

Foetal Kidney Development and Amniotic Fluid Formation in Upper Egyptian Pregnancies

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Abstract

Background: The foetal kidney development is important for its normal function. The Amniotic Fluid Index (AFI) is used to assess the amniotic fluid volume. The main source of the amniotic fluid is the foetal urine.

Aim of the Work: To establish reference values for the foetal kidney length and the AFI throughout the second and third trimesters of the normal Upper Egyptian pregnancies and to clarify the correlations between these measurements.

Subject and Methods: An ultrasonographic examination was performed to measure the foetal kidney length and the AFI on 232 normal pregnant women from the 14th week to the 42nd week of gestation. The correlations between the measurements were analysed statistically.

Results: The foetal kidney length increased gradually with gestation. There was a significantly positive correlation between the foetal kidney length and the gestational age. The linear regression showed that the gestational age could be assessed by using the foetal kidney length with an accuracy of ± 1.078 week. From the 14th week, the AFI increased progressively until the 24th week. There was a positive correlation between the AFI and the gestational age and between the AFI and the foetal kidney length. From the 25th week to the 32nd week, the AFI demonstrated little variations. From the 33rd week, the AFI declined gradually. There was a negative correlation between the AFI and the gestational age and between the AFI and the foetal kidney length.

Conclusion: The present study introduces reference values for both the foetal kidney length and the AFI in the normal Upper Egyptian pregnancies. It also discusses the correlation between the foetal kidney length and the AFI as early as the second trimester of pregnancy. At first, it is a direct correlation. Then, it shows minimal variations. Finally, it becomes an inverse one. The obtained information could be usefully applied clinically.

Key Words: *Ultrasonography – Foetal Kidney length – Amniotic fluid index.*

Introduction

THE normal foetal kidney development is crucial to the neonatal outcome [1]. Ahmadi et al., [2] stated that a standard nomogram of the foetal kidney length was useful to evaluate the growth disorders of the foetal kidneys in order to identify and manage any foetal renal abnormalities early.

The kidney develops from the uretric bud and the metanephric mesoderm. It begins to form at the 7th week becoming functional at the 11th week of gestation [3].

The development of the diagnostic ultrasound opened new possibilities for a more confident assessment of dating as reported by Butt and Lim [4] and Saxena et al., [5]. During the first trimester, the kidneys appear as hyperechoic oval structures on both sides of the developing vertebral column. Their echogenicity decreases gradually with aging [6,7].

The foetal kidney length is one of the non-traditional and more accurate pearls of the Gestational Age (GA) determination than other parameters like the Biparietal Diameter (BPD), Femur Length (FL), Head Circumference (HC) and Abdominal Circumference (AC) after the 24th week of gestation [8,9].

The amniotic fluid is a clear or little yellow liquid surrounds the foetus [10]. It promotes the musculo-skeletal development and allows for an easier foetal movement [11]. Any decrease or increase in the volume of the amniotic fluid leads to pregnancy complications [12].

Underwood et al., [13] stated that the assessment of the amniotic fluid was a complementary part of

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the ultrasonographic report of the pregnant female. Borges et al., [14] reported that the AFI was a semiquantitative technique used to evaluate the Amniotic Fluid Volume (AFV) within the gravid uterus. It was measured against the AFI chart. The AFI could be a useful adjunct to other foetal biometrics, to identify adverse outcomes [15].

The amniotic fluid appears constantly during the second half of pregnancy. The main source of its production is the baby's urine (700ml/day) and lung secretions (350ml/day). Its clearance is mainly by the baby swallowing and passing it back into the placental circulation [16]. Oligohydramnios defined as an AFI of ≤ 5 cm [11], and polyhydramnios as either an AFI ≥ 25 cm or a maximum vertical pocket ≥ 8 cm even in the presence of an AFI < 25 cm [17].

Patrelli et al., [18] stated that a balance was required to maintain a healthy AFV. It was influenced by hormones like prolactin and prostaglandins, the osmotic and hydrostatic forces, the maternal hydration and the baby's well-being.

The aim of this study was to establish the foetal kidney length and AFI scales and their correlations throughout the second and third trimesters of the normal Upper Egyptian pregnancies.

Subjects and Methods

A cross-sectional study was done on 232 healthy Upper Egyptian pregnant women who were following-up their pregnancy at the Department of Obstetrics and Gynecology, Assiut University Hospital between 2015 and 2017. They were between 18 and 40 years old of a mean age of 29.3 years. Each had a singleton foetus between 14 and 42 weeks of gestation. The mothers were sure of

their Gestational Ages (GA). A sonogram was done for each in the first trimester where the foetus's Crown Rump Length (CRL) was measured. The pregnant women were selected on the basis of the simple random sampling technique. Consents were taken from them before the study. A thorough history was taken and a complete examination was done. Any woman who had an uncertain GA, under nutrition, obesity or a disease was excluded. The true GA for each case was calculated as the sum of the age at the time of the first sonogram as determined by the CRL plus the number of weeks elapsed between the sonograms as stated by Honarvar et al., [19]. A real-time ultrasound (Medison X8 with a 0.9KHz curvilinear transducer, USA) was used to measure the foetal kidney length and the AFI. The Institutional Ethical Committee Approval was obtained prior to the study.

The right foetal kidney length was measured as the maximal longitudinal renal axis; the two calipers were positioned in relation to the upper and lower poles of the kidney Fig. (1) as described by [2]. A regression equation was generated as follows: The predicted (GA) = α (constant) + $\beta X \pm$ the Standard Error (SE) of estimate in weeks, where X represented the measurement and β was the regression coefficient.

The evaluation of the AFI was done with the modified four-quadrant technique. The uterine cavity was divided into four quadrants. The vertical diameter of the largest pocket in each quadrant was measured Fig. (2). The AFI was the sum of those four quadrants according to Hinh and Ladin-sky [20]. An AFI chart was obtained expressing the average volume of the amniotic fluid in millimeters based on the gestational age in weeks as suggested by Jeng et al., [21].



Fig. (1): An ultrasonographic image showing the maximal longitudinal renal axis. Notice that the two calipers are positioned in relation to the upper and lower poles of the kidney.



Fig. (2): An ultrasonographic image showing the vertical diameter of the largest pocket in one of the four quadrants.

Only one professional performed all the examinations in order to avoid the inter-observer variability. The foetal ultrasonographic measurements were grouped into weeks. Statistical analyses were performed with ANOVA, F-test, correlation coefficient and linear regression using SPSS Version 16.0 (SPSS Inc., Chicago, IL, USA) and $p < 0.05$ was considered statistically significant.

Results

The measurements of the foetal kidney lengths were obtained between the 14th and 42nd weeks of gestation. The minimum, maximum, mean and Standard Deviation (SD) of the foetal kidney lengths were elicited weekly in (Table 1). The crude values of the means of the foetal kidney lengths $\pm 2SD$ according to the gestational ages were represented in Chart (1). The 5th, 50th and 95th percentiles of the foetal kidney lengths according to the gestational ages after being submitted to a smoothing process using the quadratic polynomial adjustments were elicited in Chart (2). The range of the mean $\pm SD$ of the foetal kidney length was from 9.31 ± 0.19 mm at the 14th week to a maximum of 45.22 ± 0.12 mm at the 42nd week of gestation.

There was a significantly strong positive correlation between the gestational age and the foetal kidney length ($r=0.992, p=0.000$). The linear regression equation was: The predicted gestational age = $6.315 + 0.727 X$ the foetal kidney length ± 1.078 (Tables 2,3) & Chart (3).

As regards the AFI, the minimum, maximum, mean and SD were elicited weekly in (Table 4). The crude values of the means of the AFI $\pm 2SD$ according to the gestational ages were represented in Chart (4). The 5th, 50th and 95th percentiles of the AFI according to the gestational ages after being submitted to a smoothing process using the quadratic polynomial adjustments were shown in Chart (5). The range of the mean $\pm SD$ of the AFI increased from 118.32 ± 0.4 mm at the 14th week to a maximum of 147.16 ± 0.09 mm at the 24th week of gestation. Then, the mean $\pm SD$ of the AFI took a plateau form from 147.13 ± 0.08 mm at the 25th week to 144.35 ± 0.24 mm at the 32nd week of gestation. Lastly, the mean $\pm SD$ of the AFI decreased from 142.72 ± 0.33 mm at the 33rd week to 110.83 ± 0.47 mm at the 42nd week of gestation.

There was a significantly strong positive correlation between the AFI and the gestational age from 14 to 24 weeks ($r=0.978, p=0.000$). The linear regression equation was: The predicted gestational

age = $20.740 + 0.296 X$ the AFI ± 0.661 (Tables 6, 7) & Chart (6).

There was a significantly strong negative correlation between the gestational age from 33 to 42 weeks and the AFI ($r=-0.972, p=0.000$). The linear regression equation was: The predicted gestational age = $71.575 - 0.261 X$ the AFI ± 0.688 (Tables 8, 9) & Chart (7).

There was a significantly strong positive correlation between the AFI and the foetal kidney length throughout the gestational ages from 14 to 24 weeks ($r=0.986, p=0.000$). The linear regression equation was: The predicted foetal kidney length = $98.487 + 2.064 X$ the AFI ± 1.735 (Tables 10,11) & Chart (8).

There was a significantly strong negative correlation between the foetal kidney length and the AFI throughout the gestational ages from 33 to 42 weeks ($r=-0.935, p=0.000$). The linear regression equation was: The predicted foetal kidney length = $354.377 - 5.261 X$ the AFI ± 3.841 (Tables 12,13) & Chart (9).

Table (1): Descriptive statistics of the foetal kidney lengths in (mm) based on the gestational ages in weeks in the normal Upper Egyptian pregnancies.

	N	Minimum	Maximum	Mean	SD
W14	8	9.00	9.55	9.31	0.19
W15	8	10.50	11.30	10.91	0.29
W16	8	12.00	12.80	12.45	0.26
W17	8	14.00	14.79	14.51	0.28
W18	8	15.50	16.30	15.87	0.28
W19	8	17.50	17.99	17.77	0.16
W20	8	18.00	19.20	18.66	0.34
W21	8	20.00	22.00	20.96	0.65
W22	8	22.50	23.10	22.83	0.21
W23	8	23.20	23.85	23.55	0.23
W24	8	23.90	24.80	24.44	0.34
W25	8	24.85	25.70	25.27	0.36
W26	8	26.20	26.80	26.50	0.22
W27	8	27.60	28.00	27.81	0.13
W28	8	29.80	30.80	30.47	0.37
W29	8	31.70	32.00	31.85	0.11
W30	8	33.70	34.14	33.93	0.14
W31	8	34.20	35.72	35.12	0.70
W32	8	37.00	37.78	37.41	0.28
W33	8	38.70	39.10	38.88	0.13
W34	8	40.50	40.80	40.66	0.10
W35	8	41.00	41.47	41.29	0.14
W36	8	41.60	42.00	41.83	0.15
W37	8	42.20	42.59	42.38	0.12
W38	8	42.62	42.93	42.80	0.10
W39	8	42.99	43.73	43.45	0.28
W40	8	44.00	44.68	44.44	0.22
W41	8	44.70	44.90	44.79	0.07
W42	8	45.00	45.38	45.22	0.12

Table (2): Correlation between the foetal kidney length and the gestational age.

Model	r	r square	Adjusted r square	SE of the estimate	p-value
1	0.992	0.984	0.983	1.078	0.000

Table (3): Linear regression analysis of the foetal kidney length to predict the gestational age.

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	SE	Beta		
• 1 (constant)	6.315	0.198	0.992	31.889	0.000
• The foetal kidney length	0.727	0.006		117.247	0.000

Table (4): Shows a descriptive statistics of the AFI.

	N	Minimum	Maximum	Mean	SD
W14	8	117.80	118.90	118.32	0.40
W15	8	119.00	119.90	119.52	0.29
W16	8	120.90	122.50	121.65	0.52
W17	8	127.00	128.30	127.78	0.41
W18	8	133.00	133.90	133.53	0.28
W19	8	137.00	137.80	137.43	0.26
W20	8	137.90	138.70	138.32	0.28
W21	8	143.00	143.75	143.43	0.25
W22	8	145.00	145.51	145.30	0.18
W23	8	145.58	146.00	145.72	0.13
W24	8	147.00	147.28	147.16	0.09
W25	8	147.00	147.24	147.13	0.08
W26	8	146.50	147.21	147.02	0.22
W27	8	146.20	147.00	146.49	0.26
W28	8	146.00	146.80	146.22	0.24
W29	8	145.00	145.40	145.23	0.13
W30	8	144.40	145.20	144.83	0.26
W31	8	144.00	144.70	144.35	0.24
W32	8	144.00	144.70	144.35	0.24
W33	8	142.10	143.20	142.72	0.33
W34	8	141.00	142.40	141.70	0.48
W35	8	139.00	140.40	139.70	0.48
W36	8	137.00	138.40	137.70	0.48
W37	8	134.00	135.80	135.03	0.59
W38	8	131.00	132.60	131.83	0.57
W39	8	125.50	127.00	126.20	0.55
W40	8	122.00	123.50	122.82	0.46
W41	8	114.00	116.00	115.01	0.67
W42	8	110.00	111.60	110.83	0.47

Table (6): Correlation between the AFI and the gestational ages from 14 to 24 weeks.

Model	r	r square	Adjusted r square	SE of the estimate
1	0.978	0.957	0.957	0.66188

Table (7): Linear regression analysis of the AFI to predict the gestational age from 14 to 24 weeks.

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	SE	Beta		
• 1 (constant)	-20.740	0.909	0.978	-22.816	0.000
• The means of the AFI in mm	0.296	0.007		43.849	0.000

Table (8): Correlation between the AFI and the gestational ages from 33 to 42 weeks.

Model	r	r square	Adjusted r square	SE of the estimate
1	-0.972	0.944	0.943	0.688

Table (9): Linear regression analysis of the AFI to predict the gestational ages from 33 to 42 weeks.

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	SE	Beta		
• 1 (constant)	71.575	0.943	-0.972	75.908	0.000
• The means of the AFI in mm	-0.261	0.007		-36.259	0.000

Table (10): Correlation between the AFI and the foetal kidney length from 14 to 24 weeks.

Model	r	r square	Adjusted r square	SE of the estimate
1	0.986	0.973	0.973	1.73556

Table (11): Linear regression analysis of the foetal kidney length to predict the AFI from 14 to 24 weeks.

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	SE	Beta		
• 1 (constant)	98.487	0.670	0.986	147.090	0.000
• The means of the foetal kidney length in mm	2.064	0.037		55.782	0.000

Table (12): Correlation between the foetal kidney length and the AFI from 33 to 42 weeks.

Model	r	r square	Adjusted r square	SE of the estimate
1	-0.935	0.874	0.872	3.84103

Table (13): Linear regression analysis of the foetal kidney length to predict the AFI from 33 to 42 weeks.

Model	Unstandardized coefficients		Standardized coefficients	t	Sig.
	B	SE	Beta		
• 1 (constant)	354.377	9.649	-0.935	36.725	0.000
• The means of the foetal kidney length in mm	-5.261	0.226		-23.239	0.000

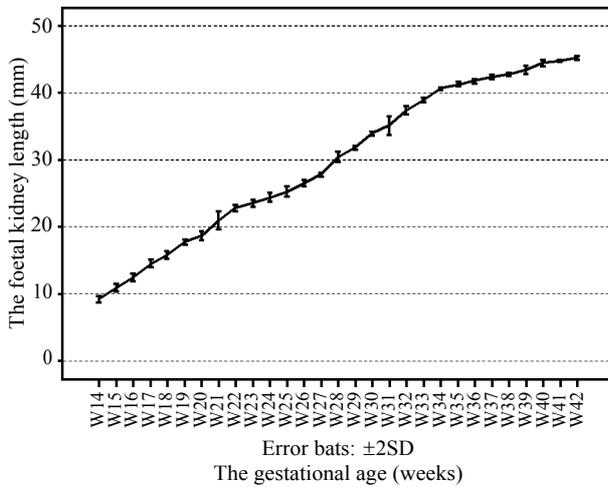
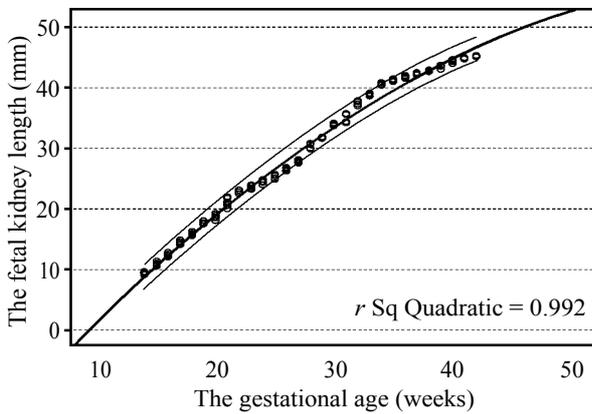


Chart (1): Crude values of the means of the foetal kidney lengths $\pm 2SD$ (mm) according to the gestational ages in weeks.

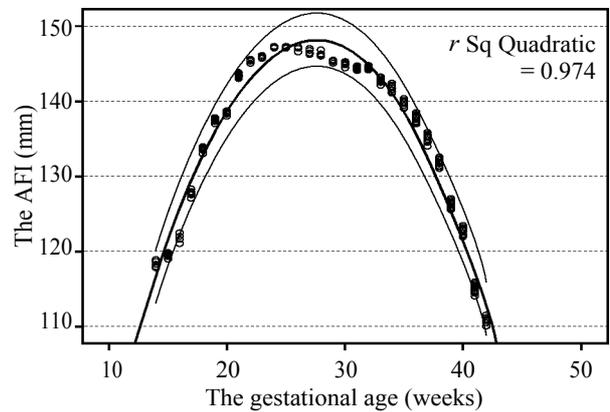


Chart (4): Represents the crude values of the means of the AFI $\pm 2SD$ (mm) according to the gestational ages in weeks.



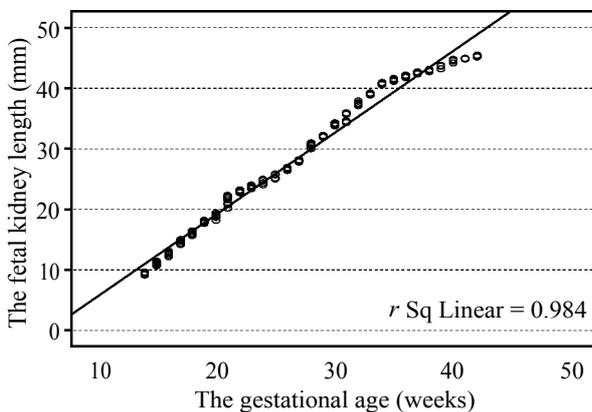
O	: Observer	Middle	— : 50th percentile
Upper	: 95th percentile	Lower	— : 5th percentile

Chart (2): 5th, 50th and 95th percentiles of the foetal kidney lengths according to the gestational ages after being submitted to a smoothing process using the quadratic polynomial adjustments.



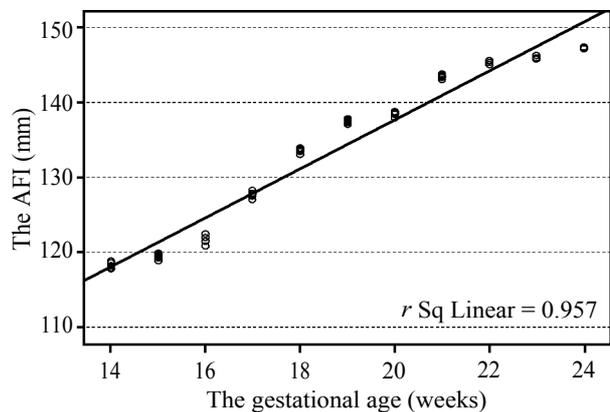
O	: Observer	Middle	— : 50th percentile
Upper	: 95th percentile	Lower	— : 5th percentile

Chart (5): Represents the 5th, 50th and 95th percentiles of the AFI according to the gestational ages after being submitted to a smoothing process using the quadratic polynomial adjustments.



O	: Observed	: Linear
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Chart (3): Represents a scatter plot between the gestational age and the foetal kidney length showing the best fit line.



O	: Observed	: Linear
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Chart (6): Represents a scatter plot between the gestational ages from 14 to 24 weeks and the AFI showing the best fit line.

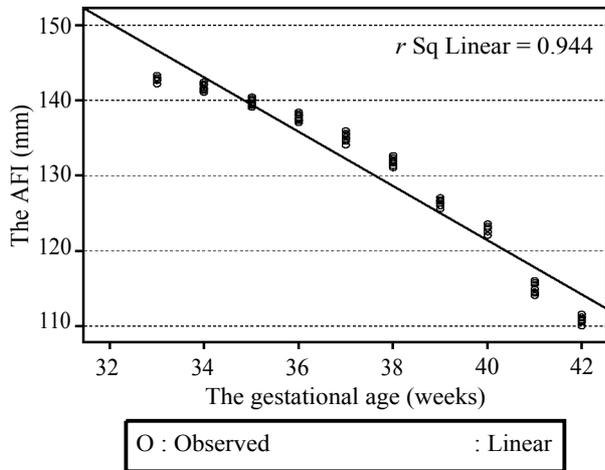


Chart (7): Represents a scatter plot between the gestational ages from 32 to 42 weeks and the AFI showing the best fit line.

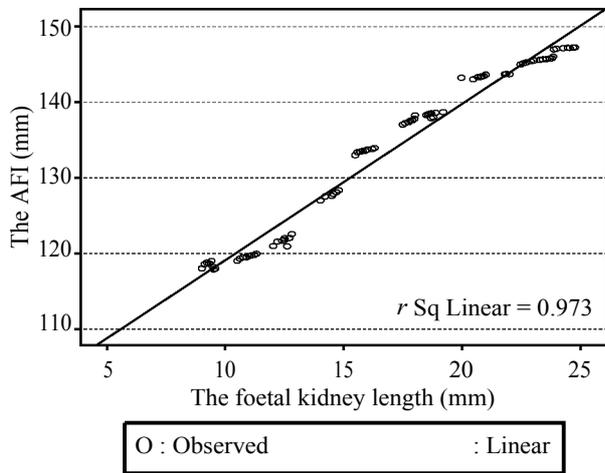


Chart (8): Represents a scatter plot between the foetal kidney length and the AFI from 14 to 24 weeks showing the best fit line.

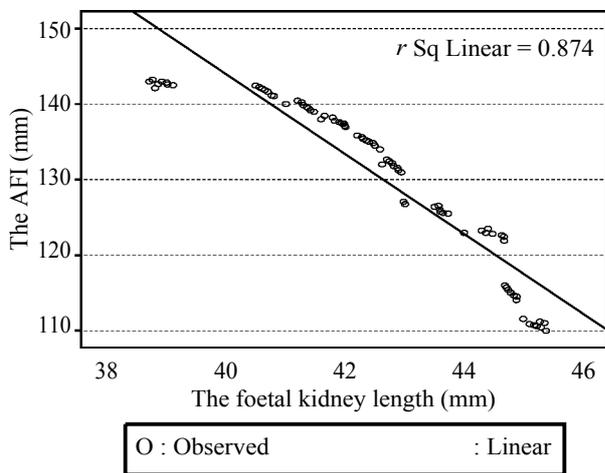


Chart (9): Represents a scatter plot between the foetal kidney length and the AFI from 33 to 42 weeks showing the best fit line.

Discussion

The present study dealt with the foetal kidney length as a parameter because the foetal growth variation affected all the organs including the antero-posterior and transverse dimensions of the kidney; however its length remained more or less unaffected as declared by Konje et al., [22] and Toosi and Rezaie-Delui [23]. Witzani and others [24] suggested that the foetal kidney length measurements obtained by the MRI were close to those obtained by the ultrasonography. Gupta and co-workers [25] and Chatterjee et al., [26] reported that the foetal kidney length had a strong correlation with the gestational age in the late trimesters even in the intrauterine growth retardation fetuses.

The present work showed that the range of the mean foetal right kidney length was from 9.31mm at the 14th week to a maximum of 45.22mm at the 42nd week of gestation. There was a uniform increase in its length of an approximately 1mm every week which comes in agreement with the result of Bertagnoli et al., [27] and Bardhan et al., [28]. They observed that the renal length in millimeters at any given gestational age was nearly corresponding to the gestational age in weeks and suggested a rule of thumb that was the renal length in millimeters approximated the gestational age in weeks. Hence, the foetal kidney length could be a fascinating tool in the determination of the gestational age without using any software as reported by Kaul et al., [29] and Kumar et al., [30].

An accurate estimation of the foetal age has clinical implications principally in the management of the high risk pregnancies [31,32].

The present study revealed a significantly strong positive correlation between the gestational age and the foetal kidney length. This comes in agreement with Ahmadi et al., [2] in Iran, Bardhan et al., [28] in India and Ugur et al., [33] among Turkish.

They added that in the cases of the engaged foetal head, that finding proved its worth, where it was difficult to measure the BPD and HC as well as in the cases of intrauterine growth retardation, macrosomia and malformation where the AC measurement gave false values.

The present work exhibited that the best fit line was with the linear regression equation of: The predicted gestational age from the kidney length = $6.315 + 0.727 X$ the foetal kidney length ± 1.078 . The present finding agrees more or less with Chatterjee et al., [26] and Saxena et al., [5] who reported that the foetal kidney length among Indians could

be used as an individual parameter in estimating the gestational age, especially in the later trimesters, where the biometric indices might not be much reliable.

Moreover, Goyal et al., [34] reported that among Indians, the foetal kidney could be seen easily sonographically at the 16th gestational week. They added that the FL was the most accurate single parameter followed by the foetal kidney length. The BPD was the least accurate one. The standard errors were ± 7.95 , ± 9.56 and ± 9.86 days, respectively. They concluded that the foetal kidney length could be used alone or easily incorporated into the model for dating pregnancies after the 16th week of gestation, especially when the BPD and FL were difficult to be measured.

The present work revealed that the range of the mean \pm the SD of the AFI increased from 118.32 ± 0.4 mm at the 14th week to a maximum of 147.16 ± 0.09 mm at the 24th week of gestation. Then, the mean \pm SD of the AFI took a plateau form from 147.13 ± 0.08 mm at the 25th week to 144.35 ± 0.24 mm at the 32nd week of gestation. Lastly, the mean \pm SD of the AFI decreased from 142.72 ± 0.33 mm at the 33rd week to 110.83 ± 0.47 mm at the 42nd week of gestation. Although Hebbar et al., [35] in India recorded different means \pm SD of the AFI values starting from the 34th week to the 39th week of gestation, they coincided with the decreasing values observed in the present work.

This finding comes in agreement with that of Brace [36] who stated that the mechanism of the amniotic fluid production, consumption, composition and volume depended on the gestational age. Fernando [37] reported that the amniotic fluid volume at any time was a balance between the production and consumption. During the first trimester, the major source of the amniotic fluid was the maternal blood and the secretion from the amnion. He observed that it increased rapidly in the first half of pregnancy then it increased slowly till the 37th week. Thereafter, it declined gradually till the 42nd week. Dutta [38] added that the study of the amniotic fluid provided useful information about the foetal well-being and maturity.

Jeng et al., [21] in Taiwan found that from 13 weeks' gestation, the AFI increased progressively until 26 weeks. From then to 38 weeks, the AFI measurements demonstrated a little variation. After 38 weeks, the AFI declined gradually towards term. They attributed that reduction to the decreased lung secretions as the baby approached term.

However, doubts remain concerning the normal values of the AFI for each gestational age as stated by Machado et al., [39]. They demonstrated that new data were needed; using reliable reference low-risk pregnant women samples, to establish the AFI limits that would indicate the perinatal risks. They confirmed that some existing curves were based on relatively small sample sizes and a normal AFI for each gestational age was not yet definitely established. Moreover, Lei and Wen [40]-the authors of a Chinese curve-suggested that different normality reference curves were needed to establish the AFI in the different populations.

The present study indicated that there was a significantly strong positive correlation between the AFI and the gestational age from 14 to 24 weeks ($r=0.978$, $p=0.000$). The best fit line was with a linear regression equation of: The predicted gestational age= $-20.740 + 0.296 X$ the AFI ± 0.661 . There was a significantly strong negative correlation between the gestational age from 33 to 42 weeks and the AFI ($r=-0.972$, $p=0.000$). The best fit line was with a linear regression equation of: The predicted gestational age= $71.575 - 0.261 X$ the AFI ± 0.688 .

Kofinas and Kofinas [41] in the USA observed that in the normal pregnancy, the AFI mean was 14.0cm at 27 weeks and decreased to 11.4cm at 42 weeks ($r=-0.25$, $p=0.000$).

Araujo et al., [42] reported that the mean AFI in a Brazilian population ranged from 12.2 ± 2.6 cm at 18 weeks to 11.6 ± 6.0 cm at 38 weeks of pregnancy. The correlation between the AFI and the GA was best represented by a linear equation of: The AFI= $17.78 - 0.153 X$ the GA.

Peixoto et al., [43] introduced reference values for the AFI from the 26th week to the 42nd week of gestation in a low-risk Brazilian population. They stated that the mean of the AFI ranged from 14.0 ± 4.1 cm at the 26th week to 8.3 ± 4.7 cm at the 42nd week, respectively. The best linear regression equation for the results' representation was: The AFI= $16.29 - 0.125 X$ the GA. Ugur et al., [33] found a moderately negative correlation between the GA and the AFI ($r=0.499$) after 24 weeks of pregnancy in the Turkish.

Porter et al., [44] in the USA during a study on two hundred eighty-two uncomplicated sets of twins between 25.5 and 40.5 weeks' gestation found the regression equation relating the median AFI to the gestational age was: The AFI= $19.4 - 0.12 X$ the gestational age.

The differences between the obtained data in the present study and the other authors' results could be attributed to the variability in the tested gestational age groups and/or populations. The differences in the used ultrasonographic devices and the observers' bias might play a role.

The present study introduced charts for the 5th, 50th and 95th percentiles of the foetal kidney length and the AFI according to the gestational age after being submitted to a smoothing process using the quadratic polynomial adjustments. The importance of such curves was due to their greater capacity to identify abnormal cases as mentioned by Machado et al., [39]. They mentioned that if the 5th percentile was used as the lower normal limit, then there would be a less likelihood of missing a case of areal oligohydramnios.

The present study exhibited that there was a significantly strong positive correlation between the AFI and the foetal kidney length from 14 to 24 weeks of gestation ($r=0.986$, $p=0.000$). The best fit line was with a linear regression equation of: The predicted gestational age= $98.487 + 2.064 X$ the AFI ± 1.735 . On the other hand, there was a significantly strong negative correlation between the foetal kidney length and the AFI from 33 to 42 weeks of gestation ($r=-0.935$, $p=0.000$). The best fit line was with a linear regression equation of: The predicted AFI= $354.377 - 5.261 X$ the foetal kidney length ± 3.841 . According to the available literature, no previous research discussed the correlation between the AFI and the foetal kidney length as early as the second trimester of pregnancy.

Conclusion:

The present work establishes reference values for both the foetal kidney length and AFI in the normal Upper Egyptian pregnancies. It also exhibits the correlation between the foetal kidney length and AFI as early as the second trimester of pregnancy. Therefore, the obtained data could be useful in the prediction of a variety of abnormalities and in the assessment of the gestational age when the date of conception is uncertain.

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نمو كلية الجنين وتكوين السائل الأمنيوسي في حالات الحمل في صعيد مصر

مقدمة: إن نمو كلية الجنين مهم لأداء وظيفتها الطبيعية. يستخدم مؤشر السائل الأمنيوسي لتقدير حجم السائل الأمنيوسي والمصدر الرئيسي له هو بول الجنين.

الهدف من الدراسة: إنشاء قيم مرجعية لطول كلية الجنين ومؤشر السائل الأمنيوسي خلال الثلثين الثاني والثالث من الحمل في حالات الحمل الطبيعية في صعيد مصر وتوضيح العلاقات بين هذه القياسات.

طريقة البحث: تم إجراء فحص بالموجات فوق الصوتية لقياس طول كلية الجنين ومؤشر السائل الأمنيوسي على ٢٣٢ امرأة طبيعية حامل من الإِسبوع الرابع عشر إلى الإِسبوع الثاني والأربعين من الحمل. تم تحليل العلاقات بين القياسات إحصائياً.

النتائج: زاد طول كلية الجنين تدريجياً مع تقدم الحمل وكان هناك ارتباط معنوي إيجابي بين طول كلية الجنين وعمر الحمل. وأظهر الإنحدار الخطي أن عمر الحمل يمكن تقديره باستخدام طول كلية الجنين بدقة تصل إلى ± 1.078 أسبوعاً. زاد مؤشر السائل الأمنيوسي من الإِسبوع الرابع عشر بإضطراد حتى الإِسبوع الرابع والعشرين. كان هناك ارتباط إيجابي بين مؤشر السائل الأمنيوسي وعمر الحمل وكذلك بين مؤشر السائل الأمنيوسي وطول كلية الجنين. أظهر مؤشر السائل الأمنيوسي تباينات قليلة من الإِسبوع الخامس والعشرين إلى الإِسبوع الثاني والثلاثين. تناقص مؤشر السائل الأمنيوسي تدريجياً من الإِسبوع الثالث والثلاثين. وكان هناك ارتباط سلبي بين مؤشر السائل الأمنيوسي وعمر الحمل وبين مؤشر السائل الأمنيوسي وطول كلية الجنين.

الخلاصة: تقدم هذه الدراسة قيم مرجعية لكل من طول كلية الجنين ومؤشر السائل الأمنيوسي في حالات الحمل الطبيعية في صعيد مصر. كما تناقش العلاقة بين طول كلية الجنين ومؤشر السائل الأمنيوسي من الثلث الثاني من الحمل، في البداية تكون علاقة طردية، ثم تظهر تباينات طفيفة وأخيراً تصبح علاقة عكسية.