ESTIMATION OF FETAL WEIGHT BASED ON ANTHROPOMETRICAL FETAL GROWTH MEASUREMENTS

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ABSTRACT

To develop a more accurate fetal weight model using fetal anthropometrical measurements.

The total number of fetuses (n= 180), according to gestational age and sex was divided in three groups, (first group 14-16 g.a.; second group 17-19g.a and the third group 20-22g.a). Anthropological measurements were done using the methodology of the International Biological Programme with standard technique of the measurements.

Some anthropometrical parameters of the fetus were analyzed. Measurements included: fetal weight, fetal head, chest, abdominal circumferences and longitudinal parameters (humerus and femur length).

Results showed that anthropometrical parameters of the fetus were in positive correlations with fetal weight, and their values were increased in different groups according to gestational age.

Fetal anthropometric models are strongly predictive of actual fetal weight. The need for using measurements of some anthropometrical parameters of the fetus are imposed as sensitive, safe and simple, and above all compelling in routine clinical practice.

Key words: *fetus, feta! weight, anthropometrical parameters, gestational age.*

Introduction

We know that certain parts of the fetus grow and develop differently during the fetal period. With mutual correlation of the dimensions obtained with anthropometric measurements, we can determine the period when certain parts of the fetus dominate in their growth and development.

According to some authors, the entire growth of the human fetus is hyperplasic, i.e. the increase of weight is not equal during the lunar months (1).

For a long time the weight of the fetus was considered the only criterion in the nomenclature and classification of new bom children (infants). Weight is considered to be the most sensitive indicator for the abnormal development of the fetus because it is strongly influenced by the intrauterine environment (Tanner JM). (2). That is why there are different views from authors of different parts of the world when it comes to explaining which is the lower limit of the weight for the corresponding gestational age.

Apart from the fact that there are differences in the factor which influence the weight of the fetus, such as economically-social composition of the population, geographic conditions, etc, the curve of the growth also changes in different environments. For that reason, and at the recommendation of WHO (3), other, more stable parameters are included in the classification, such as gestation length, crown-rump length, head circumference, abdomen circumference, limbs circumference (upper arm length, lower arm length...).

These recommendations opened up new phases for the use of other anthropometric parameters which highly correlate with gestation and fetal weight, with the use of which we can increase the precision in determining the regular intrauterine development of the fetus (4).

Aim: Assessment of the fetal weight which is based on the measurement of certain anthropometric parameters appropriately with the gestational age.

Material and Methods

The material consists of 180 fetuses obtained ex utero divided into 3 age groups: first group (14-16 g.a.); second group (17-19 g.a) and third group (20-22 g.a). Each group was divided in

subgroups according to the sex criterion. Gestational age and fetuses without any visible anatomic macroscopic malformations served as criteria.

The following anthropometric parameters were measured: body weight; the longitudinal dimensions of the body were presented with the following anthropometric parameters: body length, upper limb length (upper arm and lower arm) lower limb length (upper leg and lower leg), head circumference, biparietal diameter, chest circumference and abdomen circumference.

Anthropometric measurements were done following the International Biological Programme with standard equipment and measurement technique.

Central tendency and variability were used from the descriptive statistics, SD, X, MED, MIN, MAX. The correlation between certain anthropometric parameters was determined with regressive analysis and correlating coefficients.

Results

The results show that the weight as a basic characteristic and indicator of the physical growth is of great practical importance because it supplies information whether the fetus's weight is normal for the gestational week or there are some deviations which lead to an abnormal development of the fetus. Of the obtained values in table 1 and 2 (a, b and c) for the weight, it was noticed that the weight increased for both sexes with the increase of the gestational week. In the first group the value of body weight for male fetuses had the mean value X =165.33, in the second group 228.50 and in the third 411.83.

Body length, as one of the more important longitudinal parameters, shows the height of the fetus and points to its dependence on the gestational age, and in the first group it had an average value of 19.42, in the second group 21.60 and in the third .group 26.52, which can also be seen from the other linear parameters like the length of the upper and lower limb. The values of the descriptive statistics in the given charts for the measured anthropometric parameters show that all the stated values depend on the gestational age.

Discussion

Since the intrauterine stagnation of the fetal growth reflects the birth weight of the fetus, Thomson et. all (5) believe that it is logical to determine body weight if we put it in correlation with other fetal parameters, and this was proved with the biparietal diameter which correlates with gestational age (r=0.85) and is a good indicator in the assessment of fetal weight, especially in fetuses of 250-420 gr., as well as with the abdomen circumference which showed high correlation (r=0.82). Recently Weiner and associates (6, 7) have suggested a formula for a more precise assessment of the body weight in correlation with the head circumference and abdomen circumference and they also included a third anthropometric parameter which can have a significant influence on the assessment of the weight, and that is the length of the upper leg (r=0.90), by which we get more precise results, especially for fetuses with low body weight, which was also proven in our study.

It is considered that the period of the intrauterine growth of the fetus is accompanied with both weight and length increase (8). What is especially characteristic is the fact that this anthropometric parameter is tightly connected with the gestational age, which was mentioned back in 1970 by Scammon and Calkins (9) who determine it as a possible parameter that can replace body weight in the assessment of the regular/correct development of the fetus.

Circumferences, as a total of several measurements (bone, muscular component), are very important in following the regular intrauterine growth of the fetus. This is especially true of the abdominal circumference which points to the regular development of the abdominal organs, and it is 11.15 cm in female and 10.66 cm in male fetuses, unlike Croatia, where the value of this parameter is 12.04 cm. The upper leg circumference for the fetuses we examined is 6.22 cm for males, 6.43 cm for females, and slightly lower were the values in Slovenia 5.30 cm (10).

Table 1 .a. Values of some anthropometrical parameters in male fetuses

n = 30 (14-16 g.w)	Body weight(gr)	Body lenght(cm)	Head circumf.	BPD(cm)	Chest circumf.	Abdominal circumf.	Femur lenght (cm)	Humerus lenght (cm)
X	165.33	19.42	16.32	3.75	11.62	10.18	2.97	3.12
SD	54.17	2.66	16.29	0.47	1.78	1.86	0.44	0.53
MED	152.5	19.7	13.75	3.8	11.45	9.8	2.9	2.95
MIN	70	15	10.2	2.6	8.3	6.5	2.3	2.2
MAX	250	25	10.2	4.7	17.2	13.4	3.9	4.1

Table l.b. Values of some anthropometrical parameters in male fetuses

n = 30 (17-19 g.w)	Body weight(gr)	Body lenght(cm)	Head circumf.	BPD(cm)	Chest circumf.	Abdominal circumf.	Femur lenght(cm)	Humerus lenght (cm)
X	228.50	21.60	14.67	3.89	12.85	11.15	3.27	3.53
SD	96.23	2.97	2.01	0.48	2.06	1.88	0.65	0.55
MED	190	20.7	14.6	3.8	12.15	11.25	3.4	3.5
MIN	110	16.6	11	2.9	10	8	2	2.4
MAX	520	28	18.5	4.9	17.4	15	4.5	5

Table 1. c. Values of some anthropometrical parameters in male fetuses

n = 30 (20-22 g.w)	Body weight (gr)	Body lenght (cm)	Head circumf.	BPD(cm)	Chest circumf.	Abdominal circumf.	Femur lenght (cm)	Humerus lenght (cm)
X	411.83	26.52	18.50	5.05	15.57	14.02	3.98	4.25
SD	114.62	2.77	2.01	0.75	2.02	2.15	0.69	0.66
MED	402.5	26.35	18.65	5.2	15.65	13.95	3.95	4.15
MIN	235	21.3	14.4	3.9	10.3	10.5	2.6	3.2
MAX	605	30.5	22	7.8	19	17.4	6	5.7

Table 2. a. Values of some anthropometrical parameters in female fetuses

n = 30 (14-16 g.w)	Body weight (gr)	Body lenght (cm)	Head circumf.	BPD(cm)	Chest circumf.	Abdominal circumf.	Femur lenght (cm)	Humerus lenght (cm)
X	158.17	19.60	13.12	3.71	11.45	9.77	2.83	3.14
SD	51.05	2.14	1.50	0.53	1.32	1.42	0.37	0.57
MED	142.5	19.5	13.1	3.65	11.4	9.6	2.8	3.2
MIN	70	15	9.7	2.8	8.7	7.1	2.1	2.1
MAX	280	24.5	16.6	5	13.9	13.1	3.6	4.5

Table 2. b. Values of some anthropometrical parameters in female fetuses

n = 30 (17-19 g.w)	Body weight(gr)	Body lenght(cm)	Head circumf.	BPD(cm)	Chest circumf.	Abdominal circumf.	Femur lenght (cm)	Humerus lenght (cm)
X	214.83	21.24	14.60	4.07	12.58	10.66	3.38	3.30
SD	97.24	2.90	2.24	0.88	1.99	2.23	0.66	0.54
MED	187.5	20.25	14.55	4	12.35	10.05	3.4	3.2
MIN	100	16.2	10.5	2.6	9.2	7.1	2.1	2.4
MAX	520	27	20	6.9	17.6	16.5	5.3	4.5

Table 2. c. Values of some anthropometrical parameters in female fetuse

n = 30 (20-22 g.w)	Body weight (gr)	Body lenght (cm)	Head circumf.	BPD(cm)	Chest circumf.	Abdominal circumf.	Femur lenght (cm)	Humerus lenght (cm)
X	421.5	26.73	18.31	5.05	15.82	14.32	4.01	4.15
SD	95.86	2.63	2.39	0.78	2.71	2.03	0.61	0.60
MED	425	26.9	18.5	4.95	16.05	14.4	3.85	4.15
MIN	255	20.7	12.8	3	4.5	10.5	3	3.2
MAX	650	33.5	23.3	6.6	19.8	19.6	5.5	5.5

Conclusion

Many authors consider that the measurement of fetuses can also be an additional method which will give information for the fetal growth as well as for the changes which can occur during its growth and development. The measurement of the anthropometric parameters can help to create a model which will be used to predict the fetal weight, since the anthropometric parameters, as reliable fetal parameters, are considered to participate in the assessment of the fetal growth and development, as well as in diagnosing early intrauterine malformations. The information about the values of these anthropometric parameters of the fetal head has a great importance in the perinatal medicine, considering the fact that they are also parameters which are measured with ultrasound during the entire intrauterine development.

Our results can be used for developing certain anthropometric criteria which are used in the assessment of the fetal growth.

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