DETERMINATION OF GESTATIONAL AGE OF HUMAN FOETUSES FROM
CROWN HEEL LENGTH, CROWN RUMP LENGTH, FOOT LENGTH AND
ABDOMINAL CIRCUMFERENCE

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RESEARCH ARTICLE

DETERMINATION OF GESTATIONAL AGE OF HUMAN FOETUSES FROM CROWN HEEL LENGTH, CROWN RUMP LENGTH, FOOT LENGTH AND ABDOMINAL CIRCUMFERENCE

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ABSTRACT

Introduction: Several anatomical parameters are useful in the assessment of gestational age in human foetuses. Estimation of gestational age of human foetuses is of great medico-legal importance.

Aims and Objective: The present study aims to estimate gestational age of human foetuses using crown heel length, crown rump length; foot length and abdominal circumference.

Materials and Methods: After permission from the Institutional Ethical Committee the foetuses were collected from MGM Medical College, Hospital, Navi Mumbai, India. The measurements crown heel length, crown rump length; foot length and abdominal circumference of foetuses were measured.

Result: The crown heel length, crown rump length; foot length and abdominal circumference of foetuses increases with the increase in gestational age.

Conclusions: The knowledge of measurement of crown heel length, crown rump length; foot length and abdominal circumference on human foetuses is helpful in anatomy, forensic medicine, foeto-pathology, medical imaging, obstetrics and pediatrics.

INTRODUCTION

Gestational age is not the same as fertilization age. It takes about 14 days from the first day of the last menstrual period for conception to take place and thus for the conceptus to form. The age from this point in time (conception) is called the fertilization age and is thus 2 weeks shorter than the gestational age.

Thus a 6 week gestational age would be a 4 week fertilization age. Some authorities however casually interchange these terms reader is advised to be cautious. An average gestational period (duration of pregnancy from the first day of the last menstrual period up to delivery) is 280 days. On average, this is 9 months and 6 days (Ohuma EO *et al,* 2013). Accurate estimation of gestational age is important in obstetric care. Accurate prediction of gestational age is very important in the management of high risk pregnancies in order to prevent premature deliveries (R. Mhaskar *et al,* 1989). Knowledge of gestational age may assist obstetricians in appropriately counselling women who are at risk of a preterm delivery about likely neonatal outcomes and is also essential in the evaluation of fetal growth and the detection of intrauterine growth restriction (Kalish RB *et al,* 2009).

Estimation of gestational age of foetus is of great medico-legal Importance (Castellana C *et al,* 1999). It is of extreme importance in supporting the charge of infanticide by knowing that whether the baby born was alive and had a separate existence from the mother and that a wilful act of commission or omission caused its death (Kumar GP *et al,* 1993). Various physical parameters like foot length, hand length, head circumference, biparietal diameter, chest circumference, abdominal circumference, femur length, weight and appearance of ossification centres has been utilized for the estimation of gestational age (Bardale R *et al,* 2008). In addition, accurate fetal age estimation is very important in obstetric and pediatric clinical practice (Alexander G. R *et al,* 1990). The current study was carried out, to help the investigating authorities to solve legal problems in relation to foetuses. Main objectives of the present study were to estimate gestational age of human foetuses using crown heel length, crown rump length, foot length and abdominal circumference.

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MATERIALS AND METHODS

The present study was carried out on 70 normal human foetuses, aged between 10th to 38th gestational weeks. The normal foetuses were obtained from the Department of Obstetrics and Genecology, MGM Medical College, Navi Mumbai and MGM Hospital, Kalomboli, Navi Mumbai. After ethical review and permission from the concerned authorities of various institutes, the foetuses were collected in 10% formalin for carrying the present study. The foetuses included the spontaneous abortion and still born foetuses. Cases with any anomaly or pathology were not included in the study.

Determination of the age of the foetuses

The age of foetuses was calculated from the obstetrical history. The parameters considered for the present study includes Gestational age, Crown heel length and Crown rump length, Foot length and Abdominal circumference. Crown heel length was taken by foetus placed in supine position with all limbs extended and measurement taken from the crown of the head to the heel in foetuses with foot held in vertical position (Davidson S *et al,* 2008), while Crown rump length was measured by placing foetus in prone position with all limbs extended and measurement taken from the top of the head (crown) to the bottom of the buttocks (rump) (Merlob P *et al,* 1986). Foot length was measured from the heel to the end of the big toe and Abdominal circumference was measured at the level of umbilicus on foetuses. The measurements were taken with the help of thread and measuring scale. Vernier calliper was also used to take the measurements. All the measurements were recorded in millimetres.

OBSERVATIONS AND RESULTS

The present study was carried out in the Department of Anatomy, MGM Medical College, Navi Mumbai, from January 2015 to December 2015. Total 70 human foetuses ranging from 10th to 38th weeks were studied during the present study. To estimate the gestational age, the following parameters were studied.

Figure 1 Measuring Crown heel length (CHL), Crown rump length (CRL), Foot length (FL) and **Abdominal circumference** of foetuses.

1. Crown heel length (CHL)
2. Crown rump length (CRL)
3. Foot length (FL)
4. Abdominal circumference (AC)

The results of average crown heel length, crown rump length, foot length and abdominal circumference is shown in Table 1.
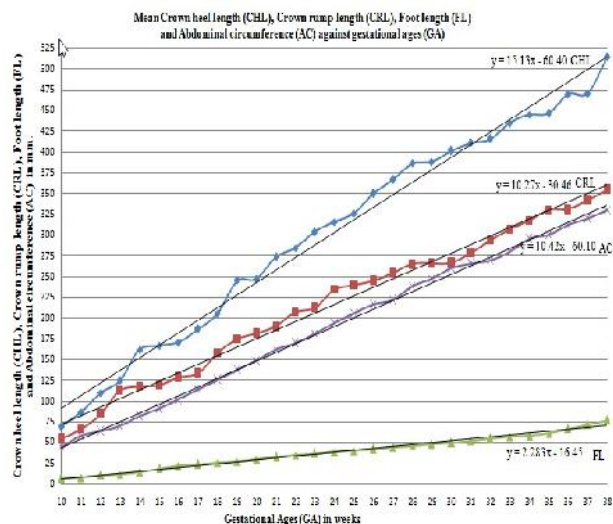

Figure 2 Scatter diagram showing linear co-relationship of Crown heel length (CHL), Crown rump length (CRL), Foot length (FL) and Abdominal circumference (AC) against gestational ages (GA).

Table 1 Mean Crown heel length (CHL), Crown rump length (CRL), Foot length (FL) and Abdominal circumference (AC) against gestational ages (GA).

GA (in weeks)	No. of foetuses	CHL (in mm)	CRL (in mm)	FL(in mm)	AC (in mm)
10	2	70	55	7.2	45
11	1	87	67	7.8	58
12	3	110	85	11	64
13	1	125	113	11.5	70
14	2	162	118	14.2	82
15	2	167	119	18.5	91
16	3	171	129	22	102
17	3	187	134	24	114
18	2	206	158	26	126
19	2	245	175	27	138
20	3	247	182	30	149
21	3	274	190	33	162
22	4	285	207	35	170
23	2	304	213	37	181
24	3	316	234	39	194
25	2	326	240	40	206
26	3	350	245	42	217
27	3	367	254	44	222
28	2	386	265	46	238
29	3	388	266	48	247
30	3	402	267	50	260
31	2	411	279	52	266
32	2	416	294	55	270
33	2	435	307	57	280
34	2	445	317	58	296
35	2	447	330	61	300
36	3	470	331	67	312
37	1	471	342	72	320
38	4	515	355	77	330

DISCUSSION

Gestational age estimated by crown heel length in the present study coincide well with that of Fok T *et al,* 2003, Archie J.G

et al, 2006, , Davinson S *et al,* 2008. Aryal DR *et al,* 2012. Similarly fetal age estimation using crown rump length in the present study is in agreement well with that of Merlob P *et al,* 1986, Archie J.G *et al,* 2006,, while it is less compared to the findings obtained from the study of Hadlock *et al,* 1982. Streeter GL 1920 has mentioned foot length only as an additional control for the determination of the foetal age. He related the disadvantage of the foot length as compared with the crown rump length in the analysis of the age because being smaller than crown rump length; foot length would have a smaller weekly increment. However, Usher and McLean 1969, have used foot length measurement in classification of postpartum infants. Mercer BM *et al,* 1987, foot length was considered as a predictor of age in special clinical cases from ultrasonographic measurement.

In the present study foetal foot length and abdominal circumference showed good correlation with the gestational age and is in agreement with Pandey VD *et al,* 2015. On comparing the results of the present study with that of previous researchers, we concluded that the present study is in agreement with that of some previous studies, while some findings were deviating owing to the difference in amount of data and population, sample size of study, genetic and environmental factors which affects the foetal development and interfere with the accurate age estimation to the particular area studied.

CONCLUSION

In the normally developing foetuses the crown heel length, crown rump length; foot length and abdominal circumference increases with advancing gestational age. These parameters have shown a significant correlation with gestational age and these parameters are the best parameters for determining gestational age and should be used by researchers because these methods are non invasive, simple to perform and less time consuming. CRL is the best parameter to determine gestational age in the first trimester, in the second and third trimester, estimation of gestational is accomplished by measuring the CHL, FL and AC. The knowledge of measurement of crown heel length, crown rump length; foot length and abdominal circumference on human foetuses is helpful in anatomy, forensic medicine, foeto-pathology, medical imaging, obstetrics and pediatrics.

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