Considerations upon Testing the Children's Somatic Development, Using the Computer

Carla Amira Karnyanszky, M.Sc. Stud.
Assist.Prof. Tiberiu Marius Karnyanszky, PhD
„Tibiscus" University of Timişoara, Romania

ABSTRACT: The aim of this study is to analyze the ways of the children's somatic-physical development. Two methods were evaluated: the comparison between the measured dimensions and the medium values, obtained from the specialized literature, and the one between the calculus of the proportionality rates and the medium rates for the population. Furthermore, this paper is based on a computer program that stores the history of children's growth, available for use in surveys on large communities (school, medical center, sport selection).
KEYWORDS: computer-aided selection, somatic development, proportionality rates

1. Introduction

Knowing the child's physical development level is of great social importance as it provides information on the health condition (with orientation towards the specialized medical care) as well as on the necessary criteria for guiding him/her towards certain activities and professional competences (perhaps towards a performance sport).

Therefore it may be considered that the assessment of the children and adolescences' health through morpho-functional elements characterizing their physical development must be a priority, both for the school doctor and for the Physical Education teacher, respectively for the trainer with whom they work individually at school classes.

The present study introduces to the assessment of the 15 years old children's developing level, based on the somatic-metric parameters determined

during the periodical evaluations carried out at the school medical cabinet, observing two aspects of the somatic developing level ([MKK05]):

- **The quantitative evaluation of the growing and developing process** by comparing the measured somatic-metric parameters with the average values for the sample population, according to age and sex;
- **The qualitative evaluation of the growing and developing process** by calculating the anthropometric proportionality indexes, using the measured parameters and their comparison to the average values for the observed population, according to age and sex.

2. Material and method

The study is based on the observations carried out on a group of school-aged ten girls whose stature, trunk height, the length of the superior limb, of the arm, forearm and hand; the height of the inferior limb, the hip, the shank and the leg; the span, the biacromial and the bitrochanterian diameter, the chest, the abdominal, the arm and forearm, the hip and shank perimeter.

The assessment of the growth level is done by comparing the measured values of the child somatic-metric parameters to their average values in the sample population, according to age and sex. The average values corresponding to the measured indexes for 15-aged girls are displayed in Table 1.

Table 1. *Values of the proportionality anthropometric indexes to assess the 14-18 years old girls' physic development (exemplification for 15 years old)*

No	Dimension	Abbreviation	-2 DS	MV	+2 DS
1	Stature	S	154,08	162,40	170,72
2	Bust height	BH	80,31	82,60	84,88
3	Superior limb length	SLL	63,12	71,00	78,87
4	Arm length	AL	20,45	24,60	28,75
5	Forearm length	FaL	21,00	25,00	29,00
6	Hand length	HL	16,11	18,40	20,68
7	Inferior limb length	ILL	87,39	98,20	109,01
8	Tight length	TL	45,91	49,20	52,49
9	Shank length	SL	35,18	41,60	48,02
10	Leg height	LL	4,05	7,40	10,75
11	Biacromial diameter	BiAcrD	30,31	32,60	34,88
12	Bispinal diameter	BispD	21,31	23,60	25,88
13	Bitrochanterian diam.	BitrD	26,56	29,60	32,63
14	Span	Sp	157,62	174,00	190,37

Yet, using these indexes only, even by comparing them to the average data in the specialized literature, may produce erroneous interpretations because:

- on a hand, the assessment of the development level of a somatic index only cannot be indicative for the development and harmonic stage of the assembly. Using one index cannot be a unique evaluation criterion of the development harmonic stage; this process can be carried out just be analyzing an ensemble of such somatic-metric parameters and proportionality indexes.

- on the other hand, the average quoted values resulted from studies from 20 years ago and the medicine, sports and physical education specialists' unanimous opinion is that a modification of the human body in time should be observed as it generally becomes longer.

Using the measures carried out as above, the proportionality indexes were calculated, according to the defining relations displayed in Table 2. Therefore, the characterization of the general individual's development is produced by establishing some proportionality relations between the ensemble and its segments.

Consequently to the analysis of the proportionality indexes the following result can be obtained:

- if the values determined on the basis of the measures parameters fall between the average values, with variations that do not surpass plus-minus a year, it can be assessed that the analyzed subject has a harmonious physical development, corresponding to his/her age;

- if the values match the column of the immediate following year, with the same variation limits, it can be assessed that the subject presents a harmonious, but accelerated development.

- if the values match the column of the inferior age with a year, with the same variation limits, it can be assessed that the subject presents a harmonious, but delayed development.

- if the values of the proportionality indexes exceed the limits of a year (plus or minus), for isolated or compact groups, it can be assessed that the subject presents a disharmonious physical development and, consequently, he/she needs guiding to specialized medical services.

Table 2. *Values of the proportionality anthropometric indexes to assess the 14-18 years old girls' physic development*

No	Anthropometric index	Age in years				
		14	15	16	17	18
1	Giufrida Ruggeri index Bust /S x 100 (%)	52,31	52,34	52,36	52,63	52,67
2	Adrian Ionescu index I_{AI} Bust –S/ 2	3,65	3,75	3,80	4,27	4,34
3	Report index of SL to stature SLL/ S x 100 (%)	43,30	42,77	42,86	43,35	43,62
4	Report index of IL to stature ILL / S x 100 (%)	47,68	47,65	47,63	47,36	47,32
5	Report index of span to stature SP / S x 100 (%)	100,50	100,31	100,29	100,20	100,24
6	Report index of biacrom. diam. to stature BiacromD / S x 100 (%)	21,39	21,88	21,94	22,09	22,36
7	Report index of bitroch. diam. to stature, BitrochD / S x 100 (%)	18,34	18,38	19,30	19,75	20,20
8	Brugsch-Goldstein Index I $_{BG}$ WPerim / S x 100 (%)	48,60	48,93	49,55	50,40	51,03
9	Report index of abdom. Perim. t stature, Abdperim/ S x 100 (%)	39,39	39,58	40,35	41,05	42,55
10	Report index of arm perimeter to stature, Aperim / S x 100 (%)	14,53	14,38	14,49	15,27	15,84
11	Report index of forearm perim. to stature Faperim / S x 100 (%)	13,68	13,75	13,78	14,10	14,31
12	Report index of tight to stature TPerim / S x 100 (%)	32,09	32,33	33,25	33,89	34,54
13	Report index of shank perimeter to stature, Perimsh / S x 100 (%)	20,44	20,73	21,21	21,32	21,61

3. Results

As a result of the measures carried out on subjects, certain values were determined out of which we present a 15 years girl ([MKK05]), with an assessment of the dimensions in absolute value (Table 3) and by calculating the proportionality indexes; the results of the interpretation were done by using both criteria.

     The growth and development quantitative evaluation, carried out by comparing the somatic-metric measured parameters to the average values

in the sample population, according to age and sex, is based on the results included in Table 3.

Therefore, as it can be seen, the child's development is between the normality limits, yet, out of the 13 indexes just one (7,7%) had a correct value, 10 being between the average values (6, namely 46.2%, under average and 4, namely 37.7%, over average); two values are beyond the admitted limits (one index, namely 7.7% over limit, the other one, namely 7.7%, under limit). However, analyzing more thoroughly, it can be observed that she has a high bust and short limbs (both limbs types as well as the span), that she is inadequately developed in the bust perimeters, having the arm and legs unequally developed (the arm perimeter is normal, but the forearm one is too big; the tight perimeter is over-developed and that of the ankle under-developed).

Table 3. *Values of the anthropometric measured indexes*

No	Dimension	-2 DS	VM	+2 DS	Measured values	Interpretation
1	Stature	154,08	162,40	170,72	159	under average
2	Bust height	80,31	82,60	84,88	83	over average
3	Superior limb length	63,12	71,00	78,87	67	under average
4	Inferior limb length	87,39	98,20	109,01	87	under average*
5	span	157,62	174,00	190,37	155	under limit
6	Biacromial diameter	30,31	32,60	34,88	36	over limittă
7	Bitrochanterian diameter	26,56	29,60	32,63	32	over average
8	Chest diameter	74,25	79,00	83,75	78	under average
9	Abdominal diameter	59,80	65,00	70,20	64	under average
10	Arm diameter	22,45	25,00	27,55	25	normal
11	Forearm diameter	20,15	22,00	23,85	23	over average
12	Tight diameter	43,42	50,00	56,58	52	over average
13	Shank diameter	28,56	32,00	35,44	31	under average

Continuing with the growth and development qualitative evaluation, carried out by calculating the anthropometrics proportionality indexes and comparing them to the average values in the sample population, according to age and sex, the obtained values were presented in Table 4.

The actual interpretation is: the superior limbs are short and muscular, the inferior limbs are long comparing to the stature, with the musculature more weakly developed, while the bust is too short comparing to the stature, meaning that the subject presents a stronger development of the inferior parts of the body.

Table 4. *Values of the calculated anthropometric indexes*

No	Anthropometric indexes	Age in years			Calculated values	Interpretation
		14	15	16		
1	GRI = Bust / S x 100	52,31	52,34	52,36	52,20	under limit
2	I_{AI} = Bust – S / 2	3,65	3,75	3,80	3,50	under limit
3	SLL Index/ S x 100	43,30	42,77	42,86	42,13	under limit
4	ILL idex / S x 100	47,68	47,65	47,63	54,71	over limit
5	Sp Index/ S x 100	100,50	100,31	100,29	97,48	under limit
6	Dbiacr Index/ S x 100	21,39	21,88	21,94	22,64	over limit
7	Dbitroch Index/ S x 100	18,34	18,38	19,30	20,12	over limit
8	I_{BG} = Chestperim Index / S x 100	48,60	48,93	49,55	49,05	over average
9	AbdPerim Index / S x 100	39,39	39,58	40,35	40,25	over average
10	APerim Index / S x 100	14,53	14,38	14,49	15,72	over limit
11	FaPerim Index /T x 100	13,68	13,75	13,78	14,46	over limit
12	Tperim Index / T x 100	32,09	32,33	33,25	32,70	over average
13	Shperim Index / T x 100	20,44	20,73	21,21	19,49	under limit

The above results were obtained by doing calculations and manual measurements, which can require a big and useless effort when applied to a great number of subjects. (in collectivities such as school, boarding school, sportive polyclinic). By using an automatic computation program, one can replace this work, producing the same interpretations in few seconds, which, for the children communities of this age, takes less than an hour for inputting, processing and listing the data corresponding to a certain class (for instance).

Such a computation program (permitting the inputting of a subject's data, the comparison of the measured values to the average one in the absolute value - from the specialized literature - and the calculation of the proportionality indexes which are then reported to average indexes in the sample population) was used in carrying out this study and it works as below:

- In Figure 1 the picked up (measured) data on the subject are input, but this variant of obtaining data can be easily replaced by reading it in a simple text file, if the program is applied for a large number of subjects.
- The next step is to compare these values to the average ones for the subject's age and sex, as in Figure 2;
- The calculation of the anthropometric indexes and their interpretation is done as in figure 3;

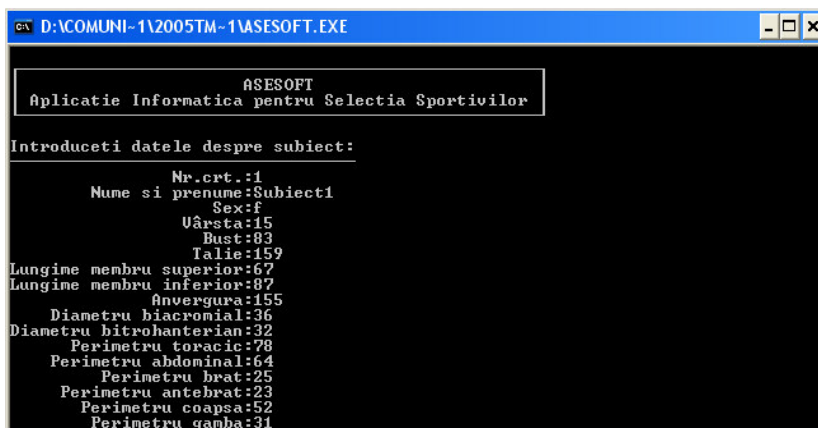- The memorizing of the read data for a subsequent use in order to follow the subject's evolution in time.

Fig. 1. *Data input*

Fig. 2. *The comparison between measurements and medium values*

Conclusions

The exposed method offers the possibility, on a hand, to compare the values obtained by measures on a children collectivity to the average ones corresponding to sex and age, and, on the other hand, to compare the associated anthropometric indexes to the corresponding average values. This calculus is done during the measuring time, but as the data base registers the whole information on a certain subject it is possible to review its evolution in time.

Fig. 3. *The comparison between antropometrics and medium indices*

This way the doctor (the nurse) form the educational institution can observe the child's development during the period he/she has him/her under observation and, consequently, can guide the parents towards a proper medical examination, when the results of the measuring indicate serious deviations from the normal values.

On the other hand, the Physical Education teacher can use this data to distribute the children on sports groups to correct their deviations from the different average measured values.

References

[Bar02]   Bârzu M.V., *Control medical şi autocontrol în educaţiei fizică şi sport*, Editura Mirton, Timişoara, 2002

[Mus04]   Muşuroi C., *Igienă, note de curs*, Universitatea „Tibiscus" din Timişoara, 2004

[MKK05]   Muşuroi C., Karnyanszky C.A., Karnyanszky T.M., *Aspecte privind metodele de testare a dezvoltării somatice la copilul aflat în perioada pubertăţii*, Simpozionul Naţional „Implicaţiile medico-psihologice ale performanţei sportive", ed. I, Universitatea „Tibiscus" din Timişoara, 1-2 aprilie 2005