



## **Ultrasonographic Assessment of Amniotic Fluid Index in Normal Singleton Pregnancy among Igbo Women, South-Eastern Nigeria**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. The first and second authors took part in all the stages of the research –viz designed the study, wrote the protocol and the first draft of the manuscript, managed the literature searches and analyses of the study. The third and fourth authors contributed in the data analysis and literature review. All the authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/JAMMR/2018/28018

#### Editor(s):

(1) Edward J. Pavlik, Division of Gynecological Oncology, University of Kentucky Medical Center, USA.

#### Reviewers:

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Complete Peer review History: <http://www.sciencedomain.org/review-history/23427>

**Original Research Article**

**Received 29<sup>th</sup> June 2016**  
**Accepted 31<sup>st</sup> August 2016**  
**Published 4<sup>th</sup> March 2018**

### **ABSTRACT**

**Aim:** The aim of this study was to determine the mean Amniotic Fluid Index (AFI) and the upper and lower limits of normal value of AFI among Igbo women of South-Eastern Nigeria carrying uncomplicated singleton pregnancy at various gestational ages.

**Study Design:** A cross sectional study.

**Place and Duration of Study:** Obstetrics and Gynecology department of St Elizabeth Specialist Hospital, Owerri, Imo State from Jan 31 to Dec 31, 2015.

**Methodology:** This is a prospective cross sectional study of 400 women carrying uncomplicated singleton pregnancies. The AFI was obtained with the patient in the supine position and measurement of the largest vertical pocket of Amniotic fluids in the four quadrants done with abdominal probe. The AFI is the sum of these four quadrants.

**Results:** The age range of the women was 16-42 years with a mean age of  $28.0 \pm 4.8$  years. The gestational age of the pregnancies was between 14 -42 weeks. The mean and median of AFI appear similar at  $15.3 \pm 5.6$ cm and 15.1cm respectively. The mean AFI for preterm was also similar to the total mean AFI with a value of  $15.6 \pm 5.7$ cm. The 5<sup>th</sup> percentile was 5.2cm while the 95<sup>th</sup> percentile was 25.3cm. The weekly AFI rose from 14 weeks gestation to a peak of 20.1 cm  $\pm$  4.5cm at a GA of 22 weeks.

**Conclusion:** The range of AFI among Igbo women of South-Eastern Nigeria extraction conforms to other internationally accepted ranges.

*Keywords: Amniotic fluid index; Igbo women; uncomplicated singleton pregnancies; ultrasonography.*

## 1. INTRODUCTION

Amniotic fluid produced mainly by the fetal urine provides nutrition, support and warmth to the growing fetus. The amount of amniotic fluid reflects the baby's urine output — which is an important measure of a baby's well-being.

Assessment of amniotic fluid volume (AFV) is an integral part of antenatal ultrasound evaluation in screening examinations in pregnancy, and in tests assessing fetal well-being. Abnormal AFV has been associated with an increased risk of perinatal mortality and several poor perinatal outcomes, including premature rupture of membranes (PROM), fetal abnormalities, abnormal birth weight, and increased risk of obstetric interventions [1].

Ultrasound (U/S) examination is the only practical method of assessing AFV. A subjective assessment of AFV should be performed at every antenatal U/S examination; it has intraobserver and interobserver agreement of 84% and 96%, respectively [2]. However, subjective evaluation does not provide a numerical value that can be used to compare patients and to follow trends in AFV over time. Objective measures should be used if the subjective assessment is abnormal in patients at increased perinatal risk, and in all patients examined in the late third trimester or post-term. However it should be noted that ultrasound estimates of AFV correlate poorly with direct measurements of amniotic fluid [3].

Though there are several ways to assess AFV, Amniotic fluid index (AFI) and single deepest

pocket (SDP) are the most-used semi-quantitative techniques [4].

Among them, amniotic fluid index (AFI) by four-quadrant technique as described by Phelan et al. [5] in 1987 remains a popular and reliable method till today.

Color Doppler U/S does not improve the diagnostic accuracy of U/S estimates of AFV [6]. It may be useful, however, in circumstances in which visualization of cord-free pockets of fluid is difficult (eg, obesity).

AFI is calculated by summing the depth in centimeters of 4 different pockets of fluid not containing cord or fetal parts in 4 abdominal quadrants using the umbilicus as a reference point and with the transducer perpendicular to the floor.

Few studies [7-9] on AFI had been done in Nigeria but none was noted among the Igbo women of South Eastern extraction hence the justification for this study.

## 2. METHODOLOGY

A convenient sample of 400 healthy women carrying uncomplicated singleton pregnancies referred to St Elizabeth Specialist, Owerri for ultrasound scanning in pregnancy from Jan 31 to Dec 31, 2015 was collected. Those with diabetes mellitus, hypertension, ultrasonographically detectable anomalies, premature rupture of membranes, intra-uterine growth restriction, and any known fetal abnormalities were excluded from the study. The ultrasound scan was done once for each of the women during pregnancy by

the first author. The ultrasound machine used was Sonoline SI 450 manufactured by Siemens Healthcare GmbH Henkestr. 127 91052 Erlangen Germany.

After obtaining consents from the women, using Moore and Cayle technique [10] the AFI was obtained with the patient in the supine position. The abdomen was divided into four quadrants. Uterine quadrants were defined by the linear nigra for right and left, and the umbilicus for upper and lower sections. Measurements of the largest vertical pocket of Amniotic fluids in the four areas were taken for all the women. Those whose pregnancy were less than 37 completed weeks of gestation were taken as preterm, while those from 37 completed weeks to 42 weeks were taken as term.

Data was collected using a proforma and analyzed using International Business Machine – Statistical Package for Social Sciences (IBM-SPSS) version 21. Frequencies and percentages were calculated.

**3. RESULTS**

Out of the 400 women carrying uncomplicated singleton pregnancies scanned within the period of study, the majority were multigravidae. Two hundred and seventy nine (69.8%) of the women were scanned during the third trimester, while only 121 (30.3%) were scanned during the second trimester. None was scanned during the first trimester.

The age range of the women was 16-42 years with a mean ± SD age of 28.0 ± 4.8 years. The median age was 28years. Also the mean and median of AFI appear similar at 15.3 ± 5.6cm and 15.1cm respectively. Thus the data was normally distributed. The age group of 35-39 years contributed 24.6% (99/400) of the women. See Table 1.

**Table 1. Mean AFI at different GA groups**

GA Range	N	Mean AFI (cm)	Std. Deviation
<19	36	13.7	4.3
20-24	70	17.5	4.6
25-29	90	16.8	5.5
30-34	96	15.3	5.6
35-39	99	13.0	7.2
>39	9	12.5	5.6
Total	400	15.3	6.0

NB: GA = Gestational Age

The mean AFI for preterm was similar to the total mean AFI with a value of 15.6 ± 5.7cm. This was higher than the term mean AFI which was 12.5 ± 7.1 cm. See Table 2.

**Table 2. Mean AFI distribution in preterm / term fetuses**

	No (%)	Mean AFI (cm)
Preterm (< 37 completed weeks GA)	352 ( 88)	15.6
Term (37completed weeks -42 weeks)	48(12)	12.5
Total Mean AFI	400(100)	5.3

The 5<sup>th</sup> and 95<sup>th</sup>percentile were taken as lower and upper limits of normal respectively. The mean 5<sup>th</sup> percentile was 5.2cm while the mean 95<sup>th</sup> percentile was 25.3 cm, however the 5<sup>th</sup> and 95<sup>th</sup> percentiles vary for each week specific gestational week (see Fig. 1).

The minimum gestational age of the pregnancies was 14 weeks while the maximum gestational age was 41 weeks. The mean AFI in the second trimester of 16.2 ± 4.8cm noted in the study was higher than that of the third trimester of 14.8 ± 6.4cm. The weekly AFI rises from 14 weeks gestation to a peak of 20.1 cm ± 4.5cm at a GA of 22 weeks. See graph below (Fig. 2).

**4. DISCUSSION**

AFI is one of the essential components of fetal biophysical profile (BPP) and its values correlate well with adequacy of fetal renal perfusion. AFI is the fifth parameter in traditional five-point biophysical profile and second parameter in rapid two-point modified BPP (the other one being NST) [11].

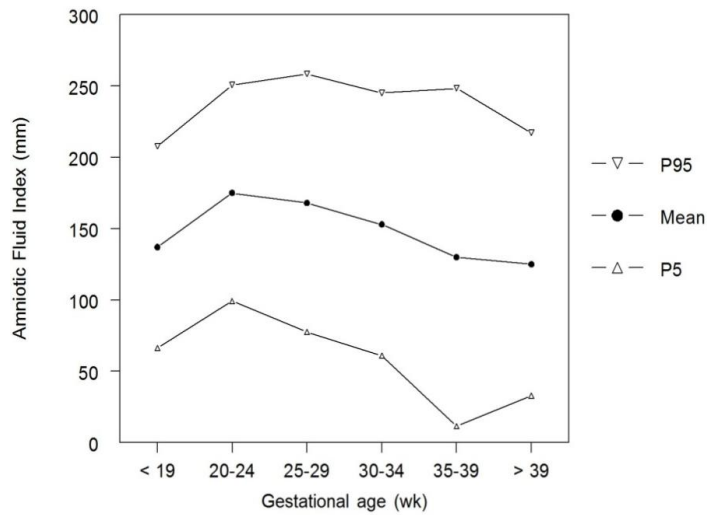
The major findings in this study were a mean AFI of 15.3cm, 5<sup>th</sup> and 95<sup>th</sup> percentile of 5.2cm and 25.3cm respectively and a peak AFI of 20.1cm at a gestational age of 22 weeks.

The mean AFI of 15.3 ± 5.6cm noted in this study is similar to the study reported by Alao et al. [7] from western Nigeria, but higher than 12.91, 12.8 and 14.5cm reported by Igbinidu et al. [8] Sharaf, [12] and Fok et al. [13] respectively at Benin, Nigeria, Karachi and China.

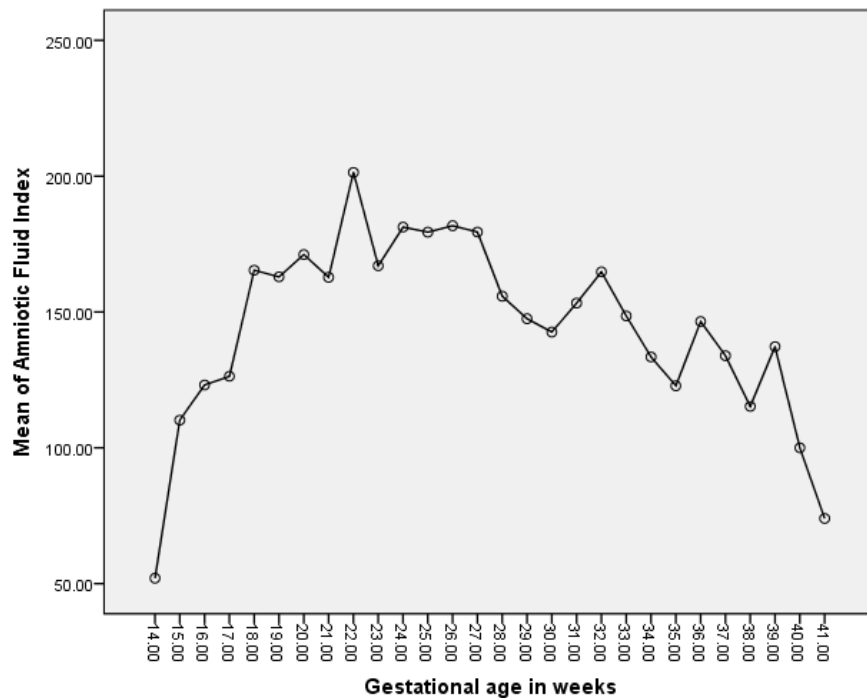
The 5<sup>th</sup> percentile was taken as lower limit and 95<sup>th</sup> percentile was taken as upper limit of normal AFI. Any value below the 5<sup>th</sup> percentile is said to be oligohydramnios, while value above the 95<sup>th</sup>

percentile is polyhydramnios. In the present study, the lower limit of normal was 5.2cm while the upper limit of normal was 25.3cm. This is similar to other studies which considered values between 8 and 25 to be normal, 5–8 low normal, and less than 5 oligohydramnios [14-16]. However, the graphical representation of AFI percentiles at different gestational ages in our

study is slightly different from that of previous studies [7-9] from other parts of Nigeria. Nigeria is made up of heterogenous population of people. Thus, this variation in graph pattern may be due to racial and environmental factors as even the previous studies in Nigeria did not record exactly the same graphical pattern.



**Fig. 1. Graphical representation of AFI percentiles at different gestational ages**  
 NB: The AFI in the figure is in mm, to convert to cm, we divide by 10



**Fig. 2. Graph of AFI against the GA**  
 NB: The mean AFI in the graph is in mm, thus to convert to cm, we divided by 10

Moore and Cayle whose values are used worldwide gave cut-off values for the AFI as an AFI of 0-5 cm labeled as low fluid, 5.1 to 8 cm as normal fluid and greater than 8 cm as high fluid value, [10] while Rutherford et al. [17] and Phelan et al. [18] proposed a range of normal AFI of 8 to 18cm. However as AFI values may be affected by the difference of race and environment, care should be taken when previously established AFI values are applied to pregnant women with different racial and environmental backgrounds [9].

We also noted that the AFI rises to a single peak of 20.14cm at the 22<sup>nd</sup> week of pregnancy followed by a gradual fall to 41<sup>st</sup> week of gestation.

Findings from other studies have been variable. Some studies [11,19,20] reported single peaks at later period of the gestation 27,30 and 33-34 weeks respectively, while others reported double peaks at 28 and 40 weeks; and 27 and 30 -31 weeks [12].

These differences between our study and other studies could be because of racial differences.

The mean AFI for preterm was similar to the mean AFI with a value of  $15.6 \pm 5.7$ cm, but higher than that of term babies which was  $12.5 \pm 7.1$ cm. This difference is statistically significant ( $P < 0.001$ ). This is contrary to other studies [7,8] in Nigeria in which there was no statistical difference between term and preterm mean AFI, but similar to another study [12] in Karachi by Habiba.

A limitation of the study was that we did not evaluate some confounding factors such as body mass index, the patients hydration status, etc.

## 5. CONCLUSION

This study has established the range of amniotic fluid index in this environment which will be a useful guide in the assessment of amniotic fluid volumes. It also showed that the range of AFI among Igbo women of South-East extraction conforms to other internationally accepted ranges.

## CONSENT

All the authors declare that written informed consents were obtained from the patients for publication of the paper.

## ETHICAL APPROVAL

All authors hereby declare that all parts and stages of the research have been examined and approved by the appropriate ethics committee and have therefore been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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