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PHYSICAL DEVELOPMENT LEVEL OF CHILDRENS OF SCHOOL #1 (GRADES 1-11) LOCATED IN ANDIJAN CITY, ANDIJAN REGION, REPUBLIC OF UZBEKISTAN

Abstract: *In this study, it was found that the body weight index of childrens of school #1 located in the city of Andijan, Uzbekistan, increases in boys and girls in grades 1-11, in boys, the body weight index does not differ significantly in the age range of 12-14 years, and in the age of 15-16 years, there is a difference in the description of "jumping". It was noted that girls' height was higher than that of boys at the age of 9-10, and that it was significantly lower than that of boys at the age of 17. It was found that girls have a significantly higher chest circumference than boys at the age of 11-17. According to the Ketle II index, body weight deficit in boys is observed at the age of 12-17 years, it is at the maximum value (20-60%) at the age of 12-14 years, excess body weight is observed at the maximum (30%) at the age of 11 years. It was found that body weight deficit is 16.36%, excess body weight is 7.27% in boys compared to the total number of respondents (n=110). In girls, the body weight deficit was observed in the age range of 9-17 years, and the maximum was noted at 14-16 years (60-70%). It was found that excess body weight in girls is 15% on average (maximum 30%) at the age of 8-14 years. It was found that body weight deficit is 24.55% of the total number of respondents (n=110), and excess body weight is 8.18% in girls. Compared to the general respondents (n=220), it was found that the deficit of body weight in children is 32.73%, and excess body weight is 7.73%. According to the Rorer index, the level of physical development of childrens is in the "normative" description, and the value of the Pine index indicates that the level of physical development of childrens in boys generally corresponds to the "dolichomorphic" self-type, while girls at the age of 17 generally belong to the "mesomorphic" self-type. In the researches, according to the Brugsch index, it was observed that the size of the chest of childrens in the general condition is close to the "normative" value, and there are no clearly expressed "deviations from the norm". It was noted that according to the value of the Verwek index , the level of physical development in boys and girls at the age of 7-16 years is generally described as "mesomorphism" (normative development), and at 17 years old it is described as "average brachymorphism" (behind the norm). The obtained results can serve as a scientific basis for the development of regional anthropo-physiological standards, as well as for the development of practical measures based on the strategy of an individual approach, taking into account the physiological indicators of the organism in the optimization of the level of physical development of childrens during school education.*

Key words: *children, indicators of physical development, Ketle II index, Rorer index, Pine index, Vervek index, Burgsh index.*

Language: *English*

Clarivate
Analytics indexed

Introduction

Monitoring the process of physical development during ontogeny is important in assessing the health status of the human body, especially in school-age children and adolescents, preventing pathological conditions with different probabilities, and taking measures for their normal physiological and intellectual development [1, p. 71-77; 2, p. 20-22].

Also, the analysis of physical development indicators in children and adolescents is considered relevant from the point of view of biotic and abiotic factors of the external environment of the human body, regional monitoring, development of regional anthropometric standards [3, p. 26-33; 4, p. 24-26; 5, p. 65-68; 6, p. 39; 7, p. 645-649; 8, p. 33-43; 9].

Based on the above data, the **purpose of this study** is to analyze the level of physical development of childrens of school #1 (grades 1-11) located in Andijan, Andijan Region, Republic of Uzbekistan.

2. MATERIAL AND METHODS
2.1. Object and study conditions

In the research, the level of physical development of children of school #1 (grades 1-11) located in the city of Andijan, Andijan region of the Republic of Uzbekistan was analyzed. Physical development indicators of a total of 220 children ($n=220$) (10 boys and 10 girls from each class) from 1st to 11th grades were studied in the experiments.

2.2. Research methods

In the studies, the body weight (kg), height (cm), chest circumference (cm) of children were measured using standard methods [10, p. 10-336; 11, p. 7-14; 12, p. 59-61; 13, p. 455-458; 14, p. 30; 15, p. 3-24; 16, p. 85-89; 17, p. 27].

In the analysis of experimental results, indices based on body weight and height index (Ketle index II; Rorer index) and indices based on chest circumference and body weight index (Pine index, Brugsh index, Vervek index) are used [1, p. 71-77; 2, p. 20-22.; 6, p. 39; 18, p. 10-152; 19, p. 208-228].

Ketle II index=BW/H (kg/m²)   (*2.1*)
BW – is body weight (kg); H – represents the height (m).

Ketle II index (kg/m²) studies have confirmed that it has a place as an objective indicator in assessing the state of physical development of children (grades 7-11) [2, p. 20-22; 20, p. 7-24; 21, p. 5-32; 22, p. 10-52.].

In the studies, the indicators of physical development of children were calculated based on the Ketle II index (kg/m²) value compared to the standard normative values for assessing the level of physical development in the age range of 7-17 years accepted by the World Health Organization [2, p. 20-22].

Rorer index=BW/H³ (kg/m³) (*2.2*)
BW – is body weight (kg); H – represents the height (m).

Rorer's index the relative density of the body (kg/m³), expressing the coefficient of obesity, the value of this index in children and adolescents is 10.7-13.7 kg/m³, the level of physical development is "*normal*" (average), <10.7 "*below the norm*" and >13.7 kg/m³ in the case of "*above the norm*", in cases of excess body weight ("*obesity*") >14 kg/m³ is noted [2, p. 20-22; 6, p. 39; 23, p. 9-12; 24, p. 190-193; 25].

Pine index=H–(BW+C) (c.u.) (*2.3*)
BW – is body weight (kg); H – height length (m); C – is chest circumference (cm).

Pine index constitution (somatotype), i.e. allowing to describe groups of proportionality level of components of the body of children and adolescents, value <20 cases "*brachymorph*"; 21-25 "*mesomorph*"; >26 "*dolichomorphic*" is evaluated as a self-type, and the smaller the value, the more "*ripe*" the body is [2, p. 20-22; 26, p. 24-31].

Brugsch index =(C×100)/H (%) (*2.4*)
H – height length (m); C – is chest circumference (cm).

Vervek index =H/(2BW+C) (c.u.) (*2.5*)
BW – is body weight (kg); H – height length (m); C – is chest circumference (cm).

Verwek's index children and adolescents are brachymorphic according to the level of physical development (body is wide and legs/arms are relatively short); dolichomorph (narrow body and relatively long arms/legs) allows to divide into somatotype groups [2, p. 20-22].

2.4. Data analysis

The results were statistically processed by a special software package OriginPro v. 8.5 SR1 (EULA, USA) and "Microsoft Excel 2007" (Microsoft, USA). The results of experiments processed mathematically-statistically using standard biometric methods [13, p. 455-458; 27, p. 20-367; 28, p. 125-459; 29, p. 5-312].

The results are given in the $M\pm m$ form of the values of the experiments carried out in n replicates, M is the arithmetic average value and m is the standard error value. In addition, the results of the experiments, a statistically significant level of values between the groups were calculated using the Student's t-test and were evaluated as statistically reliable at p values <0.05, $p<0.01$ [30, p. 675-678].

3. RESULT AND DISCUSSION

Thus, the value of the body weight indicator (kg) increases in boys and girls in grades 1-11, including 23.03±0.17 kg in 1st grade boys, 64.64±0.28 in 11th grade boys 0.19 kg, 1st grade in girls the average was 23.04±0.12 kgand 54.91±0.18 in the 11th grade 0,18 kg. In this case, it was found that there is no significant difference in body weight in boys between the ages of 12-14 years (5-9 grades), and there is a difference in the description of "*jumping*" at the age of 15-16 years (at the age of 15, the average body weight is 42.82±0.16 kg, at the age of 16 59.07±0.20 kg).

Average values of body weight, height, chest circumference in children (grades 1-11) generally correspond to the values recorded in studies conducted on the scale of the CIS [31, p. 22-28].

It was also noted that girls' height was higher than that of boys at 9-10 years old (1.33±0.01-1.43±0.02 см), and significantly lower than that of boys at 17 years old. That the chest circumference in girls at the age of 11-17 compared to boys is noticeably higher (65.84±0.19-87.18±0,23 cm) (Table 1).

Thus, in the analysis of body weight in children and adolescents in scientific researches, the Ketle II index (BMI, *Body mass index*) developed by Adolf Ketle is used, in which the value of this indicator is <18.5 "*body weight deficit*", in 18.5-25 cases "*Normal*", in 25-30 cases "*excess body weight*", in >30 cases "*obesity*" [32, p. 120-281; 33, p. 102-110; 34, p. 47-199; 35, p. 54-178; 36; 37].

Ketle II (kg/m²) index, the state of body weight deficit (thinness) in boys is observed in the age range of 12-17 years, and this state is observed at the maximum value at the age of 12-14 years (20-60%), excess body weight (obesity) was found to be observed maximum (30%) in the 11-year-old contingent. It was found that the indicator of body weight deficit (thinness) in boys is 16.36% of the total number of respondents (n=110), and excess body weight (obesity) is 7.27%.

In girls, the state of body weight deficit (thinness) was observed in the age range of 9-17 years, and the maximum value was recorded in the age range of 14-16 years (60-70%). Overweight (obesity) in girls was found to be on average 15% (maximum 30%) in the age range of 8-14 years. It was found that the indicator of body weight deficit (thinness) in girls is 24.55% of the total number of respondents (n=110), and excess body weight (obesity) is 8.18%.

Also, compared to the total respondents (n=220), it was noted that the indicator of body weight deficit (thinness) in children is 32.73%, and excess body weight (obesity) is 7.73% (Table 2).

Thus, the value of Rorer's index is equal to the average minimum of 10.40±0.06, maximum of 13.68±0.14 in boys, the average minimum of 10.69±0.08, maximum of 12.89± 0.11 in girls. the level of development was assessed in the "*normative*" description (Table 3).

Average value of the Pine index is 27.66±0.35 for boys, the maximum is 43.67±0.18, the average for girls is 20.39±0.22, the maximum is 48.49± 0.19.

A conclusion was made that it corresponds to the "*dolichomorph*" samototype . Also, in the 17-year-old age group, the average value of the Pine index was equal to 20.39±0.22, and that this group generally belongs to the "*mesomorph*" samotype (Table 3).

Usually, during the physiological age of the human body, the average value of the Brugsch index is 50-55%, and values above this range allow us to conclude that the width of the chest or vice versa [38, p. 349; 39, p. 26-29; 40, p. 59-61; 41, p. 12-135].

Thus, the average value of the Brugsch index is 65-68% in children <1 year old , 64-60% in 2-3 years old, 63-52% in 4-7 years old, and 55-50% in children and adolescents older than 7 years old. A decrease in the value allows to draw a conclusion about "*chest narrowing*", and vice versa, "*chest expansion*" [41, p. 12-135].

In the studies, Brugsch's index was recorded as minimum 43.85±0.39, maximum 49.38±0.33 in boys, minimum 44.58±0.33, maximum 53.69±0,42 in girls. The analysis of the obtained results indicates that in the contingent of schoolchildrens who participated in the experiments, the chest size is close to the "*normative*" value, and there are no clearly expressed "*deviations from the norm*".

In the studies, the average value of the Vervek index in boys was 0.83±0.02, the maximum was 1.20±0.02, in girls, the minimum was 0.83±0.01, and the maximum 0.03±1.18.

Using the Vervek index, children and adolescents can be analyzed on the basis of the physical development level based on the proportions of the trunk, arms and legs, that is, brachymorph according to the level of physical development (the body is wide and the legs/arms are relatively short); can be divided into dolichomorphic (narrow body and relatively long arms/legs) somatotype groups [2; p. 20-22; 19, 2008; p. 208-228; 41; p. 12-135; 42, p. 60-63].

In this case, the value of this index is >1.35 "*dolichomorphism*" (the body is relatively narrow, legs and arms are relatively long), 1.35-1.25 "*average dolichomorphism*", 1.25-0.85 "*mesomorphism*" (normal development), <0.85 "*moderate brachymorphism*" (behind the norm) and <0.75 "*pronounced brachymorphism*" (smallness, wide body, relatively short legs and arms) [41, 12-135; 43, p. 9-12; 44].

Based on the obtained results, the level of physical development in boys and girls at the age of 7-16 years according to the values of the Verwek index can be assessed as "*mesomorphism*" (normative development) in the general case, and "*average brachymorphism*" (behind the norm) in the general case in the 17-year age range (Table 3).

Table 1. Analysis of the main physical development indicators (*body weight, height length, chest circumference*) of childrens of school #1 (grades 1-11) located in Andijan city of Andijan region of the Republic of Uzbekistan (*M±m*)

#	Physical development indicators	Physiological age groups (Grades)										
		Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11
		Boys (*n*=110)										
1	Body weight (kg)	23,03±0,17	28,48±0,14	26,16±0,23	31,96±0,15	40,40±0,18	40,36±0,26	41,41±0,24	42,82±0,16	59,07±0,20	58,08±0,25	64,64±0,19
2	Height length (m)	1,23±0,01	1,32±0,01	1,28±0,01	1,36±0,02	1,46±0,03	1,46±0,01	1,52±0,02	1,60±0,02	1,73±0,03	1,73±0,03	1,77±0,02
3	Chest circumference (sm)	57,16±0,26	60,73±0,23	63,24±0,37	63,42±0,18	71,95±0,28	72,07±0,32	70,05±0,40	75,53±0,21	76,48±0,18	78,04±0,35	86,28±0,34
		Girls (*n*=110)										
4	Body weight (kg)	23,04±0,12	25,62±0,15	29,59±0,13	30,81±0,14	31,39±0,19	38,34±0,22	51,74±0,13	45,78±0,17	45,34±0,21	48,14±0,16	54,91±0,18
5	Height length (m)	1,22±0,01	1,26±0,01	1,33±0,01	1,43±0,02	1,39±0,01	1,49±0,03	1,586±0,04	1,60±0,01	1,60±0,01	1,60±0,02	1,62±0,01
6	Chest circumference (sm)	57,45±0,20	58,33±0,24	64,82±0,28	63,88±0,35	65,84±0,19	70,81±0,27	80,46±0,23	78,09±0,31	80,24±0,34	77,82±0,29	87,18±0,23

Table 2. The level of physical development according to the analysis of the index Ketle II (kg/m2) childrens of school #1 (grades 1-11) located in Andijan city of Andijan region of the Republic of Uzbekistan (*M±m*)

#	Grades (years)	Physical development status assessment groups									
		Body weight deficit (thinness)		Regulatory (-)		Regulatory		Regulatory (+)		Excess body weight (obesity)	
		People (%)	Standard	People (%)	Standard	People (%)	Standard	People (%)	Standard	People (%)	Standard
		Boys (*n*=110)									
1.	1 (7)		≤13	3 (30)	13.1-14.9	6 (60)	15.0-17.0	1 (10)	17.1-18.9		≥19
2.	2 (8)		≤13	3 (30)	13.1-14.9	4 (40)	15.0-17.0	2 (20)	17.1-18.9	1 (10)	≥19
3.	3 (9)		≤14	8 (80)	14.1-15.9	1 (10)	16.0-18.0	1 (10)	18.1-19.9		≥20
4.	4 (10)		≤14	2 (20)	14.1-15.9	5 (50)	16.0-18.0	3 (30)	18.1-19.9		≥20
5.	5 (11)		≤15	3 (30)	15.1-16.9	4 (40)	17.0-19.0		19.1-20.9	3 (30)	≥21
6.	6 (12)	2 (20)	≤16	3 (30)	16.1-17.9	2 (20)	18.0-20.0	1 (10)	20.1-21.9	2 (20)	≥22
7.	7 (13)	3 (30)	≤17	5 (50)	17.1-18.9	1 (10)	19.0-21.0	1 (10)	21.1-22.9		≥23
8.	8 (14)	6 (60)	≤17	3 (30)	17.1-18.9	1 (10)	19.0-21.0		21.1-22.9		≥23
9.	9 (15)	1 (10)	≤17	3 (30)	17.1-18.9	4 (40)	19.0-21.0	1 (10)	21.1-22.9	1 (10)	≥23
10.	10 (16)	4 (40)	≤18	1 (10)	18.1-19.9	4 (40)	20.0-22.0	1 (10)	22.1-23.9		≥24
11.	11 (17)	2 (20)	≤19	4 (40)	19.1-20.9	3 (30)	21.0-23.0		23.1-24.9	1 (10)	≥25
		Girls (*n*=110)									
12.	1 (7)		13≤	5 (50)	13.1-14.9	5 (50)	15.0-17.0		17.1-18.9		≥19
13.	2 (8)		13≤	4 (40)	13.1-14.9	3 (30)	15.0-17.0		17.1-18.9	3 (30)	≥19
14.	3 (9)	2 (20)	14≤	3 (30)	14.1-15.9	4 (40)	16.0-18.0		18.1-19.9	1 (10)	≥20
15.	4 (10)	4 (40)	14≤	3 (30)	14.1-15.9	3 (30)	16.0-18.0		18.1-19.9		≥20
16.	5 (11)	3 (30)	15≤	6 (60)	15.1-16.9		17.0-19.0		19.1-20.9	1 (10)	≥21
17.	6 (12)	4 (40)	16≤	3 (30)	16.1-17.9	2 (20)	18.0-20.0		20.1-21.9	1 (10)	≥22
18.	7 (13)	1 (10)	17≤	1 (10)	17.1-18.9	5 (50)	19.0-21.0	1 (10)	21.1-22.9	2 (20)	≥23
19.	8 (14)	6 (60)	17≤	3 (30)	17.1-18.9		19.0-21.0		21.1-22.9	1 (10)	≥23
20.	9 (15)	6 (60)	18≤	4 (40)	18.1-19.9		20.0-22.0		22.1-23.9		≥24
21.	10 (16)	7 (70)	19≤	2 (20)	19.1-20.9		21.0-23.0	1 (10)	23.1-24.9		≥25
22.	11 (17)	3 (30)	20≤	5 (50)	20.1-21.9	1 (10)	22.0-24.0	1 (10)	24.1-25.9		≥26

Note: In the age range 7-17, adopted by the WHO, standard regulatory values were used to assess the level of physical development.

Table 3. Analysis of index values of physical development indicators (*body weight, height length, chest circumference*) of childrens of school #1 (grades 1-11) located in Andijan city of Andijan region of the Republic of Uzbekistan (*M±m*)

#	Physical development indices	Physiological age groups (Grades)										
		Grade 1	Grade 2	Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8	Grade 9	Grade 10	Grade 11
		Boys (*n*=110)										
1	Ketle index II (kg/m^2)	15,02±0,12	16,20±0,16	15,72±0,13	17,12±0,12	18,74±0,15	19,39±0,14	17,71±0,11	16,64±0,16	19,45±0,18	19,19±0,17	20,45±0,15
2	Rorer index (kg/m^3)	12,15±0,10	12,24±0,13	12,22±0,09	12,56±0,10	12,79±0,08	13,68±0,14	11,63±0,07	10,40±0,06	11,19±0,10	11,05±0,08	11,51±0,09
3	Pine index (c.u.)	43,67±0,18	43,12±0,42	39,34±0,37	41,04±0,40	34,50±0,19	33,74±0,21	41,19±0,30	41,98±0,39	38,33±0,23	37,82±0,37	27,66±0,35
4	Brush index (%)	46,09±0,46	45,55±0,37	48,88±0,28	46,46±0,34	48,99±0,23	49,38±0,33	45,89±0,44	47,14±0,32	43,85±0,39	44,85±0,40	48,51±0,42
5	Vervek index (c.u.)	1,20±0,02	1,13±0,03	1,12±0,03	1,08±0,02	0,98±0,01	0,96±0,01	1,01±0,03	0,99±0,01	0,91±0,02	0,90±0,02	0,83±0,02
		Girls (*n*=110)										
6	Ketle index II (kg/m^2)	15,48±0,10	16,08±0,13	16,36±0,16	15,11±0,11	16,08±0,18	17,21±0,19	20,58±0,10	17,56±0,14	17,54±0,14	18,66±0,16	20,84±0,13
7	Rorer index (kg/m^3)	12,71±0,08	12,78±0,11	12,20±0,09	10,69±0,08	11,54±0,13	11,58±0,14	12,99±0,11	10,89±0,10	10,92±0,08	11,66±0,12	12,89±0,11
8	Pine index (c.u.)	41,36±0,32	42,28±0,27	39,21±0,35	48,49±0,19	42,01±0,25	40,06±0,27	26,46±0,31	37,02±0,36	35,16±0,25	34,76±0,23	20,39±0,22
9	Brush index (%)	47,13±0,26	46,24±0,29	48,44±0,19	44,58±0,33	47,22±0,23	47,44±0,20	50,73±0,21	48,47±0,30	49,96±0,32	48,48±0,38	53,69±0,42
10	Vervek index (c.u.)	1,18±0,03	1,17±0,04	1,09±0,02	1,15±0,03	1,09±0,03	1,02±0,02	0,87±0,01	0,96±0,01	0,94±0,01	0,93±0,01	0,83±0,01

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Conclusion

Thus, when analyzing the level of physical development in children and adolescents in anthropometric/physiometric studies, indices based on body weight, height index (Kettle index II; Rorer index), chest circumference, and indices based on body weight index (Pine index, Brugsch index, Vervek index) has been proven to allow making objective conclusions [1, p. 71-77; 2; 20-22; 6, p. 39; 18, p. 10-152; 19, p. 208-228; 43, p. 66-69; 45, p. 9-12; 46, p. 76-79].

In research, the body weight (kg) of childrens of school #1 (grades 1-11) located in the city of Andijan, Andijan region of the Republic of Uzbekistan, increases in the 1-11th grades, the body weight indicator does not differ significantly in the age range of 12-14 years in boys, in 15-16 years it was found that there is a difference in the description of "*jumping*". It was noted that girls' height was higher than that of boys at the age of 9-10, and that it was significantly lower than that of boys at the age of 17. It was found that girls have a significantly higher chest circumference than boys at the age of 11-17.

According to the Ketle II index, body weight deficit (thinness) in boys is observed in the age range of 12-17 years, it was found that this condition is at its maximum value (20-60%) at the age of 12-14 years, excess body weight (obesity) is observed at the maximum age of 11 years (30%). Body weight deficiency (thinness) was found to be 16.36% of the total number of respondents (n=110), and excess body weight (obesity) was 7.27% in boys. Body weight deficit in girls was observed in the age range of 9-17 years, and the maximum value was recorded in the age range of 14-16 years (60-70%). It was found that excess body weight in girls is 15% on average (maximum 30%) in the age range of 8-14 years. It was found that body weight deficit is 24.55% of the total

number of respondents (n=110) and excess body weight is 8.18% in girls. Compared to the general respondents (n=220), it was noted that the deficit of body weight in schoolchildren is 32.73%, and excess body weight is 7.73%.

According to Rorer's index value , the level of physical development of schoolchildrens in the general condition was evaluated in the "*normative*" description.

Value of the Pine index corresponds to the "*dolichomorphic*" *self-type* of physical development in boys , and the "*mesomorphic*" self-type of girls in the 17-year-old age group.

In the researches, according to the Brugsch index , it was observed that the size of the chest of schoolchildrens in the general condition is close to the "*normative*" value, and there are no clearly expressed "*deviations from the norm*".

That the level of physical development in boys and also girls at the age of 7-16 years according to the value of the Verwek index is generally described as "*mesomorphism*" (normative development), and in the age range of 17 years, it is generally described as "*average brachymorphism*" (behind the norm).

The obtained results can serve as a scientific basis for the development of regional anthropo-physiological standards, as well as for the development of practical measures based on the strategy of an individual approach, taking into account the physiological indicators of the organism in the optimization of the level of physical development of childrens during school education.

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