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SONOGRAPHIC CORRELATION BETWEEN FETAL GASTRIC SIZE AND AMNIOTIC FLUID VOLUME IN THIRD TRIMESTER PREGNANCIES

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Abstract

Background: This study aims to investigate how the fetal gastric size and amniotic fluid volume in third-trimester pregnancies correlate with each other.

Objective: To find the correlation between fetal gastric size and amniotic fluid volume in third-trimester pregnancies

Methodology: This is a cross-sectional study conducted in the UOL ultrasound clinic, Green Town, Lahore. This study used convenience sampling, and all female patients aged 18-37 years who were in their third trimester and undergoing routine obstetrical ultrasound were included. Those females who had structural abnormalities in the fetus and had polyhydramnios and oligohydramnios due to maternal diabetes were excluded.

Results: The total number of participants included in this study was 122, with ages ranging from 18 to 37. The results of this study showed that Higher BMI is linked to bigger fetal gastric sizes and more amniotic fluid, according to this study's strong positive association between BMI and both fetal gastric size and AFI.

Conclusion: This research discusses the intricate link between Higher BMI and bigger fetal gastric sizes and more amniotic fluid, according to this study's strong positive association between BMI and both fetal gastric size and AFI. Fetal development rises with gestational age (GA), as seen by the substantial positive association between GA and fetal stomach size. AGE seems to have little effect, however, since it only weakly correlates with both AFI and fetal stomach size.

CHAPTER 1

INTRODCUTION

Pregnancy is the period of time a baby develops within the uterus. Three trimesters and 40 weeks, or nine months, make up a pregnancy. Every trimester is unique due to specific changes in the mother and fetus. Throughout pregnancy, fetal growth is a systematic and intricate process. An egg that has been fertilized naturally grows into a full-grown kid within the mother's womb. It starts at conception, when the sperm and egg unite to form a single cell called a zygote. This little cell quickly divides and sticks to the uterine wall. Early on, vital support systems, including the placenta and umbilical cord, begin to form. These structures provide the fetus with oxygen and nourishment while also eliminating waste from it. The mother's body's hormonal changes also help to sustain the pregnancy. An effective implementation is necessary for healthy growth. Since it establishes the framework for all later stages of development, issues at this early period might have an impact on the whole pregnancy. (S Sabina et al, in 2015)

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During the first and second trimesters, the baby's vital organs and systems develop and progressively start to work. The heart begins beating a few weeks after conception, making it one of the first organs to begin functioning. The digestive system, lungs, brain, and spinal cord are all still growing and changing. Over time, little limb buds grow into arms and legs with fingers and toes. By the second trimester, the fetus has grown significantly in both length and size. Stronger bones and the growth of muscles enable movement. When these movements become noticeable, the mother might feel gentle twists and kicks. The development of the eyes, hearing, and other senses also occurs at this time. At this point, the fetus unquestionably looks like a little human baby. (CJ Lockwood et al, 2022)

During the third trimester, the baby's development mostly concentrates on becoming bigger and getting ready for life outside the womb. The fetus becomes heavier after birth as a layer of fat builds up under the skin to help control body temperature. During this time, the brain and lungs continue to grow and strengthen. The baby becomes more aware of its surroundings and responds to touch, light, and sound. Most of the organs are now fully mature and capable of functioning on their own. The fetus often adopts a head-down position in preparation for birth. Breathing exercises are carried out even if the lungs are still filled with fluid. At this stage, the baby is deemed full-term. Good maternal care is essential during this period to guarantee a safe and healthy delivery. (k Mullany et al, 2023)

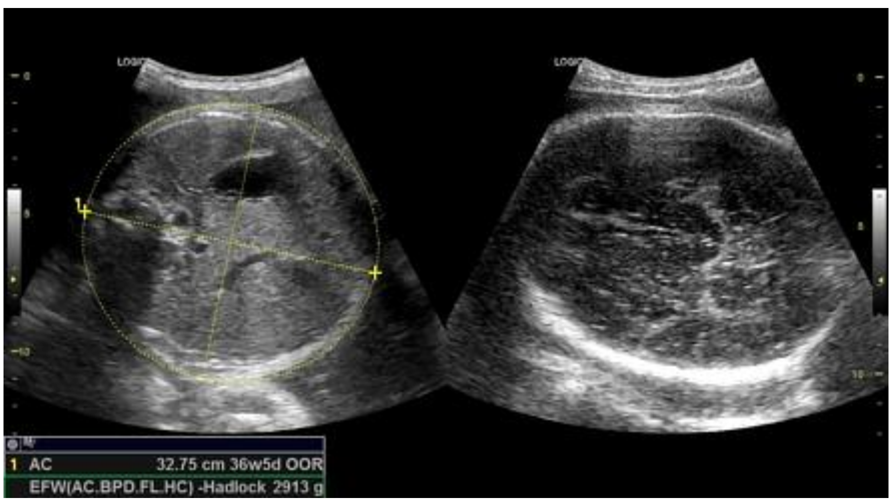

Figure 1: Abdominal Circumference; third trimester (Bell D, Weerakkody Y, et al., 2026)

During the second half of human pregnancy, the primary sources of amniotic fluid (AF) are fetal urine and lung fluid. Fluid is reabsorbed by fetal swallowing. An additional AF absorption route is required to balance fluid production and absorption; this absorption is referred to as the intramembranous pathway and is believed to occur across the fetal amnion into the fetal vasculature. AF volume is also impacted by fetal hydration. AF volume is also impacted by placental water flow since the mother supplies all of the water needed for fertilization. This commonly accepted theory

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of fetal fluid production and resorption ignores gestational variations in AF volume, post-term or acute-onset oligohydramnios, and the maintenance of AF volume homeostasis throughout gestation. For example, rather than the reduced AF volume seen in these fetuses, the ovine model's acute reduction in fetal swallowing and rise in urine output in response to hypoxia would suggest an increase in AF volume. (Beall, M. H., et al., 2017)

Healthy fetal growth and development depend on the amniotic fluid (AF), which is the fluid that surrounds the fetus in the amniotic cavity throughout intrauterine development. There are two types of amniotic fluid functions: physical and functional. The amniotic fluid protects the baby from injury and disease and helps regulate its body temperature. By allowing fetal movements and, therefore, the development of the musculoskeletal system, it shields the baby from vascular and nutritional impairment. Additionally, it prevents compression of the placenta and umbilical cord. Additionally, the fetal swallowing of the amniotic fluid promotes the development of the gastrointestinal tract. The amniotic fluid volume (AFV) is the total volume of fluid that enters and exits the amniotic region. It seems to be maintained in a dynamic equilibrium and is the result of complex interactions between maternal, fetal, and placental components. (Huri, M., et al., 2023)

In the early stages of pregnancy, the AF is isotonic with both maternal and fetal plasma, suggesting that the fluid is a transudate from the mother via the placenta, uterine decidua, or fetal skin. The non-keratinized embryonic skin functions as a membrane that permits unrestricted fluid passage. Thus, in the early stages of gestation, the AF may be simply seen as an extension of fetal extracellular fluid. Around 22 to 25 weeks of pregnancy, as the fetal epidermis keratinizes, the AF osmolality and salt content decrease due to the production of diluted fetal urine. In the latter stages of pregnancy, there are four main volume fluxes into and out of the amniotic sac. The two primary outflows are fetal swallowing and intramembranous absorption, which uses the amnion to reabsorb fluid and solutes from the amniotic compartment to the fetal circulation. Fetal urine and lung liquid secretion are the two primary outflows. Furthermore, it doesn't seem like fetal oral-nasal cavity secretions into the AF are volumetrically significant. (Brace, R.A. et al., 2018)

The stomach is essential for amniotic fluid circulation during intrauterine life. Following fetal urination, it returns to the amniotic cavity after passing through the stomach, where it is absorbed and sent to the small intestine. A stomach anomaly will thus impact the size and form of the viscus in addition to the quantity of amniotic fluid. When the fetal abdomen is filled with amniotic fluid, the stomach is visible in the upper left quadrant. Because a dilated stomach is indicative of gastrointestinal obstruction (like duodenal atresia) and because the inability to see the fetal stomach is associated with a number of congenital abnormalities that have a poor prognosis, ultrasound evaluation of the unborn stomach is necessary. (Badiu, C. et al., 2017)

An abnormal evolution was seen in 52% of infants with a small stomach on an ultrasound examination. For this reason, measuring the size of the stomach is important and should not be left out of a standard ultrasound examination. Millener et al. discovered that 48% of fetuses had congenital defects when the stomach was not visible at 14 weeks of gestation; however, this percentage dropped to 43% if the lack of transparency persisted beyond 48 weeks. Contrary to these

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results, Pretorius et al. found a 100% aberrant evolution rate in situations where the stomach was not visible. The gastric dimensions may be measured in the tenth week, and most early ultrasound imaging of the unborn stomach is achievable in the ninth. The fundus, body, pylor, and stomach curvatures may be seen beginning in the fourteenth week. Along with the stomach's size and look, it's important to depict its peristaltic movements. The size of the stomach may suggest hereditary digestive system abnormalities as well as problems with intestinal motility. (Howle, R., et al., 2020)
Ultrasound has become a crucial component of prenatal care as a safe and non-invasive method of tracking the growth and development of the baby during pregnancy (Ten Broek et al., 2021). As the pregnancy moves into the third trimester, thorough ultrasound examinations become more crucial to carefully monitor the fetus's health and identify any potential issues. Two significant factors that are often assessed at this time are the size of the fetal stomach and the amount of amniotic fluid. (Kehl and others, 2016). How sensitive sonography is for detecting fetal trisomic diseases depends on a number of factors, including the kind of chromosomal aberration, gestational age at the time of sonography, reasons for referral, criteria for positive sonographic results, and sonography quality. (Atkinson et al., 2022).

How long it takes to detect fetal abnormalities may vary depending on the kind of ultrasound equipment used at the scan site and other factors that may affect the process. A high-resolution ultrasound may assist with both a first-trimester scan and a complete diagnostic scan, as well as allow the identification of a tiny or subtle condition, even if not all pregnant women need a full diagnostic scan. Indicators include body mass index > 30, fetal nuchal translucency > 3mm, gestational diabetes mellitus, artificial reproductive technologies, maternal age 35 or older, a family history of congenital abnormalities, and a number of other conditions (Leung et al., 2021). Ultrasound is one imaging method that has considerable diagnostic value. Although diagnostic ultrasound has many applications, it is particularly useful for prenatal diagnosis. There is currently no evidence that diagnostic ultrasonography harms people or developing fetuses when used properly. (Chang et al., 2021).

Important information on the fetus's capacity for swallowing may be obtained from the ultrasound of the fetal stomach, which appears as a fluid-filled structure in the upper abdomen. Amniotic fluid intake is a normal and essential process for the fetus's development, particularly for the growth and development of the neurological and gastrointestinal systems (Rabie et al. 2017). Normal swallowing function is often indicated by a clearly visible and adequately sized stomach bubble. Potential problems including esophageal atresia or neurological abnormalities may be indicated by a notably tiny or absent stomach (Kornacki et al., 2021). The amniotic fluid that surrounds the embryo in the womb is essential for a number of critical processes; it was found in 2017. It provides the infant with comfort, aids in controlling body temperature, keeps the umbilical cord from being compressed, and is essential to lung development (Harraway et al., 2017). By the third trimester, the fetus's ability to swallow and urinate is mostly in balance, controlling the quantity of amniotic fluid. Therefore, any variations in its volume, such as polyhydramnios (excessive fluid) or oligohydramnios (insufficient fluid), may suggest possible issues with the placenta or fetus. (Jha et al. 2019).

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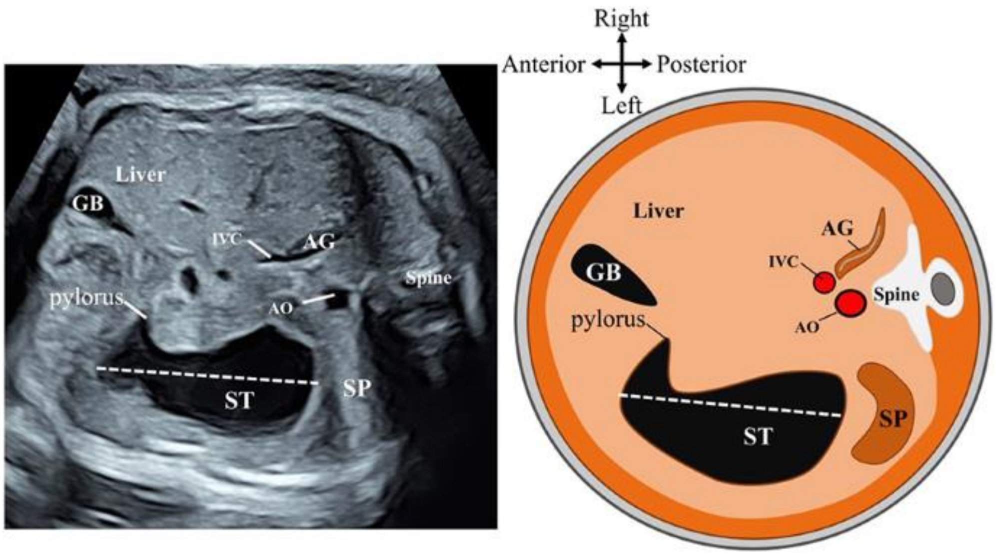

Figure 2: Abdominal Circumference showing all the abdominal organs in a fetus (Jha et al. 2019)

There seems to be a relationship between the quantity of amniotic fluid present and the size of the baby's stomach. The stomach size and fluid volume may be impacted by any interruptions in swallowing, which is one of the main ways the fetus contributes to fluid balance (Hughes et al., 2020). For example, extra amniotic fluid may build up, and the stomach may look smaller or be missing when the fetus is unable to swallow effectively (Hilliard et al., 2016). The nomogram of fetal gastric development seems to help determine normal fetal growth, and the dimensions of the fetal stomach in a typical pregnancy correspond with gestational age (Debbink et al., 2021).

Real-time ultrasound imaging was used to determine the fetal stomach size, which is defined as the greatest region comprising the pyloric site in a transverse or oblique slice (Fitzsimmons et al., 2023). Few studies have examined the direct association between these two clinically relevant markers during the third trimester. Examining this relationship might improve our knowledge of embryonic physiology and aid in the early identification of certain congenital disorders. Routine obstetric ultrasounds may benefit from the evaluation of stomach size in addition to amniotic fluid levels if a trustworthy correlation can be made (Debbink et al., 2021).

One possible indirect measure of amniotic fluid content is the size of the fetal stomach. Abnormalities in gastric size may be a reflection of changes in the dynamics of the amniotic fluid, which fills the stomach and aids in gastrointestinal function when the baby swallows it. A fetal stomach bubble that is unusually tiny or nonexistent might be a sign of oligohydramnios, esophageal atresia, or difficulty swallowing. On the other hand, gastrointestinal blockage or polyhydramnios may cause a larger fetal stomach. Despite these findings, thorough sonographic research linking measured amniotic fluid quantities in the third trimester with fetal stomach dimensions is lacking.

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Developing such a connection might provide medical professionals an extra non-invasive sonographic metric to assess the condition of amniotic fluid, particularly when traditional techniques are unclear or technically challenging.

MATERIALS AND METHODS

4.1 : Study design: Cross-sectional and descriptive study

4.2 : Settings: Data was collected from the UOL ultrasound clinic, Green Town, Lahore.

4.3 : Study duration: 4 months after approval of synopsis.

4.4 : Sample size: All the patients coming for an obstetrical scan during the third trimester were included.

4.5 : Sampling technique: Convenient sampling technique

4.6 : Sample Selection:
All patients who visited our clinical setup during our study duration were included.

4.6.1 : Inclusion criteria:

- Single pregnancy confirmed by first-trimester ultrasound or reliable last menstrual period, women in the third trimester (≥28 weeks),
- Age range; 18-37

4.6.2 : Exclusion criteria

- Fetal Structural Anomalies
- Polyhydramnios or Oligohydramnios due to maternal diabetes or hypertension, intrauterine growth restriction (IUGR).

4.7 : Equipment: Toshiba Xario, convex probe 3-5 MHz

DATA COLLECTION PROCEDURE

Following ethical approval from the hospital ethical committee, patients were recruited for the study with careful consideration of the inclusion and exclusion criteria. Informed consent was obtained from each participant, outlining all potential benefits and expected risks. The researcher was personally recording basic demographic and clinical information on a pre-designed data collection sheet. Data were collected in accordance with sheets, capturing both qualitative and quantitative variables, including age, gestational age, and whether participants were obese or non-obese. Each

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participant underwent a standardized obstetric ultrasound examination, during which the following parameters were recorded: Fetal gastric size was measured as the maximum anteroposterior diameter of the fetal stomach in the transverse axial view of the fetal abdomen, with three measurements taken per fetus and the average recorded. The amniotic fluid index (AFI) was measured using the four-quadrant technique, summing the deepest vertical pockets in all four quadrants in centimeters, and categorized as normal (8–18 cm), oligohydramnios (<8 cm), or polyhydramnios (>18 cm). Gestational age was recorded in weeks and days based on ultrasound biometry. Additional covariates, including maternal age, parity, and BMI, was also documented.

DATA ANALYSIS PROCEDURE

Data was entered into the Microsoft Excel. The data were evaluated and analyzed using MedCalc v20.215. Mean ± standard deviation (SD) will be calculated for continuous variables, including fetal gastric size, amniotic fluid index (AFI), and gestational age. A Chi-Square test was conducted for the qualitative variables. A t-test was used for the quantitative variable, showing $p < 0.05$. Histogram and Bar charts were constructed. Frequencies were also calculated

RESULTS

Table 1: Descriptive Statistics of Participant Age in the Study Sample

	N	Minimum	Maximum	Mean	Median	SD
AGE	122	18.000	37.000	27.377	27.000	5.2701

The study included 122 people, ages ranging from 18 to 37. With a median age of 27 and an average age of around 27.38, the distribution is rather symmetrical. The majority of people fall within a 5.27-year range of the average, as shown by the standard deviation of 5.27, which indicates that ages are well clustered around the mean. The relatively low standard deviation reflects a modest amount of age consistency within the sample, and the closeness of the mean and median suggests minimal skew in the data.

Table 2: Descriptive stats show the distribution of people according to AFI

Variable	AFI_Category_Normal_Oligo_Poly_ AFI Category (Normal/Oligo/Poly)	
Normal	66	54.1%
Oligohydramnios	21	17.2%
Polyhydramnios	35	28.7%
Total	122	100.0%

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The distribution of people according to their AFI (Amniotic Fluid Index) classification is shown in the data. Of the 122 individuals, 66 (54.1%) have "Normal" amniotic fluid, 21 (17.2%) have "Oligohydramnios" amniotic fluid, and 35 (28.7%) have "Polyhydramnios" amniotic fluid. This indicates that although a smaller percentage of the sample had either low or high fluid levels, the majority had normal amniotic fluid levels. The percentages add up to 100%, which represents the sample's whole classification.

.Table 3: Correlation Between AFI and AGE

Variable Y	_AFI_cm_ (AFI)(cm)
Variable X	AGE

Sample size	122
Correlation coefficient r	0.006877
Significance level	P=0.9401
95% Confidence interval for r	-0.1711 to 0.1844

For a sample of 122 people, the correlation study between AGE and AFI (measured in centimeters) reveals a correlation coefficient (r) of 0.006877, indicating a very weak and almost nonexistent linear connection between the two variables. The correlation is not statistically significant and there is no meaningful link between AGE and AFI in this sample. The correlation coefficient's 95% confidence interval, which includes zero, spans from -0.1711 to 0.1844, further highlighting the absence of a distinct, reliable association between the variables.

Table 4: Correlation Between Fetal Gastric Size and BMI

Variable Y	Fetal_Gastric_Size_mm_ Fetal Gastric Size (mm)
Variable X	BMI

Sample size	122
Correlation coefficient r	0.2090
Significance level	P=0.0209
95% Confidence interval for r	0.03242 to 0.3729

For a sample of 122 people, the correlation study between BMI and fetal gastric size yields a correlation coefficient of 0.2090, suggesting a modest positive linear association between the two

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variables. This association seems to be statistically significant since the p-value of 0.0209 is smaller than the usual significance threshold of 0.05. There is a significant but weak positive association between BMI and fetal stomach size, as seen by the correlation coefficient's 95% confidence interval. This suggests that, while the association is weak, there is a minor tendency for the fetal stomach size to expand along with BMI.

Table 5: Correlation Between Fetal Gastric Size and AGE

Variable Y	Fetal_Gastric_Size_mm_ Fetal Gastric Size (mm)
Variable X	AGE

Sample size	122
Correlation coefficient r	0.2392
Significance level	P=0.0080
95% Confidence interval for r	0.06414 to 0.3999

For a sample of 122 people, the correlation study between AGE and fetal gastric size reveals a correlation coefficient of 0.2392, suggesting a weak to moderately positive linear association between the two variables. This association seems to be statistically significant since the p-value of 0.0080 is below the traditional significance threshold of 0.05. A significant positive link is further supported by the correlation coefficient's 95% confidence interval. This indicates that there is a tiny but statistically significant trend for fetal stomach size to rise along with AGE.

Table 6: Correlation between Fetal Gastric Size and Gestational Age (in weeks)

Variable Y	Fetal_Gastric_Size_mm_ Fetal Gastric Size (mm)
Variable X	GA_WEEKS GA WEEKS

Sample size	119
Correlation coefficient r	0.8081
Significance level	P<0.0001
95% Confidence interval for r	0.7350 to 0.8626

With a correlation coefficient of 0.8081, the correlation study between GA and Fetal Gastric Size for a sample of 119 people shows a significant positive linear association. This association is very

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statistically significant, as shown by the p-value of less than 0.0001, which is much below the usual significance level of 0.05. Further supporting the strength and consistency of the positive association between GA and fetal gastric size is the correlation coefficient's 95% confidence interval. This implies that there is a strong and consistent correlation between these two factors, with fetal gastric size increasing considerably as gestational age rises.

Table 7: Correlation between AFI and BMI

Variable Y	_AFI_cm_ (AFI)(cm)
Variable X	BMI

Sample size	122
Correlation coefficient r	0.3756
Significance level	P<0.0001
95% Confidence interval for r	0.2120 to 0.5187

For a sample of 122 people, the correlation study between BMI and AFI reveals a moderately favorable linear association with a correlation coefficient of 0.3756. This association is very statistically significant since the p-value of less than 0.0001 is much below the typical significance threshold of 0.05. A significant and strong positive link between BMI and AFI is confirmed by the correlation coefficient's 95% confidence interval. This implies that, while the association is modest rather than robust, the amniotic fluid index tends to rise in tandem with an increase in BMI.

Table 8: Correlation between AFI and Gestational Age (in weeks)

Variable Y	_AFI_cm_ (AFI)(cm)
Variable X	GA_WEEKS GA WEEKS

Sample size	119
Correlation coefficient r	0.1924
Significance level	P=0.0361
95% Confidence interval for r	0.01279 to 0.3599

For a sample of 119 people, the correlation study between GA and AFI reveals a modest positive linear association with a correlation coefficient of 0.1924. The association is statistically significant, however weak, as shown by the p-value of 0. 0361.The existence of a slight but statistically significant

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association between gestational age and amniotic fluid index is further supported by the correlation coefficient's 95% confidence interval. This implies that the amniotic fluid index somewhat rises with increasing gestational age, however the correlation is weak.

Table 9: Correlation between AFI and Fetal Gastric Size

Variable Y	_AFI_cm_ (AFI)(cm)
Variable X	Fetal_Gastric_Size_mm_ Fetal Gastric Size (mm)

Sample size	122
Correlation coefficient r	0.2726
Significance level	P=0.0024
95% Confidence interval for r	0.09970 to 0.4296

For a sample of 122 people, the correlation study between Fetal Gastric Size and AFI reveals a moderately favorable linear association with a correlation coefficient of 0.2726. This association is statistically significant since the p-value of 0.0024 is much lower than the typical significance threshold of 0.05. A significant association is further supported by the correlation coefficient's 95% confidence interval. This implies that, while the association is modest rather than strong, the amniotic fluid index tends to rise in tandem with an increase in fetal stomach size.

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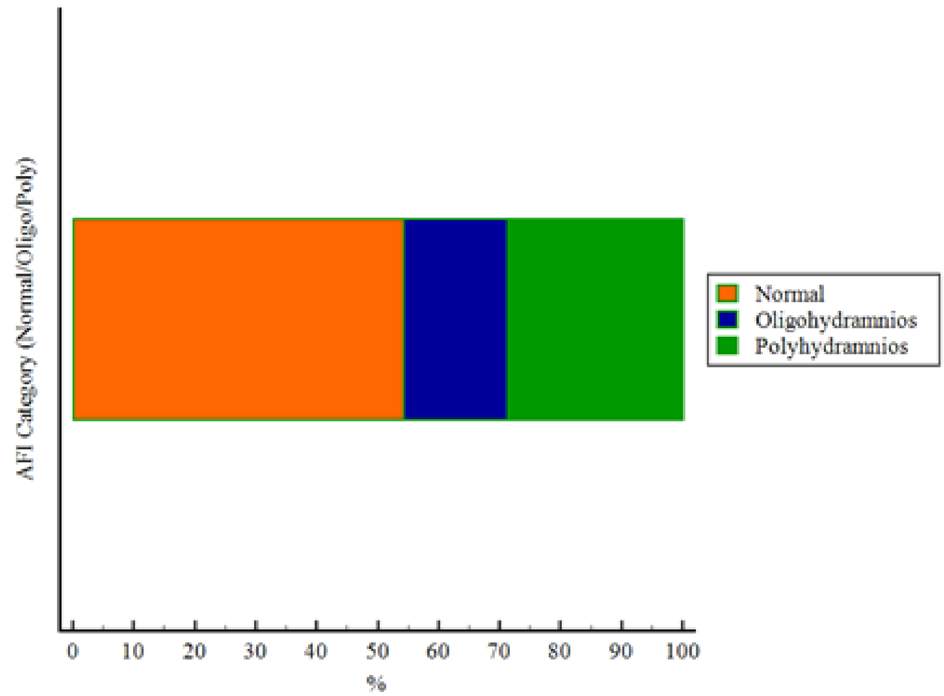

Figure 1: Boxplot of Distribution of AFI Categories (Normal, Oligohydramnios, Polyhydramnios) in the Sample

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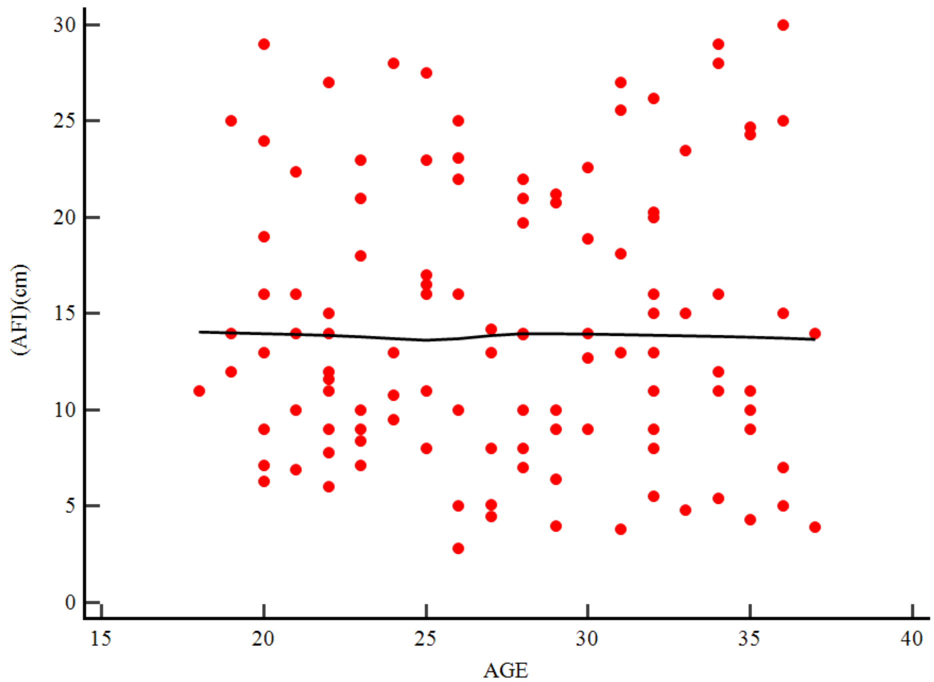

Figure 2: Scatter Plot of Amniotic fluid index (cm) vs AGE

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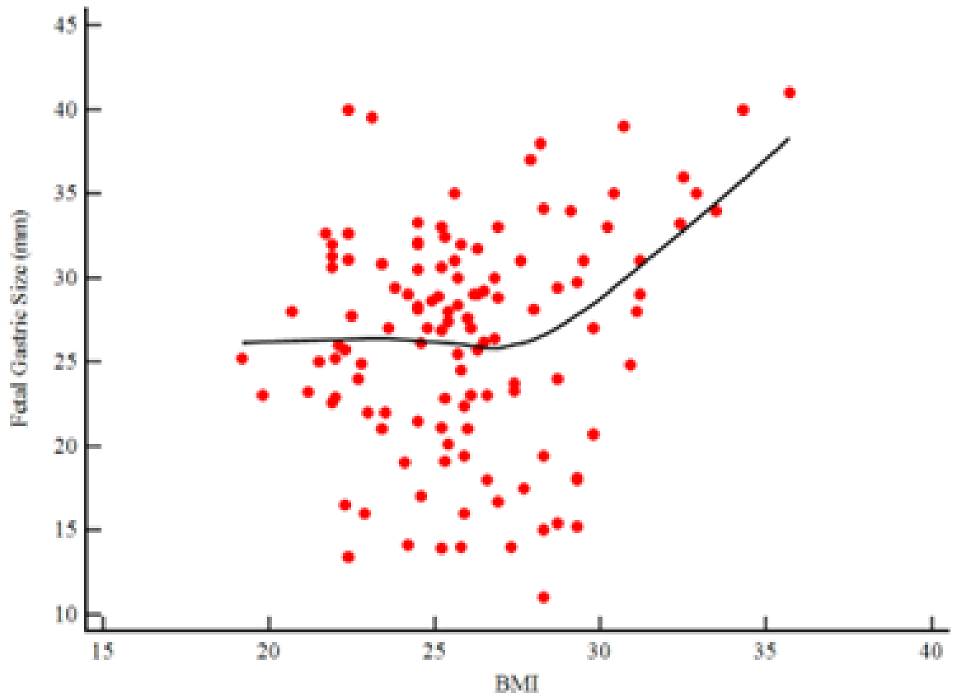

Figure 3: Scatter Plot of Fetal Gastric Size (mm) vs BMI

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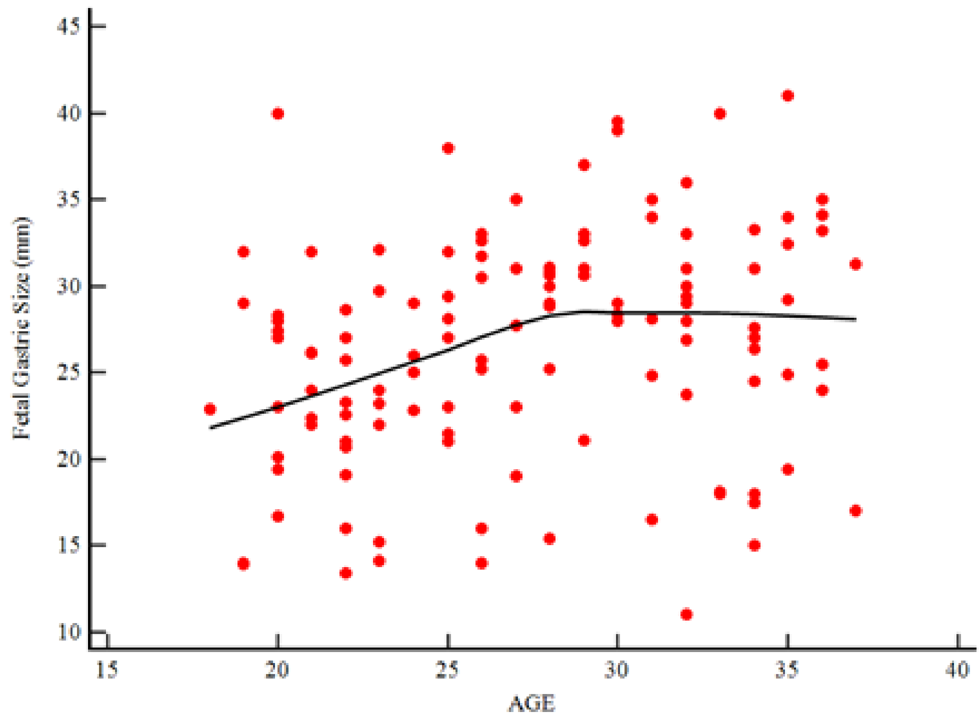

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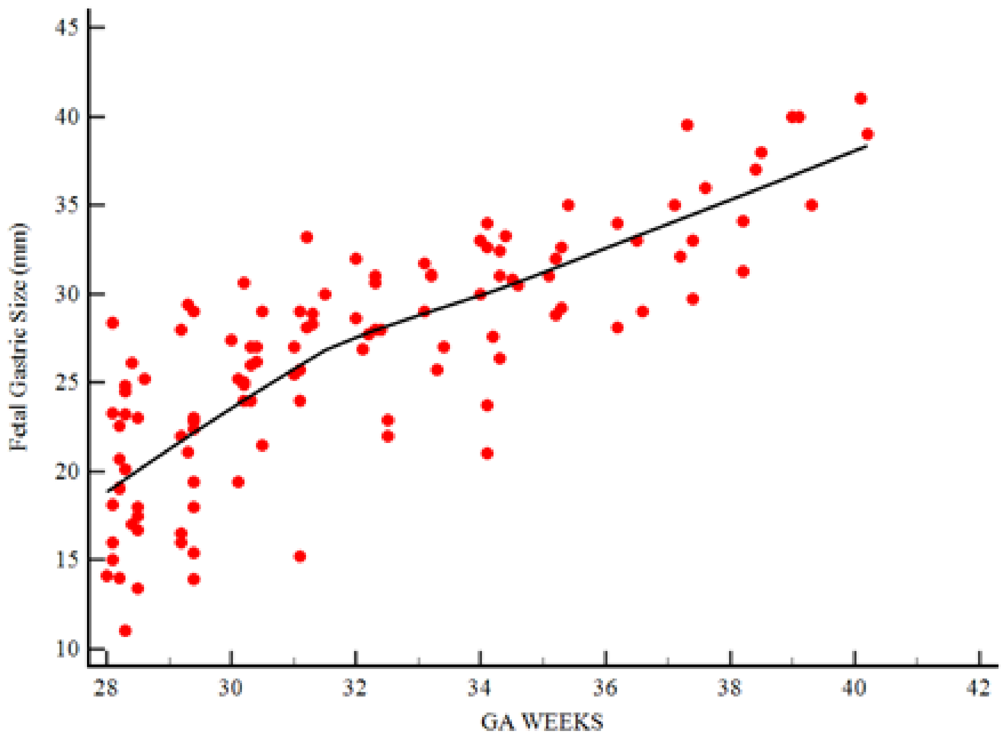

Figure 5: Scatter Plot of Fetal Gastric Size (mm) vs GA (Gestational Age in Weeks)

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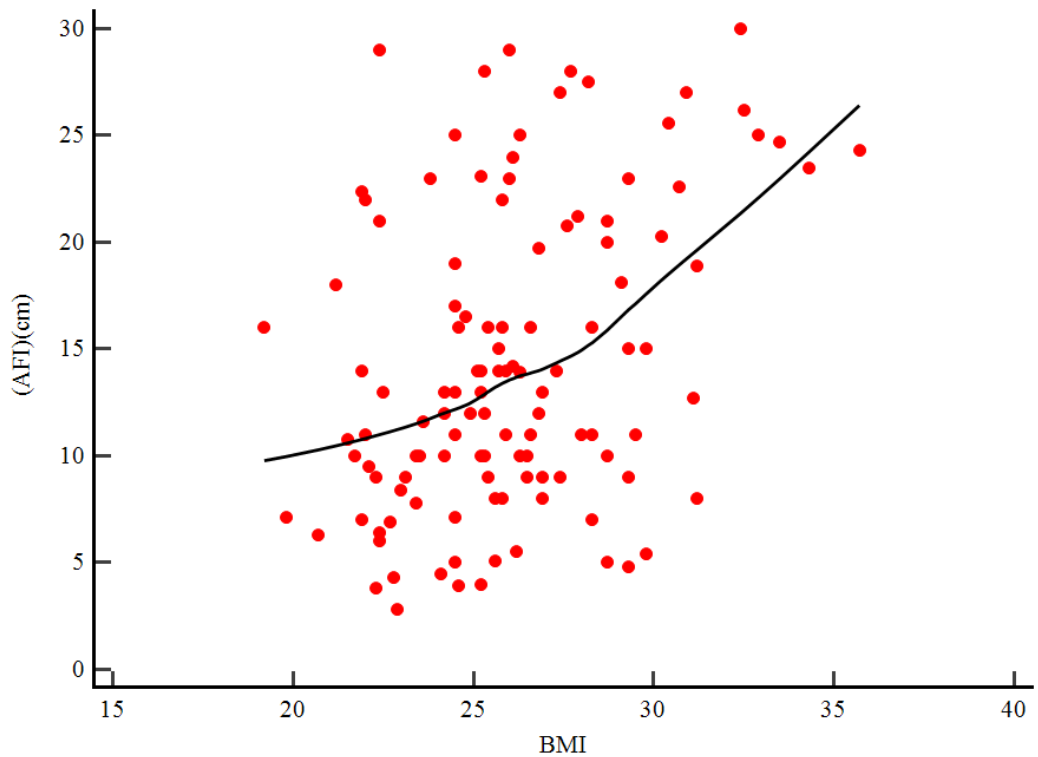

Figure 6: Scatter Plot of AFI (cm) vs BMI

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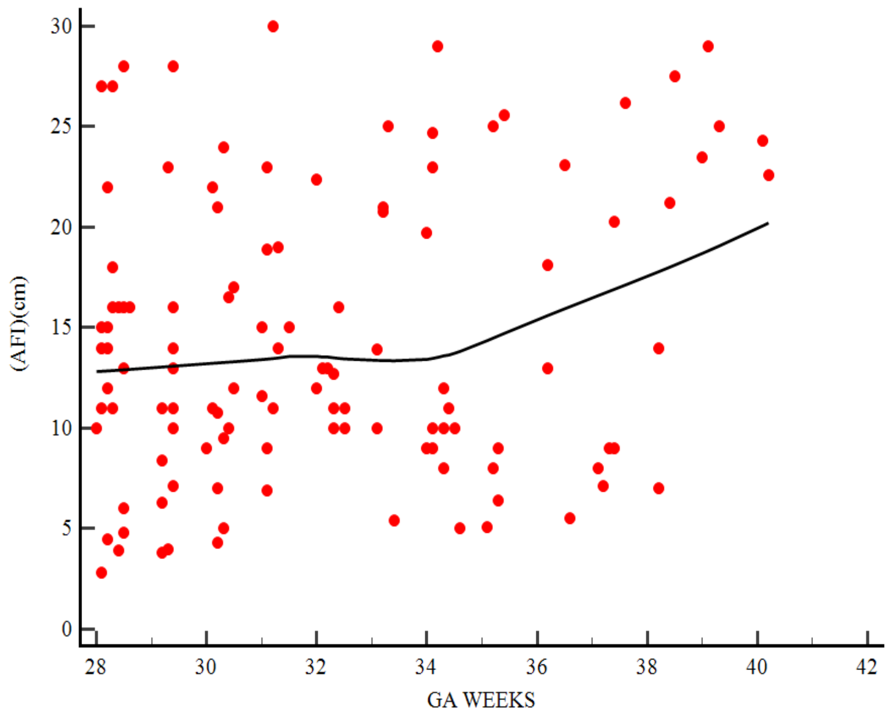

Figure 7: Scatter Plot of AFI (cm) vs GA

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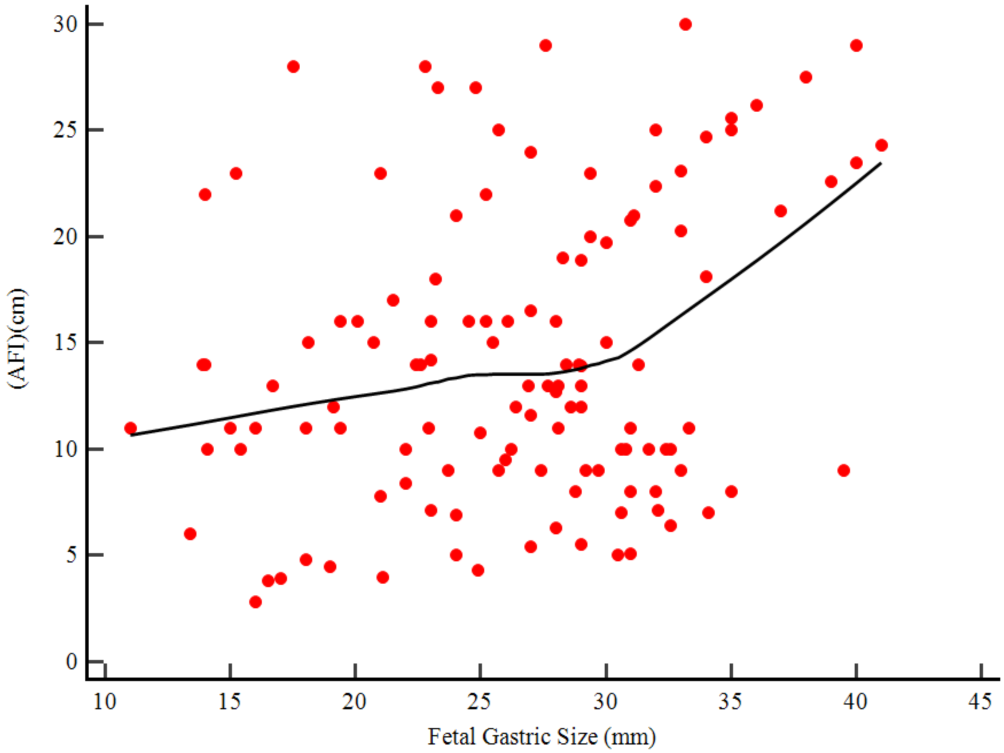

Figure 8: Scatter Plot of AFI (cm) vs Fetal Gastric Size (mm)

CHAPTER 6
DISCUSSION

The study's findings show a significant correlation between amniotic fluid volume (AFI) and fetal stomach size in third-trimester pregnancies. Fetal gastric size and AFI were shown to have a somewhat favorable connection, indicating that the amount of amniotic fluid grows in tandem with fetal gastric growth. This result lends credence to the theory that there may be a connection between amniotic fluid production and fetal development in the latter stages of pregnancy. Fetal stomach size and BMI were also shown to be significantly positively correlated, suggesting that maternal body mass may have an impact on fetal growth and amniotic fluid volume. This finding may have clinical implications for the management of pregnancies with higher BMI. The function of fetal development in affecting both stomach size and amniotic fluid levels as pregnancy proceeds is further supported by the substantial positive association between fetal gastric size and gestational age (GA). On the other hand, age showed poor correlations with both AFI and fetal stomach size, indicating that maternal age may have little effect on these metrics. These findings highlight the value of fetal stomach size and AFI sonographic parameters in evaluating fetal health during the third trimester, especially when compared to maternal characteristics such as gestational age and BMI.

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Because of variations in research emphasis, demographic, and therapeutic applicability, the current study's results both support and contradict those published by Chen et al. (2019). Chen et al. concentrated on maternal gastric antral cross-sectional area (CSA) as a surrogate for stomach volume in term pregnant women, whereas the current study shows a moderate to strong positive relationship between fetal gastric size, amniotic fluid index (AFI), gestational age, and maternal BMI, highlighting fetal growth dynamics and maternal influences in third-trimester pregnancies. The importance of sonographic stomach measures as trustworthy, noninvasive markers of physiological condition during pregnancy is shown by both investigations. Strong associations with gestational progression are noteworthy in both studies, supporting the idea that stomach dimensions are influenced by the advancement of pregnancy These findings together bolster the growing use of ultrasound in pregnancy, not only for evaluating maternal safety but also for tracking fetal development and intrauterine problems, thereby enhancing its clinical use in a variety of obstetric settings.

Particularly about the clinical interpretation of fetal stomach size and amniotic fluid volume in late pregnancy, the results of this research both contradict and supplement those published by Lépée. Fetal gastric size and AFI showed a moderately favorable association in the present research, indicating that typical increases in fetal gastric size are closely related to the control of amniotic fluid and overall fetal development throughout the third trimester. On the other hand, Lépée et al. focused on pathological circumstances where the fetal stomach is either nonexistent or abnormally tiny, showing that even in cases of severe gastric defects. Their results show that aberrant AFI is not always associated with the lack of a visible fetal stomach on ultrasound, especially when biochemical AF parameters and the EA index are normal. When taken as a whole, these findings show that although there is a positive correlation between fetal gastric size and AFI in typical third-trimester pregnancies, aberrations from this pattern, such as a non-visualized stomach with normal AF volume, should lead to more research for uncommon congenital abnormalities. This contrast emphasizes how crucial it is to combine sonographic results with sophisticated imaging and biochemical evaluation in order to distinguish between underlying disease and normal developmental variance.

By offering a more thorough understanding of the clinical significance of fetal gastric evaluation within routine fetal monitoring, the results of this investigation supplement the systematic third-trimester ultrasonography framework put forward by Villalain et al. The current study specifically highlights fetal gastric size as a meaningful sonographic parameter linked to amniotic fluid dynamics and fetal development. Additionally, the systematic approach's focus on estimated fetal weight and development trajectories is consistent with the substantial correlation between fetal stomach size and gestational age. The current study highlights the significance of individualized assessment, especially in pregnancies with elevated maternal body mass, by introducing maternal BMI as an influencing factor, in contrast to Villalain et al., which concentrates on standardized components of third-trimester scans across populations. When taken as a whole, these studies support the importance of thorough, evidence-based third-trimester ultrasound evaluation. They also imply that adding fetal gastric size to routine assessment may improve the detection of subtle growth and fluid-related variations, supporting better clinical decision-making and fetal well-being.

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CHAPTER 7 CONCLUSION

This study concludes that Higher BMI is linked to bigger fetal gastric sizes and more amniotic fluid, according to this study's strong positive association between BMI and both fetal gastric size and AFI. Fetal development rises with gestational age (GA), as seen by the substantial positive association between GA and fetal stomach size. AGE seems to have little effect, however, since it only weakly correlates with both AFI and fetal stomach size. In general, compared to AGE, BMI and GA seem to have more significant and robust associations with fetal factors.

7.2: RECOMMENDATIONS

- To enhance the efficiency and generalizability of the study results, it is recommended to incorporate data from multiple medical centers, ensuring a diverse representation of patients.
- Including participants from varied geographical regions will prevent findings from being limited to a single institution, thereby broadening the scope of the study.
- A diverse patient population will improve the external validity of the research, enabling the adjusted reference ranges for splenic dimensions to be more accurate and widely applicable across different healthcare settings and populations.
- The inclusion of data from various clinical centers can account for variations in imaging techniques, equipment standards, and operator expertise, further enhancing the reliability of the study outcomes.
- Such a comprehensive approach will strengthen the applicability of the findings, ensuring they are robust and relevant for broader clinical practice.

7.3: LIMITATIONS

- Study included a relatively limited number of patients, which limits the generalizability of findings.
- Duration of study was small.
- It is a single-centered study; results may not represent the wider population.
- It is a cross-sectional study, which shows association but not causation.
- Ultrasound is an operator-based imaging, due to which results are not generalized.
- There was no follow-up, because of that we couldn't determine the progression of the disease or the effect of treatment.

CHAPTER 8 REFERENCES

Al-Sattam, Z. M. J. (2024). Role of Ultrasound in Antenatal Detection of Echogenic Amniotic Fluid and Pregnancy Outcome. *Al-Rafidain Journal of Medical Sciences (ISSN 2789-3219)*, *6*(1), 112-116.

Andrade, W. S., Brizot, M. L., Rodrigues, A. S., Tannuri, A. C., Krebs, V. L., Nishie, E. N., ... & Zugaib, M. (2018). Sonographic markers in the prediction of fetal complex gastroschisis. *Fetal Diagnosis and Therapy*, *43*(1), 45-52.

Pakistan Journal of Medical & Cardiological Review
https://pakjmcr.com/index.php/1/about
Online ISSN 3007-2387
Print ISSN 3007-2379
Ahtesham et al - 2026
DOI: http://doi.org/10.5281/zenodo.21847154

Arlen, A. M., Nawaf, C., & Kirsch, A. J. (2019). Prune Belly Syndrome: Current Perspectives. Pediatric Health, Medicine and Therapeutics, 10, 75–81.

Atkinson, M. A., Jelin, E. B., Baschat, A., et al. (2022). Design And Protocol Of The Renal Anhydramnios Fetal Therapy (RAFT) Trial. Clinical Therapeutics, 44(8), 1161–1171.

Badiu, C. M., Lupu, G., Stroică Laura, M. T., Tarţa-Arsene, E., & Ispas, A. T. (2019). Morphometric study of feta l stomach dimensions. *Romanian J Anat*, *18*, 7-13.

Beall, M. H., Van den Wijngaard, J. P. H. M., Van Gemert, M. J. C., & Ross, M. G. (2017). Regulation of amniotic fluid volume. *Placenta*, *28*(8-9), 824-832.

Bell D, Weerakkody Y, Third trimester. Reference article, Radiopaedia.org (Accessed on 12 Jan 2026)

Brace, R.A.; Cheung, C.Y.; Anderson, D.F. Regulation of amniotic fluid volume: Insights derived from amniotic fluid volume function curves. *Am. J. Physiol.-Regul. Integr. Comp. Physiol.* **2018**, *315*, 777–789.

Chang, C. S., Choi, Y., Kim, S. Y., Yee, C., Kim, M., Sung, J. H., ... & Roh, C. R. (2021). Prenatal ultrasonographic findings of esophageal atresia: potential diagnostic role of the stomach shape. *Obstetrics & Gynecology Science*, *64*(1), 42-51.

Chen, S. C., Tai, Y. Y., Kuo, C. H., Chang, C. H., Chang, Y. H., Lin, S. Y., ... & Li, H. Y. (2025). Trajectory of serial amniotic fluid index measurements is associated with fetal growth, birth weight and neonatal adiposity. *Ultrasound in Obstetrics & Gynecology*, *66*(5), 589-597.

Chen, X., Chen, F., Zhao, Q., Zhang, L., & Liu, Z. (2019). Ultrasonographic measurement of antral area for estimating gastric fluid volume in pregnant women. *Journal of Clinical Anesthesia*, *53*, 70-73.

CJ Lockwood, Villar J, Farnot U, Barros F, et al. A randomized trial of psychosocial support during high-risk pregnancies. The Latin American Network for Perinatal and Reproductive Research. N Engl J Med 2022 327:1266.

Debbink, M. P., Son, S. L., Woodward, P. J., & Kennedy, A. M. (2021). Sonographic assessment of fetal growth abnormalities. *RadioGraphics*, *41*(1), 268-288.

Fitzsimmons, E. D., & Bajaj, T. (2023). Embryology, amniotic fluid. In StatPearls .33(4), 36-39.

Gabbay-Benziv, R., Maor-Sagie, E., Shrim, A., & Hallak, M. (2022). Determination Of Reference Values For Third Trimester Amniotic Fluid Index: a Retrospective Analysis Of a Large Cohort Of Pregnancies With Comparison To Previous Nomograms. Journal of Maternal-Fetal & Neonatal Medicine, 35(1), 134–140

Goldstein, R. F., Abell, S. K., Ranasinha, S., Misso, M. L., Boyle, J. A., Harrison, C. L., Black, M. H., Li, N., Hu, G., Corrado, F., Hegaard, H., Kim, Y. J., Haugen, M., Song, W. O., Kim, M. H., Bogaerts, A., Devlieger, R., Chung, J. H., & Teede, H. J. (2018). Gestational Weight Gain Across Continents And Ethnicity: Systematic Review And Meta-Analysis Of Maternal And Infant Outcomes In More Than One Million Women. BMC Medicine, 16(1), 1-53.

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387

Print ISSN 3007-2379

Ahtesham et al - 2026

DOI: http://doi.org/10.5281/zenodo.21847154

Harrison, C. L., Teede, H., Khan, N., Lim, S., Chauhan, A., Drakeley, S., Moran, L., & Boyle, J. (2021). Weight Management Across Preconception, Pregnancy, And Postpartum: A Systematic Review And Quality Appraisal Of International Clinical Practice Guidelines. Obesity Reviews, 22(10), 13-31

Howle, R., Sultan, P., Shah, R., Sceales, P., Van de Putte, P., & Bampoe, S. (2020). Gastric point-of-care ultrasound (PoCUS) during pregnancy and the postpartum period: a systematic review. *International Journal of Obstetric Anesthesia*, *44*, 24-32.

Hughes, D. S., & Magann, E. F. (2017). Antenatal Fetal Surveillance: Assessment Of The AFV. Best Practice & Research Clinical Obstetrics & Gynaecology, 3(8), 12 23.

Huri, M., Di Tommaso, M., & Seravalli, V. (2023). Amniotic fluid disorders: from prenatal management to neonatal outcomes. *Children*, *10*(3), 561.

Jelin, E. B., Hooper, J. E., Duregon, E., et al. (2021). Pulmonary Hypoplasia Correlates With The Length Of Anhydramnios In Patients With Early Pregnancy Renal Anhydramnios (EPRA). Journal of Perinatology, 41(8), 1924–1929

Jha, P., Feldstein, V. A., Revzin, M. V., Katz, D. S., & Moshiri, M. (2021). Role Of Imaging In Obstetric Interventions: Criteria, Considerations, And Complications. RadioGraphics, 41(4), 1243–1264.

Jha, P., Morgan, T. A., & Kennedy, A. (2019). Us Evaluation Of Twin Pregnancies: Importance Of Chorionicity And Amnioticity. RadioGraphics, 39(7), 2146–2166.

Jha, P., Raghu, P., Kennedy, A. M., Sugi, M., Morgan, T. A., Feldstein, V., ... & Penna, R. (2023). Assessment of amniotic fluid volume in pregnancy. *Radiographics*, *43*(6), e220146..

k Mullany, Garzon, S., Cacciato, P. M., Certelli, C., Salvaggio, C., Magliarditi, M., & Rizzo, G. (2023). Iron deficiency anemia in pregnancy: Novel approaches for an old problem. *Oman medical journal*, *35*(5), e166.

Kac, G., Carilho, T. R., Rasmussen, K. M., Reichenheim, M. E., Farias, D. R., Hutcheon, J. A., & Brazilian Maternal and Child Nutrition Consortium. (2021). Gestational Weight Gain Charts: Results From The Brazilian Maternal And Child Nutrition Consortium. The American Journal of Clinical Nutrition, 113(5), 1351-1360

Kehl, S., Schelkle, A., Thomas, A., Puhl, A., Meqdad, K., Tuschy, B., Berlit, S., Weiss, C., Bayer, C., Heimrich, J., Dammer, U., Raabe, E., Winkler, M., Faschingbauer, F., Beckmann, M. W., & Sütterlin, M. (2016). Single Deepest Vertical Pocket Or Amniotic Fluid Index As Evaluation Test For Predicting Adverse Pregnancy Outcome (Safe Trial): a Multicenter, Open-Label, Randomized Controlled Trial. Ultrasound in Obstetrics & Gynecology, 47(6), 674–679

Mărginean, C., Calomfirescu, M. V., Vlădăreanu, R., Mureşan, D., Pleş, L., Ceauşu, I., ... & Stamatian, F. (2020). Ultrasound screening in the third trimester of pregnancy. *Obstetrică şi Ginecologie*, *68*(3).

Mazzoni, G., Alberti, D., Torri, F., Motta, M., Platto, C., Franceschetti, L., ... & Signorelli, M. (2022). Prediction of complex gastroschisis: the evolution of therapeutic techniques and their relation with fetal sonographic features. *Journal of Neonatal-Perinatal Medicine*, *15*(1), 137-145.

Vol. 5 No. 2 (2026)

Pakistan Journal of Medical & Cardiological Review

https://pakjmcr.com/index.php/1/about

Online ISSN 3007-2387 Print ISSN 3007-2379

Ahtesham et al - 2026

DOI: http://doi.org/10.5281/zenodo.21847154

Pérez-Escamilla, R. (2023). Breastfeeding And The Obesity Pandemic. American Journal of Clinical Nutrition, 118(1), 1–2.

Roukhomovsky, M., Zieleskiewicz, L., Diaz, A., Guibaud, L., Chaumoitre, K., Desgranges, F. P., ... & Bouvet, L. (2018). Ultrasound examination of the antrum to predict gastric content volume in the third trimester of pregnancy as assessed by MRI: a prospective cohort study. *European Journal of Anaesthesiology| EJA*, *35*(5), 379-389.

S Sabina, K. Kalaivani, 'Prevalence & consequences of anemia in pregnancy', Indian J Med Res 130, November 2015, pp 627-633

Santos, S., Voerman, E., Amiano, P., Barros, H., Beilin, L., Bergström, A., Charles, M. A., Chatzi, L., Chevrier, C., Chrousos, G., Corpeleijn, E., Costa, O., Costet, N., Crozier, S., Devereux, G., Doyon, M., Eggesbø, M., Fantini, M., Farchi, S., Jaddoe, V. (2019). Impact Of Maternal Body Mass Index And Gestational Weight Gain On Pregnancy Complications: An individual participant data meta-analysis of European, North American and Australian cohorts. BJOG: An International Journal of Obstetrics & Gynaecology, 126(8), 984–995.

Van de Putte, P., Vernieuwe, L., & Perlas, A. (2019). Term pregnant patients have similar gastric volume to non-pregnant females: a single-centre cohort study. *British journal of anaesthesia*, *122*(1), 79-85.

Villalain, C., Galindo, A., Gómez-Montes, E., & Herraiz, I. (2025). 3rd trimester ultrasound assessment. *Best Practice & Research Clinical Obstetrics & Gynaecology*, 102593.