Original paper

QUALITY ANALYSIS OF ONTOGENETIC PROCESSES IN CHILDREN OF PRESCHOOL AGE

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Abstract

Anthropometric measurements which determinate longitude dimension of skeleton, volume and body mass were applied on sample subjects of 344 children (188 boys and 156 girls aged from 3 to 6) in order to perform quality analysis of treated morphological characteristics of children of this age. Calculated characteristic equation of Guttman-Kaiserov criteria shows five characteristic roots which explain total variance (90.4% in boys and 91.4% in girls). Anthropometric measurements of group of anthropometric characteristics of sample subject of this research show results that can be set in that way to determine relative position of subject in relation to other subjects or even wider of a certain population. Regulation of ontogenetic development can be performed optimally by the indicators in the area of morphological characteristics.

Keywords: *morphological characteristic, ontogenetic development, preschool children, anthropometric measurements*

Introduction

Preschool period of children lasts from the age of 3 till the beginning of primary school i.e. till the age of 6. The significance of this period for the physical and physiological development of the child is crucial (Juskeliene et al., 1996, Hraski et al., 2002). This period is followed by phase of slow growth, increased physical activity, development and coordinated movements. Period of slow growth doesn't mean it ends. It means that it is slow in relation to the other functions which develop quickly in that period (Mišigoj-Duraković and Matković, 2007, Gesell, 2013, Davies, 2010, Bijou, 1993). Understanding child's status depends on knowledge of the dynamics of their growth. Therefore this research is based on one of these areas and includes area of morphological characteristics and presents the insight of biological growth and development of the children of preschool age (Bala, 2004, Đurić, 1997). The term of age characteristics implies the knowledge of anatomic, physiological, physiological characteristics of certain age categories as well as the pedagogical methods in performing physical processes (Hadžikadunić, 2002).

Methods

Sample subjects

The research was conducted on 344 sample subjects (children) of which 188 are boys and 156 are girls, aged from 3 to 6, which are included in preschool process. When choosing variables we decided to use variables that satisfy basic metric characteristics (validity, reliability, objectivity, and sensitivity) based on the instructions of international biological program IBP, and variables which present biological growth and development of the children of this age.

Sample variables

Variables of height-(ATVIS) are used for longitudinal dimensionality of skeleton. Variables of body weight (ATTEŽ), volume of chest (AOGK) and volume of head (AOGL) are used for assessment of volume and mass of the body.

Methods of data processing

Structure of applied variables is determined by transformation of the main components without orthogonal conditions where diagonal transformation with direct oblime criteria is performed (Prskalo and Babin, 2011, Bala, 2002). Results of factor analysis within researched areas show the following parameters: in table of characteristic roots and total variance explained by solving the characteristic equation of matrix of intercorrelation, characteristic roots are calculated (Total) and characteristic vectors of matrix (total variance explained), which explains the total variance of isolated components. Column marked as % of Variance, presents relative cumulative contributions of isolated main components. Column marked as Cumulative %, presents the percentage of explained total variance i.e. total variance. Within the matrix there are coordinates of vectors i.e. parallel projections of vectors of manifest variables on factors. There are intercorrelations among isolated factors (Wiebe et al., 2008, Klarić, 2012) in the matrix of intercorrelation of isolated factors.

Results and discussion

Bartlett's test examined the possibility of subjection of the group of morphological variables to any type of factorization. Results of table 1 confirm that this matrix of data can be subjected to factorization.

Based on calculated characteristic equation (table 2) of Guttman-Kaiser criteria, we obtained five characteristics roots which explain 90 % (429% at boys and 91,183 at girls) of total variance. It can be concluded that this is high proportion of total variance explained. Individual contribution to the explanation of total variance (% of Variance) presents the first latent dimension 52,373% in boys and 60,847% in girls. The first main component presents measurement of general growth and development of total variance explained. The second latent dimension percentage is 16,435% in boys and 14,047% in girls, third dimension is 10,407% in boys and 7,870% in girls, the fourth dimension is 7,042% in boys and 4,894% in girls and fifth latent dimension is 4,172% in boys and 3,525% in girls.

Matrix of composition or matrix of factor patterns includes means of parallel projections of coordinates of vectors of variables on factors. Analysis of structure of matrix of composition of the first main component in boys and girls shows that the development at this age is defined by body mass. The first general factor is defined as factor of DEVELOPMENT. The second main component in boys shows specificity in relation to anthropometric characteristic of height. This variable has the biggest correlation to the second main component in boys and it is defined as clean factor of longitude dimensionality of skeleton. This factor is defined as GENERAL FACTOR OF GROWTH. With girls, the main component is

Table 1. KMO and Bartlett's Test

Kaiser-Meyer-Olkin Measure of Sampling Adequacy.	*boys*		*girls*	
		,884		,893
Bartlett's Test of Sphericity	Approx. Chi-Square	4740,024	Approx. Chi-Square	4310,568
	df	496	Df	496
	Sig.	,000	Sig.	,000

Table 2. Isolated main components – boys and girls

Comp.	**boys**			**Comp.**	**girls**		
	Extraction Sums of Squared Loadings				**Extraction Sums o f Squared Loadings**		
	Total	**% of Variance**	**Cumulative %**		**Total**	**% of Variance**	**Cumulative %**
1	16,759	52,373	52,373	1	19,471	60,847	60,847
2	5,259	16,435	68,808	2	4,495	14,047	74,894
3	3,330	10,407	79,215	3	2,518	7,870	82,764
4	2,253	7,042	86,257	4	1,566	4,894	87,658
5	1,335	4,172	90,429	5	1,128	3,525	91,183

characterized by variables of volume of head (for the older groups, aged from 5-6). Variables of volume of chest in boys and girls are isolated as clean factor. The fourth isolated factor is determined in boys and the fifth in girls. These factors are defined as clean factors of VOLUME. Variable of volume of head is determined by two isolated factors in boys and girls. It is characteristic that with boys at the age from 4-6 the third isolated function is determined by volume of head, while the fifth factor determinates volume of head for the age of 3, i.e. the younger age group. With girls, this variable is determined by second and the fourth isolated factor. The second isolated factor of volume of head is determined by the age group of 5-6, and the fourth group is determined by the age group of 3-4. The third isolated main component in girls is determined by longitude dimensionality of skeleton and this factor is defined as GENERAL FACTOR OF GROWTH.

Results of analysis of matrix of intercorrelation of isolated factors (table 4) show correlation

Table 3. Matrix of construction; boys and girls

Variable	Component									
	boys					girls				
	1	2	3	4	5	1	2	3	4	5
ATTEŽ age 3	,968	,015	-,063	-,031	-,049	,876	,006	-,019	-,040	,081
ATVIS age 3	-,074	-,937	-,015	-,059	-,039	,287	-,194	,725	-,163	-,111
AOGL age 3	,178	-,082	,118	,008	-,762	-,099	-,042	,095	-,877	,030
AOGK age 3	,049	-,072	-,045	-,704	-,245	,409	-,213	,062	-,229	,520
ATTEŽZ age 3,5	,986	,057	-,066	-,049	-,037	,921	,036	,049	,004	,016
ATVIS age 3,5	-,036	-,970	-,038	,008	-,020	,259	-,154	,782	-,166	-,188
AOGL age 3,5	-,008	-,178	,191	-,197	-,715	-,039	,050	,104	-,882	,032
AOGK age 3,5	,067	-,044	-,083	-,775	-,286	,362	-,176	,040	-,177	,610
ATTEZ age 4	,979	,054	-,047	-,004	-,036	,890	,040	,073	-,021	,046
ATVIS age 4	-,040	-,992	-,026	-,008	,010	,225	-,105	,804	-,143	-,128
AOGL age 4	,077	-,067	,534	-,084	-,525	,113	,279	-,088	-,749	-,018
AOGK age 4	,014	-,020	-,121	-,897	-,216	,325	-,124	,001	-,212	,638
ATTEZ age 4,5	,990	-,020	-,021	,016	-,007	,906	,055	,080	,023	,046
ATVIS age 4,5	-,021	-,981	,031	,017	,048	,207	-,060	,842	-,083	-,088
AOGL age 4,5	,094	-,023	,566	-,131	-,468	,012	,214	-,082	-,690	,264
AOGK age 4,5	,016	-,012	-,076	-,942	-,115	,145	,030	,121	-,147	,732
ATTEZ age 5	,983	-,023	,008	,012	,020	,927	,055	,054	,030	,043
ATVIS age 5	,015	-,972	,001	-,025	,028	,107	,000	,911	-,019	-,009
AOGL age 5	,050	,029	,808	-,019	-,290	,144	,557	-,045	-,427	,077
AOGK age 5	-,010	-,028	,051	-,961	,091	,078	,040	,091	-,174	,794
ATTEZ age 5,5	,976	-,058	,030	,030	,034	,931	,062	,043	,022	,036
ATVIS age 5,5	,016	-,966	,032	,001	,004	-,013	,054	,935	,017	,115
AOGL age 5,5	,018	-,005	,925	-,030	-,044	,017	,798	,013	-,278	,033
AOGK age 5,5	,053	-,053	,162	-,867	,224	,109	,079	,043	,021	,866
ATTEZ age 6	,927	-,076	,068	,012	,034	,843	,093	,065	,036	,126
ATVIS age 6	,092	-,925	-,025	,025	,000	-,125	,145	,965	,072	,187
AOGL age 6	-,029	,036	,971	-,016	,090	,120	,886	-,001	-,088	,005
AOGK age 6	,071	,002	,159	-,834	,223	,036	,076	,016	,057	,884
ATTEZ age 6,5	,906	-,007	,093	-,047	,064	,767	,087	,086	,055	,201
ATVIS age 6,5	,084	-,888	-,008	,039	-,011	-,140	,212	,893	,105	,261
AOGL age 6,5,	,025	-,018	,913	-,017	,072	,119	,936	,097	,053	-,014
AOGK age 6,5	,106	-,006	,153	-,805	,203	,009	,018	,024	,024	,959

Table 4. Matrix of intercorrelation of isolated factors

	Component Correlation Matrix									
	Boys					**Girls**				
Component	**1**	**2**	**3**	**4**	**5**	**1**	**2**	**3**	**4**	**5**
1	1,000					1,000				
2	-,432	1,000				,169	1,000			
3	,340	-,100	1,000			,640	,089	1,000		
4	-,588	,423	-,431	1,000		-,431	-,349	-,263	1,000	
5	-,243	,258	-,264	,253	1,000	,631	,358	,355	-,358	1,000

among isolated factors within area of anthropometric characteristics. Results within this matrix show that statistically significant coefficients of correlation in boys is achieved, the first isolated factor significantly correlates to the factor two (-.43), factor three (.34) factor four (.58) and slightly to factor five (.24). The highest correlation among first and fourth factor is achieved because they are determined by GENERAL FACTOR OF DEVELOPMENT. The first isolated factor, in girls, has the more significant correlation to the factor three (64), factor four (43) and factor five (63). The mentioned correlations are significant due to the fact that mentioned factors are determined by the factor of GENERAL BIOLOGICAL GROWTH AND DEVELOMPENT. Also, there is a correlation among factors two and three (42 in boys -34 in girls), factor four (25 in boys and 35 in girls). Factor three shows statistically significant correlation with the following factors: factor four (42 in boys and 26 in girls) factor five (26 in boys and 35 in girls). The fourth factor of matrix of isolated factors has statistically significant correlation to the factor five (.25 in boys and -.35 in girls). This correlation is logical because these isolated factors determinate GENERAL GROWTH AND DEVELOPMENT.

Discussion

Based on analysis of anthropometric characteristics of boys and girls we can state that isolated factors of the main components in boys, although they belong to the same morphological area through isolated factors, are clean factors. Although anthropometric characteristics are clearly defined in boys, the morphological dimension of GENERAL GROWTH AND DEVELOPMENT, which has 90% of variance explained of treated area, is defined in both genders of the preschool children. Quality differences, i.e. defined structures of morphological dimensions, during the analyzed period of growth and development are better defined in boys. It is noticed that there is better harmony in growth and development in boys than in girls, which is confirmed by other researches (Đurić, 1997). It's best to observe a child as a human that grows and monitor the dynamics of its growth and development (Selimović and Karić, 2011). Dynamics changes in sequences and it depends on subject's health and influence of the environment. Each subject goes through the process of ontogenesis, organs are biologically structured from the moment of fertilisation of female reproductive cell and are developed permanently till the stage of complete physical maturity (Bala, 2002, Vasić and Jakonić, 2009, Sabolč and Lepeš, 2012). Growth and increase of body weight are influenced by many factors such as: level of health of a child, environment in which child lives, day routines of a child, diet etc. (Benčić, 2016, Pokos). In order to understand the process of ontogenesis it is necessary to know regulations and standards of growth and development of children of this age, especially because in practice often it is very difficult to draw the line between normal variance and pathological variance.

Conclusion

Body constitution (somatotype) is the most recognizable characteristic of a human. Observing body construction during its growth enables better understanding of variance of body construction of adults who have their genesis from childhood and adolescence. Anthropometric measurements of group of anthropometric characteristics of sample subject of this research show results that can be set in that way to determine relative position of subject in relation to other subjects or even wider in a certain population. The key facts of this research are: anthropometry is a science and a skill which is current and dynamic and the use of multicomponent model of body composition (fat, muscles, bones) is obligatory part of analysis of body structure of active population. It is necessary to follow the trends and to understand the limitations of field methods and validity of chosen techniques and to use procedures which are valid and tested on active population. Creating balanced anthropometric procedures during observation of the children and active population in the common area, would enable creation of national standards in this area (e.g. gender, age) which is the case with most places in the area, but at the same time it would be an introduction for defining optimal pattern for morphological testing of preschool children whose anthropometric measurements are segments which could be easily standardized.

Literature

BALA, G. 2002. Structural differences of motor abilities in boys and girls of preschool age. Pedagogical reality, 48, 744-752.

BALA, G. 2004. Quantity differences of basic antropometric characteristics and motor abilities of boys and girls of preschool age. Messenger Anthropological Society of Yugoslavia, 39, 219-227.

BENČIĆ, A. 2016. Physical activity of preschool children. University of Pula. Faculty of Educational Sciences.

BIJOU, S. 1993. Behavior analysis of child development, New Harbinger Publications.

DAVIES, D. 2010. Child development: A practitioner's guide, Guilford Press.

ĐURIĆ, D. 1997. The growth and development of preschool children of Novi Sad. Novi Sad, Faculty of mathematics: institute of bilogy.

GESELL, A. 2013. Vision-its development in infant and child, Read Books Ltd.

HADŽIKADUNIĆ, M., BALTA, S. 2002. Corrective exercises for preschool children. Faculty of Sport and Physical Education,

HRASKI, Ž., ŽIVČIĆ, K. & ŽULJEVIĆ, N. 2002. The influence of programmed body activities on the growth and development of the preschool children. U Vladimir Findak (ur), Collection of papers of 11 summer school of kinesiology of Republic Croatia « Planning activities in fields of education, sport and sport recreation and kinesiotherapy», Rovinj, 22-26 June 2002(page 242-243) Zagreb

JUSKELIENE, V., MAGNUS, P., BAKKETEIG, L. S., DAILIDIENE, N. & JURKUVENAS, V. 1996. Prevalence and risk factors for asymmetric posture in preschool children aged 6–7 years. International journal of epidemiology, 25, 1053-1059.

KLARIĆ, A. Š. 2012. The relationship of postnatal head growth dinamics and neurodevelopmental impairment in preschool children born with intrauterine growth retardation. Medicinski fakultet, Sveučilište u Zagrebu.

MIŠIGOJ-DURAKOVIĆ, M. & MATKOVIĆ, B. R. 2007. Biological and functional characteristics of children and adolescents and sport training. Collection of papers of international of scientific and expert conference "Fitness preparation of athletes, "Faculty of kinesiology of University of Zagreb, Zagreb.

PRSKALO, I. & BABIN, J. 2011. Diagnostics in education. U V Findak (ur), Collection of papers, 20.

SABOLČ, H. & LEPEŠ, J. 2012. Razlike u motoričkim sposobnostima i telesnoj kompoziciji između dečaka i devojčica od 7 godina. Спортске науке и здравље-АПЕИРОН, 3.

SELIMOVIĆ, H. & KARIĆ, E. 2011. The learning process of preschool children. Metodički obzori, 6, 145-160.

VASIĆ, G. & JAKONIĆ, D. 2009. Somatski status dece predškolskog uzrasta Autonomne pokrajine Vojvodine. Medicina danas, 8, 125-130.

WIEBE, S. A., ESPY, K. A. & CHARAK, D. 2008. Using confirmatory factor analysis to understand executive control in preschool children: I. Latent structure. Developmental Psychology, 44, 575.

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