The Role of Educational Process during Routine Obstetric Ultrasound Examination in Maternal-Fetal Attachment

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Abstract

Introduction: Maternal-fetal Attachment (MFA) is positively associated with maternal health practices, neonatal outcomes, and possibly, maternal-infant attachment. The educational process that goes on during routine obstetric ultrasound examination have been known to influence MFA. However, this influence is not yet established among nigerian pregnant women.

Objective: Our study aimed to investigate the influence of the educational process during a routine obstetric ultrasound on Maternal-Fetal Attachment (MFA) among Nigerian pregnant women.

Materials and Method: Using a prospective and cross-sectional design, 289 pregnant women whose gestational ages ranged from 16-30 weeks, were enlisted from referrals for a routine obstetric scan at the University of Nigeria Teaching Hospital, Ituku Ozalla, Enugu, Nigeria. The 2-Dimensional ultrasonography was performed using a real-time ultrasound unit. Two questionnaires were used in the study, which was the demographic questionnaire and the Maternal-Fetal Attachment Scale (MFAS), which was used to assess MFA immediately before and two weeks after the ultrasound examination. During the ultrasound examination, the sonographer discussed the fetal image with the mother. Data were analysed using SPSS version 21.0. Paired t-test was used to compare the pre- and post- mean values. ANOVA was used to compare the values of more than two means.

Results: The mothers' total MFA pre-mean score increased significantly ($p=0.0001$) from 3.34 ± 0.18 to a post-mean score of 3.74 ± 0.20 after the routine obstetric ultrasound which involved educational process.

Conclusion: The educational process during routine obstetric ultrasound positively influences MFA during pregnancy among mothers in this locality, which implies a possible improvement in maternal health practices and neonatal outcomes.

Keywords
Routine obstetric ultrasound, maternal-fetal attachment, Educational process

Introduction

Poor neonatal outcome, which is mostly characterised by high maternal and infant mortality and morbidity ratestillpose a severe health challenge in Nigeria [1,2]. The challenge remains a concern as they are indicators of the poor state of health services with the implication that relevant health-related millennium development goals may not be achieved in the country. Although the United Nations (UN) estimate on Maternal Mortality Rate (MMR) in Nigeria reduced from 800 per 100,000 live births in 2009 to 576 per 100.000 live births in 2013, it is still not insufficient to achieve its Millennium Development Goals targets [3].

Maternal-Fetal Attachment (MFA) is a term that is used to refer to the bond that exists between a pregnant woman and her unborn child [4,5] and is defined by Cranley [6] as "the extent to which women engage in behaviour that represents an affiliation and interaction with their unborn child". Maternal-Fetal Attachment theory suggests that MFA influences maternal health practices and, so, offers a critical viewpoint to the improvement of perinatal health, neonatal outcomes [7,8] and also the future child development [9,10]. The

relationship that exists between a mother and her child does not start at the culmination of pregnancy, but at the time when the mother has begun to perceive and interpret the movements of her fetus. This period called 'quickening', confirms an awareness of another separate being for the mother and initiates the attachment process between the mother and fetus. Previous research suggests that MFA is positively associated with maternal health practices, neonatal outcomes, and possibly, maternal-infant attachment [11-14] and empirical evidence exists that MFA characteristically increases as gestation progresses, implying that positive MFA suggests positive birth outcomes [15].

During the past two decades, there has been a shift from "quickening" being the way the pregnant woman fundamentally acknowledged the separate being existing inside of her. A growing body of evidence that a mother seeing the sonograms of her unborn child may increase maternal attachment to the fetus at an early stage of pregnancy became popular [7,16].Obstetric and prenatal management have been influenced by the use of this diagnostic tool, ultrasound examination, which aids early and timely detection of potential obstetric anomalies with no recognised risks to the unborn fetus or mother and also assists in the attachment process by bringing to clarity the individuality and separateness of the fetus. In turn, this technology provides the expectant mothers with a video image of their unborn, which is perceived by them as a peep into their womb. Previous studies have found routine obstetric ultrasound examinations especially in pregnancies in which there are high psychosocial risks and active substance abuse, to have the likelihood of increasing maternal-fetal attachment and decreasing the risk of behaviours that may compromise the overall health status of the pregnancy [17,18,19]

Greater sensitivity of attachment to the fetus was felt among mothers who underwent routine obstetric ultrasound examinations that included an educational process by the sonographer [20,21]. This process involves the sonographer spending just a few extra time (about 3 minutes) with a mother-to-be during the routine obstetric ultrasound examination to demonstrate, explain and discuss the fetal ultrasound image [22]. Several research studies have examined the experience of women undergoing obstetric ultrasound scanning involving the educational process. Their findings suggest that for women with normal pregnancies and low risk for complications, viewing the fetus on ultrasound generally is a most positive, reassuring and significant event which also seemed to be beneficial by reducing potentially harmful maternal behaviour [23]. Fetal parts that show motion, such as the beating of heart and extremities, get a greater level of attention and seem to provide mothers with substantial guarantee about the health of their fetus [20].

There are, however, controversies as regards the adoption of routine obstetric ultrasonography. Lumley [16], referred to one of the controversies as "diagnostic toxicity" of the obstetric ultrasound and can be in conveyed in form of "slips of the tongue", incorrect diagnosis, identification of structures which cannot be understood and language that is both unfamiliar and perturbing to the mothers and impolite proclamations by the sonographer. These known to be the negative impact of obstetric ultrasound on the mothers and increases their anxiety level though is highly dependent on the sonographer's competence. Lumley [16], however, suggested that if the sonographer gives positive feedback, then the negative effect of obstetric ultrasound is reduced to its barest minimum. Those who promote the use of prenatal ultrasound for every pregnancy claim the experience will reassure the pregnant woman about fetal well-being, will encourage the women to abandon practices injurious to the fetus, aid early attachment and will be an enjoyable and fascinating experience [24,25]. Others argued that it increases the cost of prenatal care and does not improve perinatal outcome [26,27]

Apart from anomalies, is there more to be deliberated on, in the routine prenatal ultrasound examination? Could neonatal outcome and maternal behaviours and practices be improved through the educational process during routine obstetric ultrasound examination as a means of improving maternal-fetal attachment among pregnant women in developing countries?

With these equivocal findings, therefore, it becomes necessary to establish a correlation between maternal-fetal attachment and the education that goes on during routine obstetric

ultrasound examination in this locality, through the use of the Cranley Maternal-fetal Attachment Scale (MFAS). No published studies to date have provided a relationship between the education that goes on during routine obstetric ultrasound examinations and maternal-fetal attachment in our locality and also the influence of some maternal characteristics on the MFA.

This study, therefore, aimed at studying the influence of the educational process that goes on during routine obstetric ultrasound on maternal-fetal attachment, taking into account the influence of some maternal characteristics on the MFA in our locality.

Materials and Methods

Participants

A prospective, cross-sectional design was adopted for this study. Two hundred and eighty-ninepregnant women who had a singleton, uncomplicated pregnancies, without any history of mental illness, not primigravidas and whose gestational ages ranged from 16-30 weeks, were enlisted from referrals for a routine obstetric scan at the University of Nigeria Teaching Hospital, Ituku Ozalla, Enugu.

Written informed consent and verbal assents were obtained from the women at the time of the study. The study protocol was approved by the University of Nigeria Teaching Hospital Research Ethics Committee.

Procedures

A pilot/pre-test study was conducted utilising ten subjects to determine the length of time for completion of the questionnaires and to identify any potential problems which might occur during the data gathering process. Subjects in the pilot study experienced no difficulties in understanding the directions or in completing the questionnaires. Therefore, no changes were made in the questionnaires or the procedure. Therefore, two hundred and eighty-nine (289) questionnaires were properly completed and returned.

Demographic data questionnaire

This was developed by the researcher to collect the personal data of the participants which include age, marital status, ethnicity, religion, level of education attained, monthly income, number of pregnancies, number of children alive, planned or unplanned pregnancy, gestation age, history of miscarriage, history of child with birth defect and fetal movement. Participants just answered by checking lists or filling in the blanks.

Cranley Maternal-Fetal Attachment Scale (MFAS)

This scale was developed by Cranely [6], and consists of 24 individual items relating to MFA during pregnancy on a 5-point Likert scale of Definitely yes (5), yes (4), uncertain (3), No (2), Definitely No (1), with a score of 5 having the highest attachment. All statements were positive except "item 22". The scale was further divided into five subscales, which represent five aspects of the maternal-fetal relationship:

1. Role-taking (4 items)
2. Differentiation of self from the fetus (4 items)
3. Giving of self (5 items)
4. Attributing characteristics or intentions to the fetus (6 items)
5. Interaction with the fetus (5 items)

A coefficient of reliability of 0.85 was established for the scale with the reliability of the subscales ranging from 0.52 to 0.73. No modification was done on the original MFA scale as the researcher found it suitable for our environment. The questionnaire was distributed and filled by the respondents twice: immediately before and one week after the ultrasound scan.

Procedure for Data Collection

A sequential identity number was written on each completed questionnaire received both for pre- and post- questionnaires in other to maintain anonymity and consistency. Thus, there was no way to link a questionnaire to the respondent. Questionnaires were reviewed to verify that inclusion criteria were met and recruitment of participants was suspended when 289 questionnaires were filled and returned. The data collection procedure was as follows: The patient comes into the reception and is dully registered for an ultrasound examination. The researcher approached the potential participants and informed them about the purpose and the significance of the information that was being sought. The participants who agreed to participate in this study were now given the consent form to fill. While the participants were taking water to fill their bladder in readiness for the scan, the researcher distributed the demographic questionnaires and the pre- MFA scale. This process of filling the questionnaires took approximately 10 minutes. The researchers

were available for clarification if any participant did not understand any part of the questionnaire. The participants returned the completed questionnaires to the researcher and were then taken in for their ultrasound examination. Participant lies on the couch while the sonographer scans her. The sonographer takes care of the measurement of the fetal parts as well as the rest of the information needed by the obstetrician/clinician that referred her for the scan. The sonographer explained and discussed the fetal ultrasound image with the mother familiarising her with the basic anatomy of the fetus by pointing out some of the physical features and organs of the fetus like the head, face, limbs, heart etc. Conversation between the mother and the sonographer is encouraged by the sonographer allowing the mother-to-be (and father-to-be, if he was there) to ask questions. This extra procedure took about 5 minutes for each participant. It is this learning process the mother undergoes about the fetus and the scan in general that we call the 'Educational Process'. This educational process was standardised in the sense that the explanation and discussion of the fetal image to the mother was the same for all the subjects, to ensure uniformity. The participants filled the Post-MFA questionnaire one week after the ultrasound examination [28].

Data Analysis

Data were categorised according to age, gestation age, fetal movement and MFA scores. Percentage responses, mean scores and standard deviation of demographic data and MFA scores were calculated using SPSS (version 21.0). The total MFA score for each subject was calculated, resulting in potential total MFA scores for the scale ranging from 24-120. The MFAS was further categorised into five subscales- role-taking, differentiation of self from the fetus, giving of self, attributing characteristics and intentions to the fetus and interaction with fetus- and the mean score of each subscale calculated. Each Subject's overall mean MFA level ranked as follows: scores of 24.00-43.00 (mean scores of 1.0000-1.7917), means very low MFA; scores of 43.01-62.00 (mean scores of 1.7921-2.5833) means low MFA; scores of 62.0-81.00 (mean scores of 2.5838-3.3750) means Fair MFA; scores of 81.01-100.00 (mean scores of 3.3754-4.1671) means high MFA; scores of 100.01-120.00 (mean scores of 4.1671-5.0000) means very high MFA [6].

Paired t-test and ANOVA were used to determine the influence of the educational process during obstetric ultrasound examination on Maternal-Fetal Attachment. P-value of < 0.05 was considered significant.

Results

The maternal demographic/clinical characteristics are presented in Table 1. Most of the respondents were within the 25 – 29 years' age group (51.9%), with gestational ages, almost evenly distributed among the 16-20wks (32.5%), 21-25wks (31.1%) and 26-30weeks (36.3%). The respondents who had felt their fetus move as at the time of the study were 63.3%.

Table 1: Maternal Demographic/clinical Characteristics

S/N	Characteristics	Sub groups/ Types	Number of respondents	Percent (%)
1.	Maternal Age	< 19yrs	7	2.4
		20-24 yrs	41	14.2
		25 - 29yrs	150	51.9
		30 - 34yrs	66	22.8
		35-39yrs	23	8
		>40 yrs	2	7
2.	Gestation Age:	16 - 20 wks	94	32.5
		21 - 25 wks	90	31.1
		26 - 30 wks	105	36.3
3.	Fetal Movement	Yes	183	63.3
		No	76	26.3
		Not sure	30	10.4

The mean and standard deviation for the five subscale scores of the MFA scale (pre-test and post-test) were calculated for the total group of respondents. The subscale with the highest mean scores was "Giving of self to the fetus" with both pre-test (mean = 4.251) and post-test (mean = 4.554). The subscale with the least mean scores in both the pre-test and the post-test was the subscale "interaction with fetus". Increases in the mean scores were found in almost all the subscales with a marked increase in the areas of attributing characteristics to the fetus (from 2.949 to 3.283) and roletaking (from 3.405 to 4.239). Paired *t*-tests on the MFA subscales and the total attachment score shows marked significant differences in all the subscales ($p=0.000$) except that of "differentiation of self" ($p=0.082$). The overall Maternal-Fetal Attachment Scale Pre-test showed a mean score of 3.342 (S.D.= 0.184) whereas the mean score Post-test was 3.742(S.D.=0.197) with significant difference ($p=0.000$) as shown in Table 2.

Table 2: Pre- and Post MFA Subscales mean scores and Paired *t*-tests on MFA Subscale.

Subscales of MFA		Mean: pre-test(S.D) post-test(S.D)	N	t-value	Sig(2-tailed)
1	Roletaking	3.4048(0.45361) 4.2388(0.44498)	289	-22.180	.000
2	Differentiation of self	3.8296(0.49754) 3.8979(0.43045)	289	-1.747	.082
3	Interaction with the fetus	2.2747(0.43328) 2.7377(0.56100)	289	-13.147	.000
4	Attributing Characteristics to the fetus	2.9493(0.39249) 3.2826(0.40483)	289	-9.904	.000
5	Giving of self	4.2505(0.39591) 4.5536(0.26496)	289	-10.863	.000
	Total MFA	3.3418(0.18383) 3.7421(0.19660)	289	-25.272	.000

Statistical analysis was applied using Analysis of Variance (ANOVA), about maternal age, education level, gestational age, on the Maternal – Fetal Attachment pre-test scores. The result shows that none of these maternal characteristics had any significant influence ($p > 0.005$) on the pre-MFA scores. Table 3 shows the result of the analysis.

Table 3: ANOVA Test on Pre- MFAS in relation to Maternal Characteristics

Maternal Characteristics	ANOVA F-value	p-value	Remark
Age	1.907	0.093	NS
Education Level	0.817	0.485	NS
Gestation Age	0.475	0.622	NS

***NS = Not Significant**

Discussion

The purpose of this study was to determine the influence of the educational process that goes on during routine obstetric ultrasound, on maternal-fetal attachment. This study revealed that the educational process during obstetric ultrasound positively influenced Maternal-Fetal Attachment. This finding is made evident by the fact that the mothers' MFA scores increased significantly from a pre-mean value of 3.342 to Post-mean value of 3.742 with $p<0.000$ which implies the mothers' MFA score was fair. This finding is in agreement with that of Durbin [21], who noted that the educational process involved in routine obstetric ultrasound examination significantly influenced Maternal-Fetal Attachment. In studies by Kohn *et al.,* [20] and Müller [29], their findings indicated a significant increase in maternal-fetal attachment demonstrated by questionnaires and interviews. The mothers noted in both verbal and nonverbal responses to increased awareness, visibility and wholeness of the baby inside them. These studies further concluded that some of the women exhibited attachment behaviours and the desire to share the experience with others.

When the individual items of the MFAS were categorised into five subscales, all the subscales showed significant differences in mean scores after the routine ultrasound examination, except "differentiation of self from fetus" ($p=0.082$). The subscale with the highest Post-MFA scores was "Giving of self'. The second and third Subscales with the highest scores were "Role taking" and "Differentiation of self from the fetus". This result is similar to that of Chanachote's [30] who found out that pregnant women in their 2nd and 3rd trimesters demonstrated high MFA scores in the areas of "Giving of self", "Role taking" and "Differentiation of self from the fetus". Similarly, Bloom [31], who used the same MFA scale to

measure Maternal-Fetal Attachment, found that pregnant women in 2nd and 3rd trimesters scored high in "Role taking" and "Differentiation of self from the fetus". Durbin [21], in her findings, noted that pregnant women who were also in their 2nd and 3rd trimesters scored high in "Role taking", "Giving of self" and "Differentiation of self from the fetus" too.

The two subscales that were the least scored of MFA scale were "attributing characteristics" and "interaction with the fetus" although they showed good and significant scores. This finding is also consistent with Durbin's [21] findings with "attributing characteristics" ranking the least. This may be because some "attributing characteristics and interaction with the fetus" such as "I poke my baby to get him/her to poke back" and "I wonder if the baby can hear inside of me" are not usual occurrences. Some women feared they could hurt their babies if forinstance, they poked them. Another possible reason, according to Chanachote [30] was that it could appear embarrassing talking to an unborn (unseen) baby.

The fetal ultrasound affords as it were, a one-to-one consultation centre with the fetus as the individual and the mother the spokesperson. The experience (educational process) renders a relief, personal awareness and fulfilment that reaches the mother's deepest being in addition to the medical benefits of anatomically surveying the fetus, which makes the fetal ultrasound very vital [20]. Further studies showed that obstetric ultrasound examination has a "substantial psychological effect on the attitudes of the parents toward each other and the fetus [32]. The sonographer's positive feedback might have been a major contributor to the increased MFA behaviours among pregnant women in this study after the educational process during their ultrasonography. Therefore, the findings of this study have implications for sonographers as they relate to the expanding body of knowledge regarding the concept of prenatal maternal attachment. The sonographer while scanning pregnant women in the prenatal period can take advantage of these findings to positively strengthen attachment behaviours of the mothers such as their talking to the fetus and stroking the pregnant abdomen to convey caring for the fetus. Thus the sonographer through patient education and preventive guidance can assist pregnant women in reinforcing their feelings and behaviours of attachment to their fetus and may also serve to enhance other behaviours indicative of maternal-fetal attachment.

Building on this positive experience by the pregnant women while viewing their fetus via ultrasonography with the educational process that accompanies it, the sonographer may find this opportunity as optimal also to emphasise other important areas of maternal health practices such as appropriate dietary habits, avoidance/abstinence of drugs and compliance with prescribed prenatal visits. This research work serves as a preliminary study, which lays the foundation for future endeavours in this area, especially in this locality. A more extensive, long-term study, could look at the effects of prenatal attachment as it relates to possibly predicting the postnatal attachment outcome.

In conclusion, evaluating maternal-fetal attachment and the educational process that goes on during obstetric ultrasound, evidence from this study supports the theory that these two variables are directly related. Mothers demonstrated a significantly greater level of attachment to their fetus after the educational process during the obstetric ultrasound. This research finding supports the fact that maternal-fetal attachment plays a very significant role in the health of pregnant women and their unborn babies. This finding would add in no small way to the growing body of knowledge that will help develop interventions specific to impaired maternal-fetal attachment in our locality. The ultrasound community's consciousness to the relevance of the psychological effects of the obstetric ultrasound is expected to be raised by this study. The researchers believe the most important potential benefit of the routine obstetric scan is in the reduction of perinatal mortality and morbidity. If poor levels of MFA are noted during the progress of a woman's pregnancy, then suitable interventions ought to be employed to help a woman in attaining a tangibly and mentally sound pregnancy which in turn best optimises maternal and fetal health. The use of the educational process during an obstetric ultrasound to enhance MFA can make this difference.

Limitations of the Study

The sampling in this study was selected by convenience sampling and therefore, cannot

represent the general population. Moreover, the population is somewhat homogenous. As Tables 1 and 2 indicate, the majority of the participants were between the ages of 25 and 29, married, Igbos, Christians, multiparas, and who were experiencing planned pregnancies.

A second limitation related to a large number of multiparas who served as subjects is the possibility that they experienced ultrasonography with a previous pregnancy. Therefore, it is plausible that multiparas' reactions to second or third ultrasonography were significantly different from their reactions to that experience with their first pregnancies. Here again, the study did not control for this variable nor were multiparas asked if they experienced ultrasonography with a previous pregnancy.

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The Authors declare no conflict of interest

References

1. Omoigberal AI, Sadoh WE, Nwaneri DU. A 4 year review of neonatal outcome at the University of Benin Teaching Hospital, Benin City. Nigerian journal of clinical practice. 2010;13(3).
2. Morakinyo OM, Fagbamigbe AF. Neonatal, infant and under-five mortalities in Nigeria: An examination of trends and drivers (2003-2013). PloS one. 2017 Aug 9;12(8) :e0182990.
3. UNICEF, Nigeria: Evaluation of the Maternal, Newborn and Child Health Week in Nigeria 2016 https://www.unicef.org/evaldatabase/index_95507.html accessed on 29th April, 2019
4. Salisbury A, Law K, LaGasse L, Lester B. Maternal-fetal attachment. Jama. 2003 Apr 2;289(13):1701-.
5. Alhusen JL. A literature update on maternal-fetal attachment. Journal of Obstetric, Gynecologic & Neonatal Nursing. 2008 May 1;37(3):315-28.
6. Cranley M. Development of a tool for the measurement of maternal attachment during pregnancy. Nurs Res 1981; 30:281–284. [Medline]
7. Ji EK, Pretorius DH, Newton R, Uyan K, Hull AD, Hollenbach K, Nelson TR. Effects of ultrasound on maternal-fetal bonding: a comparison of two-and three-dimensional imaging. Ultrasound in Obstetrics and Gynecology: The Official Journal of the International Society of Ultrasound in Obstetrics and Gynecology. 2005 May;25(5):473-7.
8. Facello DC. Maternal/fetal attachment: associations among family relationships, maternal health practices, and antenatal attachment. West Virginia University; 2008.
9. Sroufe LA, Egeland BY, Carlson EL, Collins WA. Placing early attachment experiences in developmental context. Attachment from infancy to adulthood: The major longitudinal studies. 2005:48-70.
10. Thompson, R. A. Early attachment and later development: Familiar questions, new answers. In J. Cassidy, & P. R. Shaver (Eds.), Handbook of attachment: Theory, research, and clinical applications 2008 (2nd ed. pp. 348–365). New York, NY: Guilford Press.
11. Mercer RT. Becoming A mother versus Maternal Role Attainment. Journal of Nursing Scholarship. 2004; 36:226-32.
12. Lindgren K. Testing the health practices in pregnancy questionnaire–II. Journal of Obstetric, Gynecologic, & Neonatal Nursing. 2005 Jul;34(4):465-72.
13. Brandon A, Pitts S, Denton W, Stringer C, Evans H. A history of The Theory of Prenatal Attachment. Journal of Prenatal & Perinatal Psychology and Health. 2009;23(4):201-22.
14. Ross E. Maternal—fetal attachment and engagement with antenatal advice. British Journal of Midwifery. 2012 Aug;20(8):566-75.
15. Cannella BL. Maternal–fetal attachment: an integrative review. Journal of Advanced Nursing. 2005 Apr;50(1):60-8.
16. Lumley J. Through a glass darkly: ultrasound and prenatal bonding. Birth. 1990 Dec;17(4):214-7.
17. Papp Z, Fekete T. The evolving role of ultrasound in obstetrics/gynecology practice. International Journal of Gynecology & Obstetrics. 2003 Sep 1;82(3):339-46.
18. Gonzaga MA, Kiguli-Malwadde E, Francis B, Rosemary B. Current knowledge, attitudes and practices of expectant women toward routine sonography in pregnancy at Naguru health

centre, Uganda. The Pan African medical journal. 2009;3.
19. Maas AJ, Vreeswijk CM, Braeken J, Vingerhoets AJ, van Bakel HJ. Determinants of maternal fetal attachment in women from a community-based sample. Journal of Reproductive and Infant Psychology. 2014 Jan 1;32(1):5-24.
20. Kohn CL, Nelson A, Weiner S. Gravidas' responses to realtime ultrasound fetal image. Journal of Obstetric, Gynecologic, & Neonatal Nursing. 1980 Mar;9(2):77-80.
21. Durbin SA. Understanding the Effects of the Obstetrical Ultrasound (Doctoral dissertation, University of Wisconsin-Stout).
22. Boukydis CZ. Adult perception of infant appearance: A review. Child psychiatry and human development. 1981 Mar 1;11(4):241-54.
23. Berman, M. & Cohen. H. Obstetrics and gynecology. 1997 (2nd edition). Philadelphia, PA, Lippincott
24. Downey DB, Fenster A, Williams JC. Clinical utility of three dimensional US. Radiographics 2000; 20:559–571.
25. Timor-Tritsch IE, Platt LD. Three-dimensional ultrasound experience in obstetrics. Curr Opin Obstet Gynecol 2002; 14:569–575.
26. Ewigman BG, Crane JP, Frigoletto FD, LeFevre ML, Bain RP, McNellis D, RADIUS Study Group. Effect of prenatal ultrasound screening on perinatal outcome. New England journal of medicine. 1993 Sep 16;329(12):821-7.
27. Geerts LT, Brand EJ, Theron GB. Routine obstetric ultrasound examinations in South Africa: cost and effect on perinatal outcome–a prospective randomised controlled trial. BJOG: An International Journal of Obstetrics & Gynaecology. 1996 Jun;103(6):501-7..
28. Sedgmen B, McMahon C, Cairns D, Benzie RJ, Woodfield RL. The impact of two-dimensional versus three-dimensional ultrasound exposure on maternal–fetal attachment and maternal health behavior in pregnancy. Ultrasound in obstetrics & gynecology. 2006 Mar;27(3):245-51.
29. Müller ME. Prenatal and postnatal attachment: A modest correlation. Journal of Obstetric, Gynecologic, & Neonatal Nursing. 1996 Feb;25(2):161-6.
30. Chanachote S. *Spousal Support and Maternal-fetal Attachment in Pregnant Industrial Workers* (Doctoral dissertation, Mahidol University).
31. Bloom KC. Perceived relationship with the father of the baby and maternal attachment in adolescents. Journal of Obstetric, Gynecologic, & Neonatal Nursing. 1998 Jul;27(4):420-30.
32. Zlotogorski Z, Tadmor O, Rabinovitz R, Diamant Y. Parental attitudes toward obstetric ultrasound examination. Journal of Obstetrics and Gynaecology Research. 1997 Feb;23(1):25-8.