

## ANTHROPODYNAMICAL STATUS OF THE CHILDREN SINCE THEIR BORN UP TO THE AGE OF TWO YEARS

Osman Muftić, Jasna Jurum –Kipke, Diana Milčić, Milivoj Novak

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### Summary

*In this work our intentions were directed in the analysis of the anthropo- measures of the children since their born up to the age of two years depending to respective harmonically canon.*

*Special attention we have paid to the modelling of the biomechanical wire model of the selected children, partially because of its importance that biomechanics should have in growing process of the baby. An exact analysis of a child's figure in describing of its motion is a very complex task. Moreover, it is complex also in the cases when many parameters of the motion are simplified. Results proved the idea of possible interpretation of the wire model which corresponds to harmonically calculated values, as the basis for calculation of dynamical moments of inertia*

### 1. Introduction

Human measures, with this also at children, as a group of fundamental anthropological data, are widely elaborated in the specific literature. Unfortunately, there are mostly the data of adults and it is very seldom to find respective children's data and partially of the children since their born up to the two years. Knowing the values of these anthropometrical values are very important in a such examples when we use the biomechanics as the method of growing analysis.

### 2. Methods and materials

Harmonically constructed circle

The construction of harmonically circle is based according to Zederbauer on a regular triangle with hypotenuse  $a$ , and sides  $b$ , as it is shown in figure 1. After we draw over sides of triangle respective squares, we can finally draw the circle of radius  $R$  that passes through the peaks of a such geometrical construction. Mathematical relations between this geometrical values gives the harmonically numbers. Derived values of this relations are:

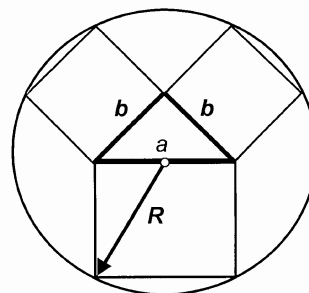


Figure 1. Harmonically constructed circle

$$a = 1; \quad R = \frac{\sqrt{5}}{2}; \quad b = \frac{\sqrt{2}}{2}; \quad r = b - \frac{a}{2}; \quad d = R - \frac{a}{2}; \quad b + r.$$

which we call the harmonically determined numbers. This harmonically numbers were applied on a many natural and artistic examples showing surprised correlations between the dimensions of analysed objects or subjects.

### 3. Harmonically circle and the net of a body lengths canons

As the first step in children's dynamic anthropometry was in determination of the two main anthropometric characteristics as they are body length (standing height) and actual weight of the body as the functions of canonical and harmonically dependence. On the same way as we determined for adults so called eight head length canon, it is possible to apply four head length canon to the relations of the anthropomeasures at newborn babies as it is shown in the figure 2. Confirmation to this hypothesis we found in the relative relationships of the fundamental compositions of the newborns and adults, as it is shown in Table 1.

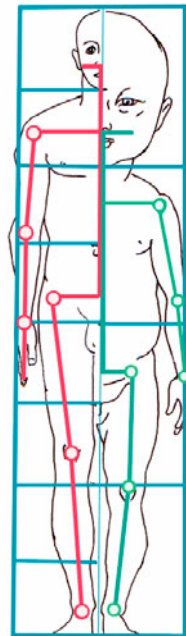


Figure 2. Comparative canons for an adult and newborn

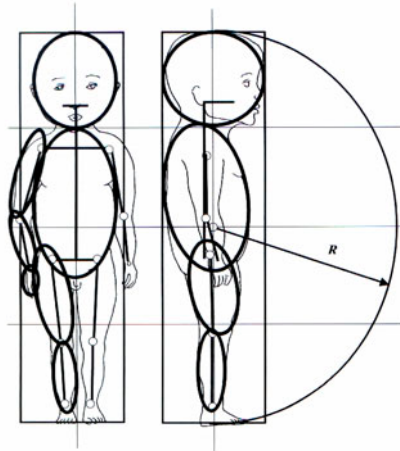
Table 1. Relative relationships of the body composition

Part	Newborn	Adult
Skin and fat	26%	25%
Intestines	16%	14%
Nerves	15%	3%
Muscles	25%	40%
Bones	18%	18%

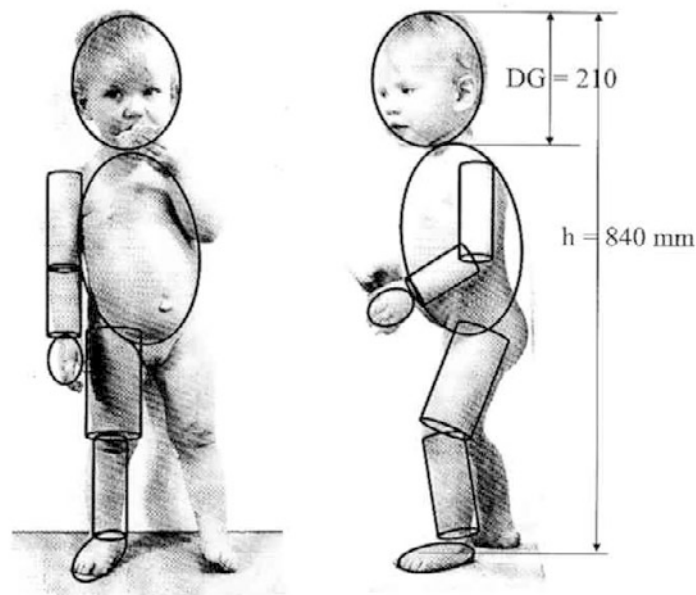
According with the four head length canon of the newborn babies well as the children of two years, we established respective net in two directions, as it was shown in the figure 4, 5 and 6.



**Figure 3. The newborn baby**



**Figure 4. The contour of the newborn baby-4 head length canon**



The girl of age 1,5 with  $h = 840$  mm

Associated canon 4HL  
Head length 210 mm

**Figure 5. The girl of 1,5 years with respective geometrical volumes wich replaces segmental parts – 4 head length canon**

There are also obvious differences of the canons application to the children and the adult. Our research in the dynamical anthropomeasures of children resulted as first with prove of harmonically validity between the segmental and dimensional values. From the shape of the newborn baby in two directions located in the net of four squares we defined approximate ellipsoids respectively to the body parts, according to the Fig. 4. From this approximation we calculated out respective volumes of body parts as follows:

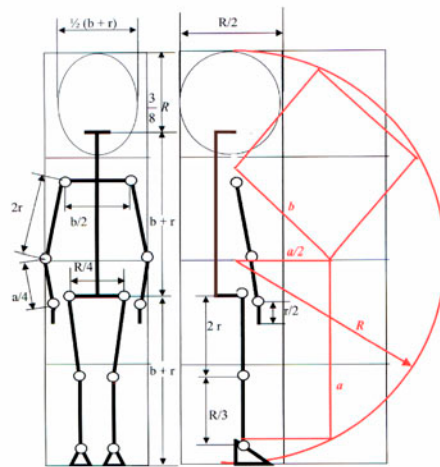
Head and neck - approximately:	$655,0 \text{ cm}^3$
Trunk:	$1962,5 \text{ cm}^3$
Hand:	$226,9 \text{ cm}^3$
Leg:	$250,0 \text{ cm}^3$

Total volume, of a such body with lengths of 50 cm, is  $3571,3 \text{ cm}^3$ , what gives with specific density  $\gamma = 1,09 \text{ kg/dm}^3$  the new borne body mass of 3,9 kg.

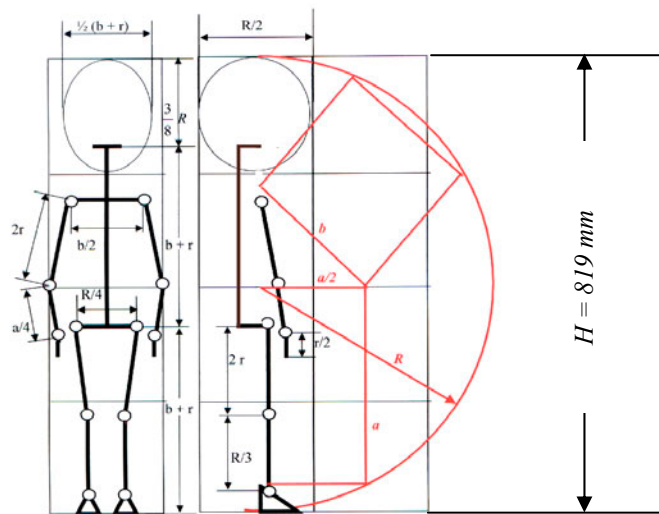
#### 4. Results

Mentioned volumes of the body segments gave out the prove of an approximate distribution of the new borne baby masses, which are together with the harmonically circle good tool for determination of the characteristic points of the joints of the body. From such an assuming we have made the wire model of the newborn baby as well as for baby of 1,5 years, as it is shown in the figures. It is obvious that the lengths of the body segments satisfy harmonically determined numbers as well as four and four and half head length canon as follows:

In the first example the length of the head is  $\frac{1}{4}$  of the body length (Fig.6). The length of the spine is  $b+r$ . The length of trunk is 0.375 of the body length. Upper arm is  $2r$ , and lower arm is  $a/4$  and hand is  $r/2$ . Upper leg is  $2r$ , and lower leg is  $R/3$ .



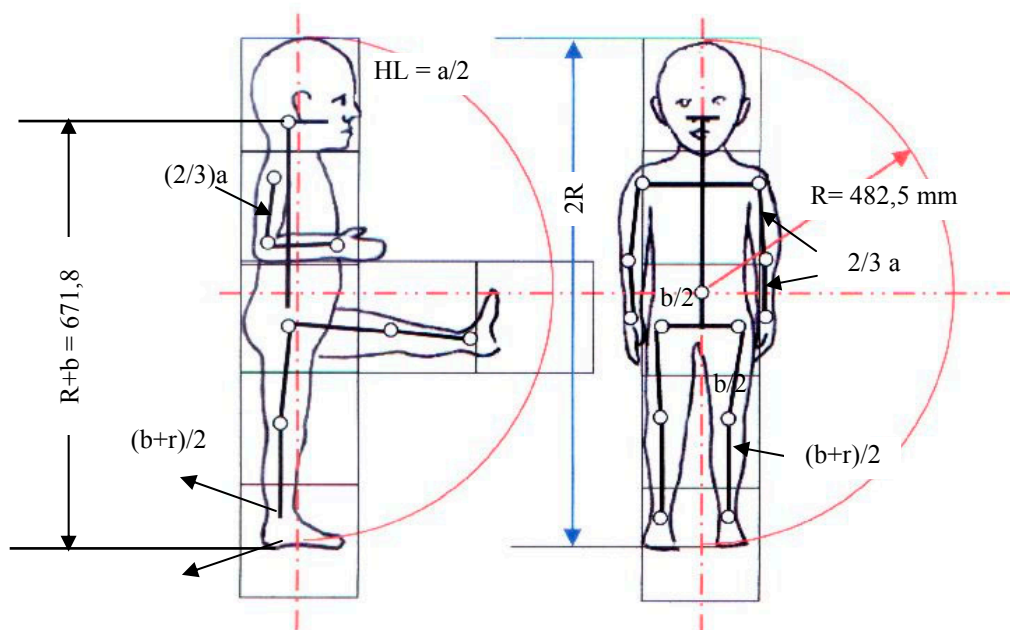
**Figure 6 . The wire model of the newborn on**



**Figure 7. The wire model of the 1,5 years child**

In the second example we used according to our measurements, for 1,5 years child the same four head length canon, as it is shown in the figure 7, where are shown harmonical values.

The third example, the Fig.8 shows harmonical relations when we applied the net of four and half head length canon.



**Figure 8. The wire model of the 2 years child –Four and half canon**

In this case the harmonical values, that comes out from the harmonical circle for examined subject are:

$R = 482,5 \text{ mm}; a = 431,56; b = 304,25; r = 88,47$  and  $b+r = 392,72 \text{ mm}$ .

## 5. Conclusion

The established method of drawing the newborn's contours and wire model by the application of harmonically circle and four head length canon represents an easy and simple method with the use of which it is possible to determine the linear anthropomeasures of the new born baby of different height within normal limits directly from the knowledge of his height from head to heel. It is also shown a relative good correlation between harmonical values in different head length canons.

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Osman Muftić, Faculty of Mechanical Engineering, Univeristy of Zagreb, Ivana Lučića 5, 10000 ZAGREB, Croatia, +382-1-6168-222, [osman.muftic@fsb.hr](mailto:osman.muftic@fsb.hr)  
 Jasna Jurum-Kipke, Faculty of transportation, Zagreb  
 Diana Milčić, Faculty of Graphical Art, Zagreb  
 Milivoj Novak, Clinical Hospital Rebro, Zagreb