 13 (25), 147–154.
- Campbell, S. (2006). 4D and prenatal bonding: still more questions than answers. *Ultrasound in Obstetrics & Gynecology*; 27(3), 243–244.
- Erdemoglu Cigdem, & Yesim, A. (2018). *The correlation of the gender of the fetus with prenatal attachment and perceived social support level. Medicine Science International Medical Journal*; 7 (3): 499-502
- Ghodrati, F., & Akbarzadeh, M (2018). A Review of the Importance of Maternal - fetal Attachment According to the Islamic Recommendations. *Journal of Midwifery and Reproductive Health*, 6 (1), 1193–1200.
- Janbakhshov CE. (2013) Association between fetal inutero wellness and anxiety, depression, adulthood attachment features, prenatal attachment during pregnancy. Dissertation, Dokuz Eylül University, İzmir.
- Ji, E.-K. Pretorius, D. H., Newton, R., Uyan, K., Hull, A. D. Hollenbach, K., & Nelson, T. R. (2005). Effects of ultrasound on maternal-fetal bonding: a comparison of two- and three-dimensional imaging: Effects of 3D ultrasound on maternal-fetal bonding. *Ultrasound in Obstetrics and Gynecology*, 25 (5), 473–477.
- Kohan, S., & Salehi, K. (2017). Maternal-Fetal Attachment: What We Know and What We Need to Know. *International Journal of Pregnancy & Child Birth*; 2(5), 1–3.
- Lou, S., Frumer, M., Schlütter, M. M., Petersen, O. B., Vogel, I., & Nielsen, C. P. (2017). Experiences and expectations in the first trimester of pregnancy: A qualitative study. *Health Expectations : An International Journal of Public Participation in Health Care and Health Policy*, 20(6), 1320–1329.
- Moussa, S., Osama, R., Moh, E., Aef, K., Tamer, G., and Muhammad, E. (2011). Correlate of antenatal bonding (an Egyptian study). *Egyptian Journal of Psychiatry*; 33 (3): 126-134.
- Molander, E., Alehagen, S., & Berterö, C. (2008). A routine ultrasound examination during pregnancy: A world of possibilities. *Midwifery*, 26, 18–26. Moussa. (2011). Correlates of antenatal bonding (an Egyptian Study). Retrieved October 8, 2019, from <http://new.ejpsy.eg.net/article.asp?issn=1110-1105>.
- Murakami, K., Tsujino, K., Sase, M., Nakata, M., Ito, M., & Kutsunugi, S. (2012). Japanese women's attitudes towards routine ultrasound screening during pregnancy: Prenatal ultrasound screening in Japan. *Nursing & Health Sciences*, 14 (1), 95–101.
- Öhman, S. G., & Waldenström, U. (2008). Second-trimester routine ultrasound screening: Expectations and experiences in a nationwide Swedish sample. *Ultrasound in Obstetrics & Gynecology*, 32(1), 15–22.
- Sedgmen, B, McMahon, C, Cairns, D., Benzie, R. J., & Woodfield, R. L. (2006). The impact of two-dimensional versus three-dimensional ultrasound exposure on maternal-fetal attachment and maternal health behavior in pregnancy. *Ultrasound in Obstetrics & Gynecology*, 27(3), 245–251.
- Türk, R., Sakar, T., & Erkaya, R. (2017). The Effect of Pregnancy on Happiness. *Procedia - Social and Behavioral Sciences*, 237, 1247–1253.