Research project: STATE AND STIMULATION OF DEVELOPMENT IN CHILDREN AGED 8-9 LIVING UNDER WAR CONDITIONS

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SUMMARY

The somatic, functional and metabolic characteristics of children at 8 years of age have been established. These children have, for the previous three years, lived under stressful conditions of direct shelling, poor nutrition and movement. At the same time there has been an evaluation of the effects of programmed physical activities which have been applied in the aim of stimulating natural physical dynamics and functional developments and the elimination of stagnation of development which occurs from conditions of unfavorable factors. The research and the program of physical activities included 41 boys, starting at an average age of 8 years and four months. The somatic characteristics of the boys, according to 25 antropometric measures (IBP), show a lag in the boy's physical development according to their age group by one year. The lagging behind is especially evident in volume dimensions and underskin tissue fat (Przulj, 1991., Bonacin, 1995. Blaha, 1982.). An improvement of conditions and a greater scope of movement activities for the duration of 8 months did not significantly influence on the improvement of the somatic and functional status of the boys in comparison with the controlled group (N=21) of the same average age during another measurement period. While resting, on the level of aerobic threshold, anaerobic threshold and maximal oxygen uptake, the value of ergonometric, functional and metabolic parameters were confirmed: VO2 stpd , Ve btps, Ve * VO2-1, Ve*VCO2-1, RQ, fc (beats*min-1), work load in Watts and on the basis of these relative indicators were completed. The gradual growth of work load was completed with the help of bicyklergometer (Monark). After 3 minutes of easy pedaling (warming-up) an initial work load was given of Watt*body mass and increased by 1/3 of the mass*Watt every minute until the achievement of maximal oxygen uptake. Individual aerobic and anaerobic thresholds (Aep) and (Anp), for each person examined were confirmed on the basis of the smallest sizes in the points of the crucial curves Ve*VO2-1 and Ve*VCO2-1 (Wasserman et al., 1973 and 1991, Cooper et al, 1984, Yacov, 1991). For the level of maximum oxygen uptake, the work load was taken, on which the greatest worth of VO2 was achieved and it did not increase with the following greater work load. The average value of ergonometric, functional and metabolic parameters of the initial state and the final measurement of the experiment group:

- level of aerobic threshold: 2.4 and 2.3 work load (Watt*mass-1), 30.57 and 28.37 VO2kg(ml*kg-1*min-1), 168.6 and 166.6 fc(beats*min-1), 5.08 and 5.31 VO2*fc-1, 64.7 ad 62.6 VO2*VO2 max-1 %, 85.9 and 85.4 fc*fc(VO2max)-1 %, 63.4 and 62.6 W*W(VO2max-1)%,
- level of anaerobic threshold: 2.7 and 2.7 work load (Watt*mass-1), 33.15 and 34.54 VO2 kg(ml*kg-1*min-1), 175.4 and 175.7 fc (beats*min-1), 5.6 and 6.1 VO2*fc-1, 74.4 and 76.2 VO2*VO2max-1%, 89.3 and 90.1 fc*fc(VO2max), 70.7 and 72.7 W*W(VO2max)-1%,
- level of maximum oxygen uptake: 3.8 and 3.7 work load (Watt*mass-1), 47.2 and 45.3 VO2kg(ml*kg-1*min-1), 196.3 and 195.1 fc(beats*min-1), 6.8 and 7.3 VO2*fc-1.

Significant statistical differences are confirmed only on the values of VO2* fc-1 I and II measuring P = 001.

The results confirm the assumption of the general strategy of adaptation, directed in the formation and protection of functional reserves from exhaustion, for priority of growth needs and development and only on that basis can an increase of ability for an even greater level of their total and rational usage can occur. For a significant growth ability of a greater level of mobilization of functional reserves there is a need for a greater intensity and a longer time period in completing physical activities.

INTRODUCTION

With a view into somatic status and functional potential of boys at the age of 8 years, an assessment of parameters of growth and physical development and functional and metabolic parameters have been established on the level of aerobic and anaerobic threshold and maximal oxygen uptake (Brdaric, 1973. Radojevic, 1973. Vranesic, 1988. Przulj, 1991. Bonacin, 1995.). A full program of anthropometric measurements (IBP), ergonometric, Functional and metabolic parameters on the level of aerobic and anaerobic thresholds (as an indicator of the ability for mobilization of functional potential) and the maximum oxygen uptake (as a measure of total aerobic organism productivity) are assumed as criteria for:

- an objective estimate of a three year reaction to stressful war conditions, poor nutrition and an extreme decrease in physical activities in somatic and functional development and as

- to estimate of effects of the applied program the eight months physical activities for the over coming of stagnation which resulted from somatic and functional development of boys.

The assumption is that with this type of approach a complex notion of the character of the adaptation process, can be achieved for this growth period for the increase of functional reserves of the organism and the ability for their most complete rational mobilization.

METHOD

The research included 41 boys of 8 years and four months of age in the first measurement and 9 and one month old in the second measurement. The control group was made up of 21 boys with an average of 9 years and three months of age. The choice of those examined was completed among boys from a narrow urban environment, after the expressed desire and agreement of their parents who wished there to be a testing of their functional abilities.

The somatic characteristics of those examined were confirmed by the applied antropometric measures which represent the basic antropometric dimension. Body length is established by measuring the body height, length of upper extremities (arm length) and lower extremities (leg length). Transversal dimensions and the skeletal size are established with parameters: shoulder width, hip width, diameter of hand joints, diameter of palm, knee diameter, diameter of ankle joints. The dimension of the body volume is determined by the parameters: circumference of the breast skin, circumference of elbows, circumference of upper arms tensed, circumference of upper leg.

The dimension of underskin fat tissue is established by anthropometric measures: facial skin wrinkles, chin skin wrinkles, breast skin wrinkles 1, skin wrinkles above m. triceps, skin wrinkles under the shoulder blades, stomach skin wrinkles , breast skin wrinkles 2, hip skin wrinkles, skin wrinkles above the patella, skin wrinkles under the knee. Especially established is the percentage of the fat (fat %), Parizkova.J. 1963.

The estimation of oxygen and carbon dioxide in exhaled air is determined by the Beckman-Oxygen Analyzer OM-11 and CO2 Analyzer LB-2 system. The program of physical activity (elementary games, natural scope of movement and sport games), the boys of the experimental group were included. The middle value (MV) and standard deviation (SD) were established for all investigations of the parameter. Meaningful differences between meddle values of the parameters was established by T-tests and between groups of methods of discriminatory analysis (Ben. W. Bolch, 1979.)[1]

Ergonometric, functional and metabolic parameters

With the ergonometric parameters the created level of work load in Watts were registered and relative functional and metabolic parameters indicators were completed on the basis of their.

1 The program was realized in the duration of 8 months, three times weekly work in comparison to kg of physical mass (2,4 Watt*kg mass-1). Work load before Aep in comparison to the size of the work load before VO2 max reaches 63.4%. The pulse cost of the Watt load is 1.23 fc*Watt-1 and the oxygen cost of the Watt load is 9.99 VO2*Watt -1. The absolute and relative middle values of the ergonometric parameters of the boys in the experimental groups before testing at the beginning of the experiment in total support the work load of the boys of the same age group who have less movement activities. The percentage of completed work effectiveness total is 29,6.

The level of ergonommetric parameters at the completion of the experiment (II measure) results in a greater absolute value (71.8 Watts). The differences in the sizes of relative ergonometric parameters are of statistical meaning, except the percentage of the work load in Watts in comparison to achieved work load before maximum oxygen usage (62.8%). There are no meaningful statistical differences in the size of ergonometric parameters of the boys of the experiment and the control group.

The functional and metabolic parameters on the level of aerobic threshold of the experimental group, I and II measures, is proportional with the size of their peers with close somatic characteristics. The intensity of the oxygen usage total is 858 ml*min-1 (stpd), oxygen usage on the basis of kg body mass 35.15 VO2 ml*kg*min-1. Oxygen uptake in comparison to the amount of consumption before VO2, maximum total is 64.7%. A relative small value of oxygen pulse shows a type of reaction of the organism to physical load which is a result for this age group. The oxygen pulse total is 5.08 ml*fc-1. The differences which resulted in ergonometric, functional and metabolic status of the boys of the experimental group after 8 months of the applied program on all sides of physical activities according to the results of the discriminant analysis (Mahalanobius) is mainly given by the parameters: ventilation equivalent to oxygen, oxygen pulse and oxygen uptake on kg physical mass of examinees. On the level of Aep the greatest percentage of work effectiveness is achieved (29.6 that is 31.2%). The boys of experimental group before the completed measurement differ in all measurement sizes of the ergonometric, functional and metabolic parameters from the boys in the control group on the level of P=.0058 (discriminant analysis). The difference in the groups is mostly given by the parameters achieved by the relative work load (Watt*kg-1), oxygen uptake on the basis of kg physical mass (VO2*kg-1*min-1) and involvement of heart contractions, resulted in the percentage work load in comparison to their size before the maximum oxygen uptake (Table 2).

Anaerobic threshold (Anp)

The achieved level of work load before Anp is greater than the level of work load before the Aep by 7.2 that is 11.4%. The examinees achieve an average work load of 2.68 Watt*k-1 that is 70.8 - 72.7% load in Watts in comparison to the level of work load achieved before the maximum oxygen consumption. This shows the fact that the aerobic-anaerobic zone overcomes a relatively narrow, which according to all judging this is a general characteristics of this age group. Before Anp growth mobilization of oxygen and pulse capacity in comparison to the value before VO2 max total is 10% that is 4%. Oxygen uptake by kg physical mass achieved 35..35 VO2kg (ml*kg-1*min-1) and oxygen pulse 5.63-6.15 VO2*fc-1. The pulse cost of work is somewhat lower 1.06 dfc*Watt-1, and oxygen cost is meaningfully greater 10.7 dVO2*Watt-1 than before Aep. The completed growth of functional and metabolic parameters after 8 months of applied program of all sides of the physical activities of the boys in the experimental group (II measurement) is of statistical meaning. The parameters with the greatest discriminant arrangement are: ventilation equivalent CO2, ventilation equivalent VO2, percentage of achieved work load and pulse achieved on the level of VO2 max, work load Watt*kg physical mass-1 and oxygen uptake by kg physical mass. Differences in ergonometric, functional and metabolic parameters of the boys of the experimental group (second measurement) and the control group are on the level of meaning P=.033. The size of the measurement of parameters before Anp are proportional actual somatic characteristics and characteristics of the everyday physical activities.

Level of maximum oxygen consumption (VO2max)

Ergonometric, functional and metabolic sizes established on the level of VO2 max are taken as upper limits of inclusion of aerobic potential and reliable measures of the estimate of the level of mobilized functional reserves of the organism on the level of aerobic and anaerobic threshold. It should be kept in view , the fact that the direction of adaptive functional changes is determined beforehand by intensity of work activities that is they are determined by energetic sources. The level of work load before VO2 max is, in comparison to the level of Anp, relatively high. The difference is around 30%. Close to the same size of the growth of the same oxygen consumption in comparison to the kg physical mass and oxygen pulse. The pulse cost of the work load and percentage of achieved work effectiveness are at least on this level of load. In accordance to the oxygen cost of Watts load achieves the greatest size. Achieved growth of the size of ergonometric, functiònal and metabolic parameters confirmed before the second measurement of the experiment group is of statistical meaning. The greatest discriminant value has a ventilation equivalent to oxygen, involvement of heart contractions, work load and intensity of oxygen uptake in comparison to kg body mass and pulse cost of work load. A meaningful difference in ergonomtric, functional and metabolic parameter sizes on the level of VO2 max experimental and control group is on the level of P=.027 (Table 2b).

General characteristics of the mobilization of ergonometric, functional and metabolic parameters on the level of aerobic threshold, aerobic threshold and maximum oxygen uptake are the following:

- great level of dependence between somatic status, ergonometric, functional and metabolic sizes,
- narrow zone of aerobic-anaerobic crossing and relatively low involvement of ergonometric sizes, functional and metabolic potential before anaerobic threshold,
- high level of mobilization of functional capacity before aerobic threshold,
- expressed relative sizes of mobilized aerobic-anaerobic functional reserves of the organism on the level of maximum oxygen usage.

The practical value of the determined individual somatic profiles has been confirmed, ergonometric and metabolic characteristics of the examinees (during resttimes, before aerobic threshold, anaerobic threshold and maximum oxygen uptake) in the programming of physical activities in accordance to the ability of children of this age group. Adaptive reactions of the organism on the applied program on all sides of the physical activities were not obviously manifested as the project foresaw.

Table 1.

SOMATIC CHARACTERISTICS

	Experimental Group				Control Group		
	N=41 I measurement		N=36 II measurement		N=21		
Variables	Mean	SD	Mean	SD	Mean	SD	
Body height	131.2	4.9	135.3	5.8	135.8	4.6	TJVISINA
Body weight	28.2	3.2	31.2	4.0	32.1	3.4	TJELMASA
Lower extremity	704.8	28.4	726.4	35.8	725.8	27.7	DUZNOGE
Upper extremity	567.2	22.9	584.9	27.4	584.8	22.8	DUZRUKE
Biacromial breadth	275.1	10.9	292.7	11.1	299.0	12.1	SIRRAME
Biiliocristal width	198.4	9.9	194.6	9.5	198.0	12.0	SIRKARL
Wrist width	44.4	1.7	45.8	2.0	46.6	2.0	DIRUCNZ
Bicondilar humerus	54.4	2.0	56.2	2.2	56.8	2.1	DILAKTA
Bicondilaar femur	77.8	3.2	79.9	3.5	80.9	3.8	DIKOLJE
Ancle breadth	59.3	2.3	60.8	2.4	61.5	3.0	DISKOCZ
Chest circumference	607.6	31.6	613.2	32.5	618.8	34.3	OBGRUDI
Forearm circumference	185.0	9.6	189.4	8.8	194.9	8.4	OBPODLAK
Upper arm circumferce	189.8	9.8	205.9	9.7	202.0	10.0	OBNADLMX
Thigh circumference	348.5	19.1	359.6	16.4	365.6	21.0	OBNATKOL
Calf circumference	254.7	11.3	261.6	10.6	268.1	14.0	OBPOTKOL
Facial skinfold	54.3	5.9	56.2	4.8	55.7	6.6	KNLICA
Below chin skinfold	37.6	7.2	39.4	5.3	40.1	8.5	KNPODBRA
Chest 1 skinfold	30.3	5.4	33.0	4.8	34.3	9.2	KNGRUDI1
Tricers skinfold	59.1	6.3	61.4	7.5	62.7	9.1	KNTRICEP
Subscapular skinfold	42.5	9.1	45.6	8.2	51.4	18.5	KNLEDJA
Abdomen skinfold	48.5	6.3	53.0	5.3	56.3	16.0	KNTRBUHA
Chest 2 skinfold	35.3	7.3	38.6	6.7	36.9	14.3	KNGRUDI2
Suprailiac skinfold	40.6	7.1	44.9	5.4	48.2	12.6	KNBOKA
Thigh skinfold	52.2	7.9	54.3	5.9	54.2	9.2	KNNATKOL
Calf skinfold	38.3	2.3	39.7	3.1	41.4	4.2	KNLISTA1
Fat - percent	10.6	1.7	11.44	1.91	11.99	2.1	MAST%
Age - decimal years	8.392	15	9.066	16	9.240	15	STAROST

Table 2.

FUNCTIONAL AND METHABOLIC CHARACTERISTICS

Resting

Experimental Group				Control Group		
N=41 I measurement		N=36 II measurement		N=21		
Mean	SD	Mean	SD	Mean	SD	Variables
189.54	22.65	202.97	25.71	207.48	21.78	VO2 stpd
7.37	.89	7.82	1.00	8.02	.88	Vestpd
.85	.02	.86	.03	.86	.03	RQ
88.15	2.42	85.56	1.56	85.62	1.74	fc(beats*min-1)

ERGONOMETRIC, FUNCTIONAL AND METHABOLIC CHARACTERISTICS

Aerobic threshold

Experimental Group **Control group**
N=41 **N=36** **N=21**
I measurement **II measurement**

Mean	SD	Mean	SD	Mean	SD	Variables
67.42	7.67	71.81	8.92	72.82	7.37	Watts
858.29	94.93	884.14	103.55	904.05	92.70	VO2 stpd(ml*min-1)
28.48	3.41	29.89	3.52	30.93	3.56	Ve btps(ml*min-1)
25.52	.42	26.03	.17	26.27	.52	Ve*VO2-1
.86	.02	.84	.01	.85	.03	RQ
29.76	.36	30.89	.12	30.85	.46	Ve*CO2-1
168.64	2.13	166.61	1.49	166.36	2.56	fc(beats*min-1)
2.40	.10	2.30	.04	2.26	.08	Watt*kg body mass-1
63.36	2.34	62.77	.53	62.54	1.52	W*WVO2max-1 %
30.57	1.56	28.37	.42	28.05	.91	VO2*kg-1*min-1
64.71	3.09	62.61	.71	62.90	2.11	VO2*VO2max-1 %
5.08	.54	5.31	.62	5.44	.53	VO2*fc-1
85.90	1.11	85.36	.35	85.07	.82	fc*fc(VO2max-1)%
1.23	.14	1.15	.14	1.12	.12	dfc*Watts-1
9.99	.24	9.50	.10	9.55	.20	dVO2*Watts-1
29.62	.83	31.25	.33	31.00	.79	W effect
6.14	.70	6.21	.71	6.33	.65	dVO2*dfc-1
8.392	.15	9.066	.16	9.240	.15	Age-decim. years

Table 2b.
Anaerobic threshold

Mean	SD	Mean	SD	Mean	SD	Variables
75.41	8.43	83.19	10.41	83.43	8.23	Watts
987.37	92.91	1074.72	113.07	1080.14	90.31	VO2 stpd(ml*min=1)
34.30	3.27	38.05	4.03	38.48	3.31	Ve btps(ml*min-1)
26.73	.16	27.24	.16	27.39	.33	Ve*VO2-1
.93	.01	.95	.02	.96	.02	RQ
28.72	.15	28.61	.11	28.61	.19	Ve*CO2-1
177.39	1.64	174.72	2.05	175.00	1.71	fc(beats*min-1)
2.68	.15	2.67	.07	2.61	.11	Watt*kg body mass-1
70.76	.78	72.71	.76	71.90	1.61	W*WVO2max-1 %
35.15	1.30	34.54	1.08	33.77	1.43	VO2*kg-1*min-1
74.42	.67	76.18	.64	75.50	1.38	VO2*VO2max-1 %
5.63	.54	6.15	.65	6.17	.53	VO2*fc-1
89.34	1.40	89.79	1.09	89.64	.89	fc*fc(VO2max-1)%
1.19	.14	1.10	.14	1.08	.12	dfc*Watts-1
10.66	.23	10.51	.25	10.48	.21	dVO2*Watts-1
27.25	.60	27.49	.67	27.53	.55	W effect
7.32	.66	7.96	.81	7.95	.63	dVO2*dfc-1

Maximal oxygen uptake level

Mean	SD	Mean	SD	Mean	SD	Variables
106.61	12.04	114.42	14.41	116.10	11.74	Watts
1327.02	126.57	1410.58	149.57	1431.33	124.28	VO2max stpd
59.43	5.76	64.54	6.90	65.86	6.00	Ve btps
34.46	1.19	35.21	2.01	35.83	2.43	Ve*VO2-1
1.04	.02	1.06	.02	1.07	.03	RQ
1380.80	131.92	1498.28	158.60	1526.90	134.79	VCO2
33.14	.45	33.54	.39	33.65	.61	Ve*VCO2-1
196.32	3.52	194.14	2.74	196.43	3.16	fc(beats*min-1)
3.79	.03	3.67	.04	3.62	.08	W*kg body mass-1
47.23	.96	45.33	.95	44.72	1.18	VO2max(ml*min-1)
6.84	.66	7.32	.79	7.44	.62	VO2max*fc-1
1.06	.12	.99	.12	.98	.11	dfc*Watts-1
10.73	.22	10.58	.24	10.56	.20	dVO2*Watts-1
26.59	.55	26.97	.62	27.02	.51	W Effect
10.67	1.02	11.27	1.21	11.48	.94	dVO2*dfc-1
8.392	.15	9.066	.16	9.240	.15	Age-decim. years

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