ESTIMATION OF GESTATIONAL AGE SPECIFIC AMNIOTIC FLUID INDEX IN NORMAL PREGNANCY IN NEPALESE WOMEN

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ABSTRACT

Amniotic fluid volume (AFV) is estimated in almost all the antenatal scans referred for ultrasonography (USG). It has proven to be a very good predictor for poor pregnancy outcomes. Several standard text books have quoted normal range of amniotic fluid index (AFI). These reference range may not be applicable to all the population as over the years different studies have shown that it varies among different population. Since such variations has been postulated, our aim is to formulate a reference range of gestational age specific AFI in normal pregnancy among Nepalese women. Therefore, a cross-sectional study was carried out among 537 normal pregnancies who attended the out-patient department of Nepal Medical College Teaching Hospital. Women with any maternal and fetal complications were excluded from the study. Subsequently median, the 5th, 50th and the 95th percentile values were calculated for each gestational week and were compared with studies among other population. Among the 537 women enrolled in the study, the mean maternal age was 26.5 years with the estimated fetal weight (EFW) at term pregnancy ranged from 2372 grams to 3750 grams with the mean being 3261 grams. The mean AFI at preterm was found to be 12.6 cm ± 2.36 and at term 11.0 cm ± 2.82. The percentiles values for first to 99th percentile of the entire data was calculated and the normal range of the AFI was estimated to be between 6 – 17 cm. As studies have shown the variance in AFI range among different population. It is imperative to formulate a reference of AFI among different population. In our study we found they are lower as compared to the Caucasian population, similar to Indian population and higher than the Chinese population.

KEYWORDS

Amniotic fluid index, normal pregnancy, ultrasonography

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INTRODUCTION

Estimation of amniotic fluid volume (AFV) is carried out in almost all the antenatal scans referred for ultrasonography (USG). It has proven to be a very good predictor for poor pregnancy outcomes.[1-3] Previously, several measurement techniques such as single deepest pocket[1-6] and two-diameter pocket volumes[7] have been used to estimate the AFV. Although calculation of amniotic fluid index (AFI) is also an indirect method to estimate the amniotic fluid volume, it is reliable, accurate, quick and easily reproducible.

Several standard text books have quoted normal range of AFI. These reference range may not be applicable to all the population as over the years different studies have shown that it varies among different population.[8-10]

The purpose of this study is to formulate a gestational age specific normal reference range of AFI among the Nepalese population and to compare it with the outcomes among the different population. To our knowledge this study has not been carried out in Nepalese population to date.

Table 1: Exclusion criteria

Gestational Age	**< 16 weeks and/or > 40 weeks**
Maternal	Any form of maternal complications such as • Pregnancy induce hypertension • Diabetes • Preeclampsia • Vaginal bleeding, etc.
Fetal	• Multifetal gestation • Detection of fetal anomalies • Growth discordance • Premature rupture of membrane • IUFD
Outcome	• Preterm or postdated delivery • Any form of complications during delivery • Use of any assisted delivery technique (such as vacuum delivery) other than elective cesarean delivery.

MATERIALS AND METHODS

A prospective cross-sectional study was carried out among 537 Nepalese women between 20 to 40 weeks of gestation attending the Department of Radiology, Nepal Medical College Teaching Hospital for ultrasonography from September 2017 to August 2021. All the patients were referred for routine prenatal ultrasound evaluation and only a single examination of the multiple measurements from each pregnancy was included.

The inclusion criteria were all 20 – 40 weeks of gestation with known last menstrual period or availability of at least one USG prior to 20 weeks. The exclusion criteria are summed up in Table 1.

All the measurements were performed on Toshiba Xario 100 machine (Toshiba Co., Japan) with a 3.5 MHz transducer. Informed consent was obtained from all the enrolled patients. The standard AFI measurement technique described by Phelan *et al*[11] and Moore and Cayle[9] were used.

Four ways have been put forward for the measurement of AFV: subjective evaluation, two by two measurement, single deepest pocket and AFI. For the measurement of AFI the uterus was divided in four quadrants, left and right by the linea nigra and upper and lower halves by an imaginary line half way between the uterine fundus and the maternal symphysis pubis. The transducer was placed perpendicular to the floor in each quadrant. And the deepest clear pocket without any fetal parts were measured in each quadrant. Finally, the measurements from all the quadrants were summed.

The data were processed in the software statistical package IBM SPSS statistics version 25 for windows. The fifth, 50th and 95th percentiles of AFI for each gestational week were calculated. Then the values were compared with other population.

RESULTS

Among the 537 women enrolled in the study, the age range was between 18 – 41 years old with the mean age being 26.5 years. The estimated fetal weight (EFW) at term pregnancy ranged from 2372 grams to 3750 grams with the mean EFW being 3261 grams. Gestational age specific amniotic fluid index was obtained as represented in table 2.

The percentiles values for first to 99th percentile of the entire data as well between the preterm

Table 2: Gestational age specific AFI values

Gestational Age (Weeks)	5th	50th	95th
20	9.0	11.1	14.0
21	9.8	13.0	16.8
22	9.0	13.1	17.0
23	10.9	12.1	13.6
24	11.0	12.6	16.5
25	8.0	13.8	16.0
26	9.0	15.1	16.8
27	10.3	14.2	16.2
28	8.9	14.8	17.5
29	9.3	13.0	16.7
30	9.2	13.9	16.6
31	9.1	13.0	16.2
32	7.5	13.4	18.0
33	9.3	12.2	16.5
34	7.7	13.1	18.1
35	7.7	11.5	15.8
36	8.7	11.1	16.4
37	6.8	11.1	16.1
38	6.0	10.3	16.7
39	6.4	9.9	17.1
40	7.1	9.7	13.9

and term were obtained as illustrated in table 3. It was observed that the AFI was greater in preterm than term pregnancy (P <0.0001 by unpaired t-test). The mean AFI at preterm was found to be 12.6 cm ± 2.36 and at term 11.0 cm ± 2.82. Although oligohydramnios is defined as

Table 4: Comparison of lower limit of AFI in different studies

Studies carried out in different populations	Lower limit of AFI
Phelan *et al*[9]	<5cm
Lee and Wen[10]	<5.6cm
Dizon-Townson *et al*[22]	<7cm
Khadilkar *et al*[8]	<6cm
Jeng *et al*	<8cm
Alley *et al*	<6cm
Current study	<6cm

Table 5: Upper limit AFI different studies

Studies carried out in different populations	Reference level for polyhydramnios
Khadilkar *et al*[8]	>21cm
Moore and Cayle *et al*[9]	>21cm
Alley *et al*	>21cm
Current study	>17 cm

more than two standard deviations below the mean, the 5th centile value is recommended for screening.[12] Therefore the 5th centile was taken as lower limit of normal and 95th percentile was taken as upper limit of normal AFI. Therefore, for term pregnancy the lower limit of normal was estimated to be 6 cm and upper limit of normal to be 16 cm for our population.

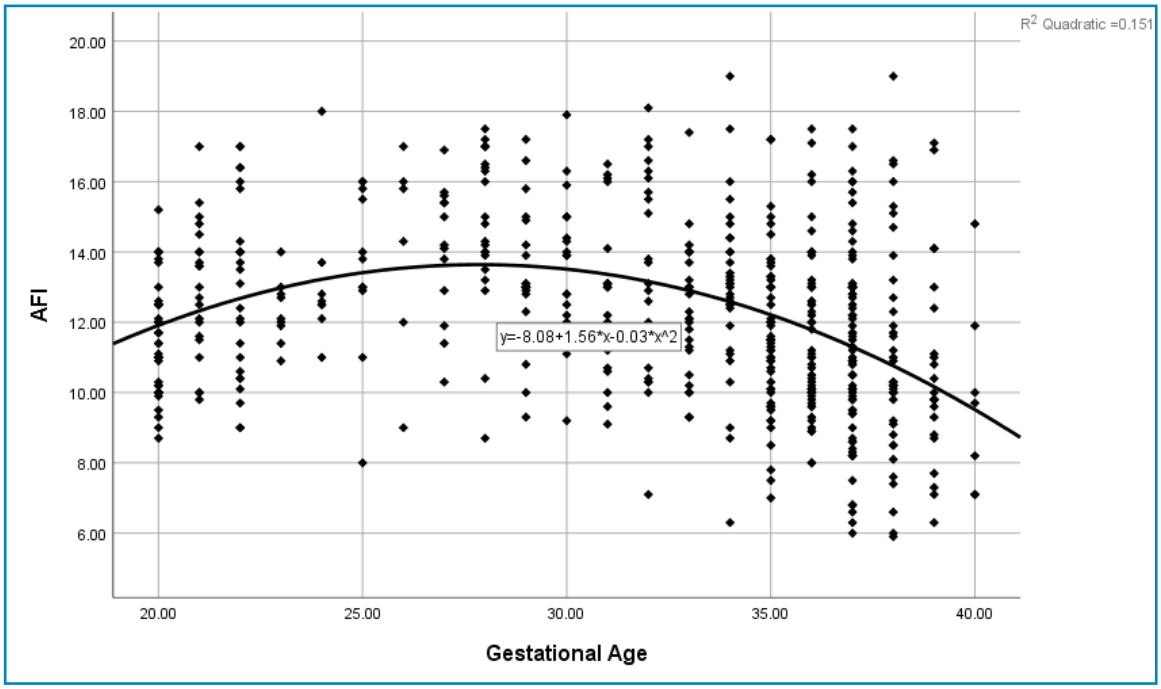
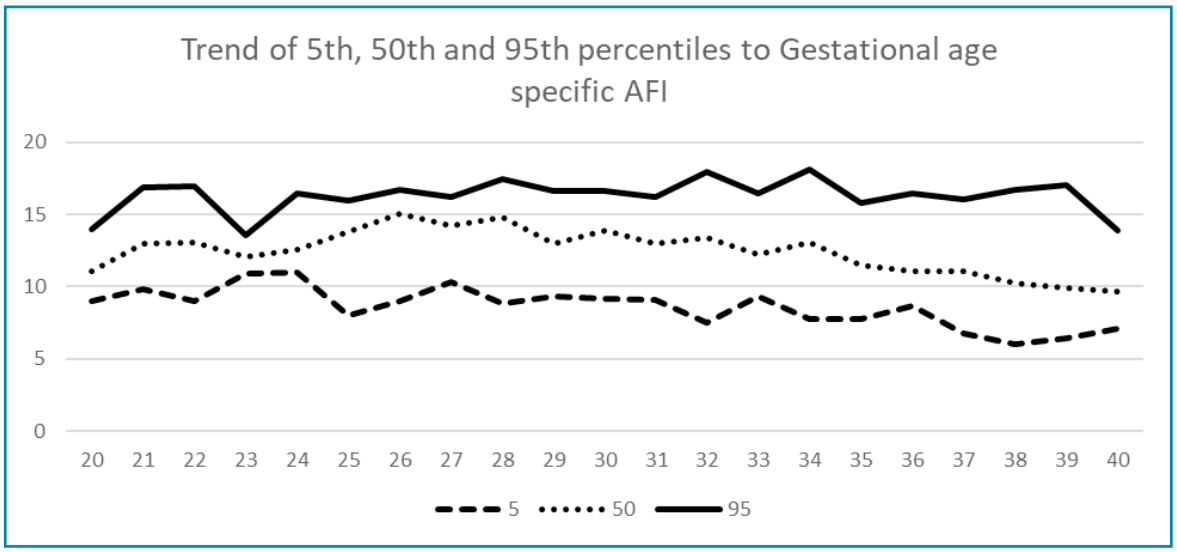


Fig. 1: Gradual change in AFI at different gestational ages

Table 3: Percentiles values

	1st	2.5th	5th	50th	95th	97.5th	99th
Total (n= 537)	6.3	7.1	8.1	12.1	16.9	17.2	17.7
Preterm (20-27 weeks) (n =134)	8.2	9.0	9.2	12.5	16.5	17.0	17.6
Preterm (28-36 weeks) (n = 262)	7.0	8.0	9.0	12.7	17.0	17.4	17.9
Term (37-40 weeks) (n =141)	5.9	6.1	6.6	10.8	16.4	17.0	18.3



Similarly, for preterm pregnancy the upper and lower limit was 8 cm and 17 cm respectively.

The AFI values showed initial gradual increase with gestational age, with the median reaching peak at 28 weeks of gestation beyond which there was gradual decrease as shown in the trend linedisplayed in figure 1. The equation of the trend line was:

$y = - 8.08 + 1.56x - 0.03x^2$

The 5th, 50th and 95th percentile of gestational age specific AFI was also calculated as represented figure 2, in which it can be clearly observed the trend line that there is gradual decrease in the amniotic fluid volume in later pregnancy.

DISCUSSION

There are several factors that determine not only the AFV but also the measurement of AFI. Several techniques have been postulated for the measurement of AFV. Dye dilution techniques have been used to measure AFV by Queenan *et al.*13 and Haswell *et al*,[14] which is an invasive procedure requiring amniocentesis and not practical for the use of screening. It could also be estimated clinically quiet accurately by obstetricians, but there are several factors which make it difficult such as obesity, abdominal wall oedema, etc. Therefore, the use of USG has made it easier as well as accurate. There are several ways of measurement of AFV by USG such as: single deepest pocket[1-6] and two-diameter pocket volumes.[7] However the standard AFI measurement technique as described by Phelan[11] has been shown to be a superior method for screening purposes.

The referred levels of AFI that are currently followed in our context are derived from the studies based on western populations. The different populations in the world differ from each other in socioeconomic status, eating habits, body habitus, average age of pregnancy, etc. Therefore, due to these factors the AFV may differ for different populations. Thus, different population-based formulation of AFI values is imperative.

The main aim of our study was to formulate a gestational age specific AFI range based on Nepalese population. According to our study the

lower limit of normal AFI, i.e., oligohydramnios was found to be 6 cm. This was similar to a study carried out in a study Indian population but slightly higher than those carried out in the Chinese population as shown in table 4.[8,10]

The reference range for oligohydramnios was almost similar in these studies differing in only less than a centimeter. However, the upper limit of normal for almost all the studies was above 21 cm. And the currently followed cut off limit for polyhydramnios in clinical practice is 25 cm.[15] However it was estimated to be only 17 cm in our study. Therefore,in our population the alarm signs for polyhydramnios should be raised at relatively lower levels of amniotic fluid volume. As polyhydramnios may be associated with several fetal abnormalities such as fetal macrosomia, renal anomalies, etc.

The estimated normal reference range of AFI was found to be between 6 cm – 17 cm in our study, which varies in the upper limit from the currently followed normal reference between 5 cm – 25 cm. As, already mentioned the amniotic fluid volume is a vital tool during the evaluation of the fetal growth. Therefore it is important to provide a population based normal reference to the clinicians. Our study highlights a very crucial factor that the suspicion of polyhydramnious in Nepalese population should begin at lower levels than the currently stated reference level of 25 cm.

Although this was only a clustered study carried out in certain specific population of Nepal, it underlines the necessity of population based normal reference range of amniotic fluid index. Therefore more studies in different parts of Nepal should be carried out, which later should be used to formulate a normal reference range.

Conflict of interest: none

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