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Research Article

Determining and investigating frontomaxillary facial (FMF) angel in normal and trisomy 21 fetuses at 16-24 weeks of gestate

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ABSTRACT

Screening for fetal chromosomal defects is considered a necessary prenatal measure of prenatal care.Trisomies are the most common chromosomal defects and the most common of them in human is trisomy 21 that has been named as Down syndrome. Thoughthe main cause of this syndrome is not known but its mechanism is in the form of the lack of separation of chromosomes which results in the birth of an individual with 47 chromosomes. Those with this syndrome have various disorders in different organ in their body and though life expectancy has increased for them in recent years, this increase is still in 40-60 years. Thus, knowing medical problem of these individuals and dealing properly with them seems necessary. The shape of nasal bone and its angle with frontal bone is helpful in diagnosing many diseases in fetus.Frontomaxillary facial (FMF) angel is considered a sonographic marker in screening and diagnosing chromosomal defects that can provide the possibility of correct diagnosis of chromosomal defects. The aim of this study is determining a range for FMF angle in in normal and trisomy 21 fetuses at 16-24 weeks of gestation. Ultrasonography will be done with trans-abdominal method using Zimens-acousan device and the measurements will be done in mid sagitalprofile view by 2D probe. For achieving the objective of the study women with gestational age of 16 to 24 weeks visiting Shariati, Imam Khomeini and Women's university hospitals in Tehran during 2011-2013 are taken into the study and sampling is done in non-random way. 15 fetuses with Down syndrome and 200 normal fetuses are studied. The results indicate that there is a significant difference in FMF angle values between normal fetuses and fetuses having Down syndrome and the values of this angle is increased for Fetuses with Down syndrome.

INTRODUCTION

Screening for fetal chromosome defects is considered a necessary prenatal measure of prenatal care. From the past, mother's age was considered a danger determination factor. This provides the opportunity of screening or invasive diagnostic tests before 20 weeks of gestation for pregnant women of all age groups.

Trisomies are the most common chromosomal defects and the most common of them in human is trisomy 21 that has been named as Down

syndrome (1). Though the main cause of this syndrome is not known but its mechanism is the lack of separation of chromosomes which results in the birth of an individual with 47 chromosomes (2).

Those with this syndrome have various disorders in different organ in their body and though life expectancy has increased for them in recent years, this increase is still in 40-60 years. Thus, knowing medical problem of these individuals and dealing properly with them seems necessary (2).

In 1866 Langdon Down reported a case of trisomy 21 in which the skin of the body was more than the surface of the body and it had small nose and flat face (3).

This chromosomal defect was named Down syndrome later. In the past decade seeing these evidences became possible in ultrasound imaging at 3 months of gestation.

By adding Biochemistry markers of mother's serum such as β-hCG and PAPP-A at the time of ultrasonography imaging as much as NT and NB the accuracy of diagnosing Down syndrome reach more than 90 % and by taking into consideration the new sonographic markers including tricuspid valve regurgitation,ductusvenosus flow and facial angle this figure reach 97% which is considered a tremendous transformation in screening and diagnosing chromosomal defects.

The shape of nasal bone and its angle with frontal bone is helpful in diagnosing many diseases in all age groups. . Frontomaxillary facial (FMF) angel which is the angle between the upper surface of the maxilla and the frontal bone in a mid-sagittal view of the fetal face is considered an a sonographic marker in screening and diagnosing chromosomal defects that can provide the possibility of correct diagnosis of chromosomal defects(this angle has been shown clear ley in the following figures). It should be noted that for sampling in the present study, mid-sagittal plane view using Zimens-acousan device in 2d mode has been used. The aim of the present study is investigating FMF angel in normal fetuses and comparing them with those of fetuses with Down syndrome.

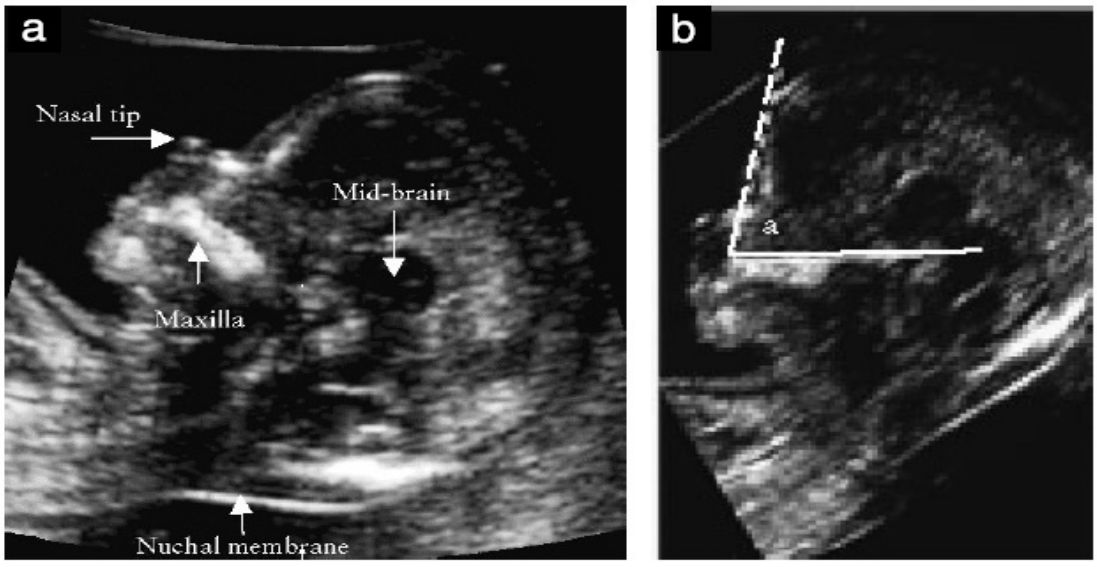

Figure 1. Ultrasound image of mid-sagittal view of fetal profile shows tip of the nose, nuchal translucency, skin of the back of the neck and jaw bone. Frontomaxillary facial angel is defined as the angle between the upper surface of the maxilla and the frontal bone (b) [8].

Research method and the obtained results are provided as follows.

METHODS

This study is done in analytical-cross-sectional way on women with gestational age of 16 to 24 weeks visiting Shariati, Imam Khomeini and Women's university hospitals in Tehran during 2011-2013.

After doing necessary coordination and explaining the objectives and stages of the study to patients and gaining patients' consent, their information is collected and completed in the checklist of the study.

Then ultrasonography in trans-abdominal manner is requested for them. For preventing measurement error all instances ofultrasonography are conducted by a skilled specialist. It should be noted that ultrasonography was repeated 3 times for each case and the best obtained sample was chosen for conducting the study.

After determining FMF angle values, we will determine and analyze the values in normal fetuses and fetuses with Down syndrome. In such way that first FMF angle values are measured and calculated in the samples and then the results are presented in the form of statistical tables.

Then with the aid of statistical tests in inferential statistics, the study hypotheses are investigated through generalizing the result of the samples to the main population. The hypothesis that is investigated in this paper is the hypothesis of the equality of FMF angle in normal fetuses and fetuses with Down syndrome. Also hypotheses related to FMF angle values are investigated by their gender and age.

Statistical analyses

In table 1 the results of descriptive statistics of FMF angle values are summarized by normal fetuses and fetuses with Down syndrome. Based on these results the mean of FMF angle in normal fetuses is lower than that of fetuses with Down syndrome. Though, no significant difference has been observed between the two groups in terms of MOM mean.

Table 1: descriptive analysis of FMF angle values by genetic involvement

	Syndrome/normal	number	mean	median	MoMmean	Standard deviation	minimum	maximum
FMF	Down syndrome	15	90.58	91.6	0.988937409	4.19	83.1	95.7
	normal	200	83.72	83.75	0.999701493	3.32	77	90.1

Table 3 shows descriptive analysis of FMF angle values by weeks of gestation in normal fetuses and fetuses with Down syndrome

Table 3. The mean of MOM FMF angle in fetuses of 16 to 24 weeks of gestation by week and genetic involvements

week	Normal/Down syndrome	number	MoM FMF angle mean
16 weeks	Down syndrome	2	1.041484716
	Normal	17	0.994486392
17 weeks	Down syndrome	2	1.008187773
	Normal	20	1.005134328
18 weeks	Down syndrome	2	1.02128821
	Normal	26	1.000229621
19 weeks	Down syndrome	3	0.943959243
	Normal	34	1.004389816
20 weeks	Down syndrome	1	0.930131004
	Normal	23	0.995820896
21	Down syndrome	1	1.012008734

weeks			
	Normal	31	1.000828117
22 weeks	Down syndrome	2	0.94268559
	Normal	23	0.998364698
23 weeks	Down syndrome	2	1.016375546
	Normal	21	0.99405828
24 weeks	Down syndrome	0	0
	Normal	5	1.001791045

Also, the results of inferential statistics are provided below.

For testing the hypothesis of the normalness of FMF angle distribution Kolmogorov-Smirnov test was used. The null hypothesis of this test is that the distribution is normal. This test was done using SPSS software. Based on the results of this test and as the sig or p-value is higher than 0.05 and equal to 0.716, there is no reason for rejection of the normalness of FMF angle distribution. Thus, due to the normalness of distribution and for investigating FMF angle characteristics in the two groups parametric tests should be used.

For this purpose, for investigating FMF angle values between the two groups of normal fetuses and fetuses with Down syndrome, independent T-test is used. In this test the null hypothesis is that there is no significant difference in FMF angle values between Trisomy 21 fetuses and normal fetuses.

For testing the hypothesis of the equality of the two samples first the test of the hypothesis of equality of variances should be done for determining appropriate statistic. This test has been done by SPSS software. The sig value of this test is 0.162 which is higher than 0.05 error level. Thus there is no reason for rejection of the equality of variance. Also, the sig value of testing the hypothesis of the equality of the means of the two groups is equal to zero. Thus, as this value is lower than 0.05 error level the null hypothesis is rejected. In other words, the results of this test indicate that there is a significant difference between FMF angle values of normal fetuses and those of fetuses with Down syndrome.

Also the results of testing the hypothesis of the impact of fetus's gender in FMF angle values indicate that there is no significant difference between male and female fetuses in terms of FMF angle values therefore, the fetus's gender is not effective in FMF angle values. This hypothesis has been investigated by independent T-test and as in this test sig is equal to 0.381 which is higher than 0.05 error level there is no reason for rejection of the null hypothesis which means that there is no significant difference in the value of the mean of FMF angle in male and female fetuses.

Then the relationship between FMF angle and the age of fetus (weeks of gestation) has been studied using correlation test. The null hypothesis of this study is the lack of correlation. The sig value in this test is equal to 0.301 which indicates that there is no reason for rejecting null hypothesis. Thus, there is no significant relationship between fetus age and FMF angle value.

CONCLUSION

Based on the results of the analyses and statistical test, the mean of FMF angle in normal fetuses is equal to 83.72 and in fetuses with Down syndrome, it is equal to 90.58. Thus, FMF angle in normal fetuses is smaller than that of fetuses with Down syndrome. Also determining FMF angle mean in normal fetuses and

fetuses with Down syndrome indicates that there is no significant difference in FMF angle values of male and female fetuses in both normal group and trisomy 21 group (sig=0.381). Another finding of this study is that there is no significant relationship between fetus age and FMF angle (sig=0301). This can also be seen in figure 2.

Also, statistical test conducted indicates that there is a significant difference in FMF angle values between normal fetuses and fetuses with Down syndrome and fetuses with Down syndrome have a bigger FMF angel. Thus, this factor can be used as a criterion in diagnosing fetuses with Down syndrome.

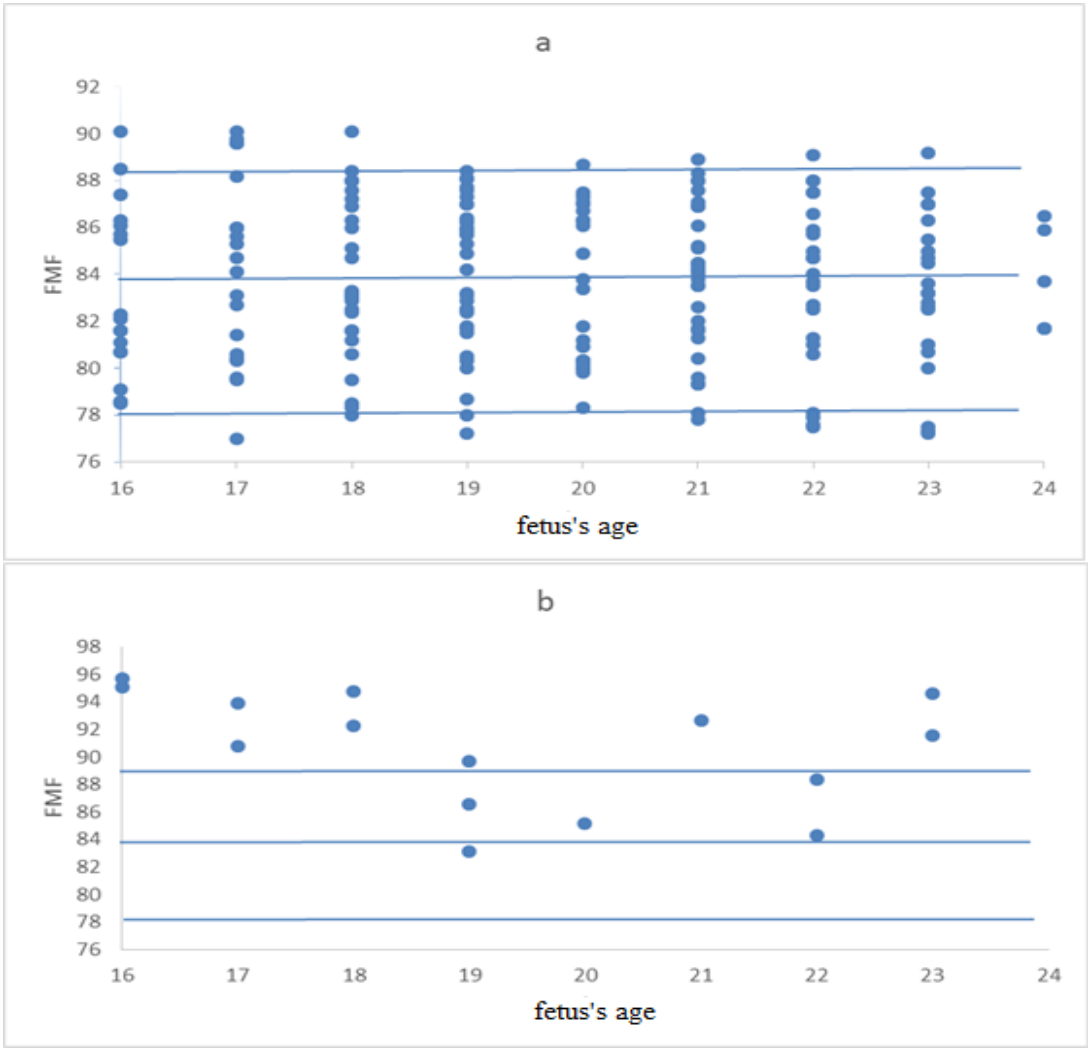

Figure 2. FMF angle in 200 normal fetuses (a). FMF angle in 15 fetuses with Down syndrome (b)that has been drawn on reference areas (mean, 5th and 95th percentiles) for normal fetuses based on gestation age (weeks).

DISCUSSION

The data collected using 2D ultrasonography indicates that during the second three months of gestation the FMF angle in significantly bigger than that of normal fetuses. FMF angle in normal fetuses is in [77, 90.1] range while this range is in [83.1, 95.7) range for fetuses with Down syndrome.

FMF angle values in normal fetuses and fetuses with Down syndrome are shown by weeks of gestation in figure 2. These values have been drawn on reference areas (mean, 5th and 95th percentiles) that have been determined based on data related to normal fetuses.

95th percentile of FMF angle in normal fetuses is equal to 78 while no FMF angle value related to fetuses with trisomy 21 are in this range.

Finally, it should be mentioned than sonographic fetus profile for FMF angle is a sensitive screening method in the second three months of gestation for trisomy 21. And as normally in the screening in the second three month of gestation the fetus profile is investigated, necessary skill for obtaining this view and determining FMF angles is widely available. Thus, it is necessary that FMF angles are paid attention to as an important factor in in time diagnosis of trisomy 21 in fetus in first few weeks of pregnancy.

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