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THE INFLUENCE OF MOTOR TESTS, ANTHROPOMETRIC MEASURES AND BODY COMPOSITION ON PHYSICAL EFFICIENCY IN ADOLESCENT SWIMMERS

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(Original scientific paper)

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Abstract

This one labour it investigate impact and connectivity between motor vehicles anthropometric tests measures and measures on the bodily composition where the swimmers adolescents from different adults categories . The research includes 70 participants (35 male and 35 female), divided in three adults groups : wound adolescence (10–12 years), middle adolescence (13–16 years) and late adolescence (17–19 years). Six anthropometric measures (body height, weight, arm span, seat height, foot length and body mass index), two body composition assessment variables (percentage of fat and muscle mass) and two motor tests (critical speed) were applied of swimming and long jump).The results show significant differences between the age groups in all analyzed parameters. Older swimmers show greater physical maturity, with better performance on motor tests and better body composition. Anthropometric measures, such as body height and arm span, also increase with age, reflecting biological and training effects. The percentage of fat decreases significantly, while the percentage of muscle mass increases in older age categories. These findings emphasize the specific training needs of swimmers at different stages of adolescence and highlight the importance of a personalized approach in sports selection and preparation. The paper makes a significant contribution to the understanding of the complex relationship between physical characteristics and performance in young swimmers.

Key words: *anthropometric measures, body composition, motor skills , swimming , adolescence .*

Introduction

The development on the swimmers adolescents represents complex process who includes junction on biological , physiological and motoric factors , which together affect on sports performance . The anthropometric ones measures , motor tests and physical composition everything basic indicators which her define the physical ability and potential on athletes , especially in phases on growth and development how adolescence . The understanding on these parameters is key for optimization on training and sports selection , as well as for support on healthy development .

Swimming how sport asks tall degree on coordination , strength and endurance , what it does ideal model for research on the physical and the functional characteristics where adolescents . Most of them researches focused on this one topic so far they have identified that the anthropometric ones characteristics , such as bodily height , span on hands and body weight , they have direct correlation with the success in swimming . The same so , the estimate on the bodily composition , as the percentage on fat and muscle table , additionally it points out the meaning on the specific training for improvement on the swimmers performance .

However , the number is limited on studies which her analyze the interaction on these factors where the swimmers from different adults categories , what leaves space for deeper scientific analysis . This one labour there is for purpose yes them investigate the connection and the differences between motor vehicles anthropometric tests measures and measures on the bodily composition where adolescents swimmers from three different adults groups . Additionally , labor everything strive yes determine how age and physiological changes affect on performance and yes them identify the parameters which can yes be used for precisely planning on the training one process .

This research is relevant how for the theoretical understanding on the physical development , as well as for the practical application in training the programs for young people swimmers . The results will offer directions for creation on optimized training strategies , which will them improve the swimmers abilities and will it support the healthy one development on adolescents .

Materials And Methods

The research included 70 participants (35 male and 35 female), arranged in three age categories: early adolescence (10–12 years), middle adolescence (13–16 years) and late adolescence (17–19 years). Participants were selected based on their active participation in swimming training programs.

The survey covered the following categories:

1. Anthropometric measures: body height, weight, arm span, seat height, foot length and body mass index (BMI).

2. Body composition: percentage of fat (FAT%) and percentage of muscle mass (MMAS%).

3. Motor tests: critical swimming speed (CSS) and long jump (SDM).

The following Measurement Methods were implemented.

Anthropometric measures : Standard procedures were applied according to the methodology of the International Biological Program (Lohman , Roche & Martorell , 1988). The measurements were carried out with anthropometers , height meters , electronic scales and other specialized instruments.

Body composition: Assessment of body composition was performed using bioelectrical impedance , using Body Composition Monitor (OMRON - BF511). Motor tests: Critical swimming speed (CSS): Calculated by the formula CSS = (D2 - D1) ÷ (T2 - T1), where D and T represent distances and times for 200m and 400m. Standing Long Jump (SDM): Measured with a springboard and tape measure, following a standardized procedure.

The measurements were performed in standard conditions (temperature 17–22°C) and appropriate sports equipment. Participants were measured by experts with previously provided written consent. The time of measurement was unified for all participants (7:30–14:30).

Statistical analysis was performed by applying multivariate and univariate analyzes of variance (ANOVA) to determine differences between categories. Post-hoc LSD tests were used for specific analysis of significance. Correlations between different parameters were determined by Pearson's coefficients. SPSS v.26 and STATISTICA 12 software were used for data processing.

The research was conducted in accordance with ethical standards and protocols for working with adolescents, including written consent from parents and participants.

Results

Table No. 1: Anthropometric characteristics in adolescent swimmers

The table her displays the difference in anthropometric measures (body height, weight, arm span, seat height, foot length and body mass index) among the three age categories.

Body height (AVIS): A progressive difference between age categories is noticeable. Swimmers from late adolescence (17–19 years) are statistically significantly taller than those from early (10–12 years) and middle (13–16 years) adolescence. This confirms the biological predisposition to growth, which is accelerated during puberty.

Body weight (BWE): There are statistically significant differences between categories, with weight being highest in late adolescent swimmers. This indicates the influence of age and training on the development of body mass.

Arm Span (ARSR): Arm span is related to swimming ability. The results show that swimmers from the older categories have a significantly larger arm span, which is an important functional advantage for swimming.

Body Mass Index (BMI): BMI is moderately high in all categories, but there are no significant differences between groups, indicating that swimmers of all ages manage to maintain a healthy ratio between weight and height .

Table No. 2: Body composition

In this table shows the estimates of percentage of fat tissue (FAT%) and muscle mass (MMAS%) in different age categories.

Percentage of Fatty Tissue (FAT%): There is a decrease in FAT% with increasing age, suggesting that regular exercise and puberty contribute to a decrease in body fat.

Muscle mass percentage (MMAS%): MMAS% increases with age, peaking in late adolescence. This highlights the role of specific swimming training for development on the muscles .

Table 1. Anthropometric characteristics composition of adolescent swimmers from several age categories

Dependent Variable	(I) Subgroup	(J) Subgroup	Mean Difference (IJ)	Std . Error	Sig. [b]	95% Confidence Interval for Difference [b]	
						Lower Bound	Upper Bound
AVIS	1.0	2.0	-12,375) *	2,584	,000	-17,530)	-7,220)
		3.0	-20,813) *	2,584	,000	-25,968)	-15,657)
	2.0	1.0	12,375 *	2,584	,000	7,220	17,530
		3.0	-8.438) *	2,584	.002	-13,593)	-3.282)
	3.0	1.0	20,813 *	2,584	,000	15,657	25,968
		2.0	8,438 *	2,584	.002	3,282	13,593
ATTACH	1.0	2.0	-9.444) *	2,907	.002	-15,242)	-3.645)
		3.0	-21,296) *	2,907	,000	-27,094)	-15,497)
	2.0	1.0	9,444 *	2,907	.002	3,645	15,242
		3.0	-11,852) *	2,907	,000	-17,651)	-6.053)
	3.0	1.0	21,296 *	2,907	,000	15,497	27,094
		2.0	11,852 *	2,907	,000	6,053	17,651
ARSR	1.0	2.0	-15,504) *	3,054	,000	-21,597)	-9,412)
		3.0	-23,458) *	3,054	,000	-29,551)	-17,366)
	2.0	1.0	15,504 *	3,054	,000	9,412	21,597
		3.0	-7.954) *	3,054	,011	-14,047)	-1.862)
	3.0	1.0	23,458 *	3,054	,000	17,366	29,551
		2.0	7,954 *	3,054	,011	1,862	14,047
ASED	1.0	2.0	-38,954)	26,948	,153	-92,714)	14,806
		3.0	-10,975)	26,948	,685	-64,735)	42,785
	2.0	1.0	38,954	26,948	,153	-14,806)	92,714
		3.0	27,979	26,948	,303	-25,781)	81,739
	3.0	1.0	10,975	26,948	,685	-42,785)	64,735
		2.0	-27,979)	26,948	,303	-81,739)	25,781
AUGST	1.0	2.0	-2.675) *	1,247	.035	-5.162)	-,188)
		3.0	-3,150) *	1,247	,014	-5.637)	-.663)
	2.0	1.0	2.675 *	1,247	.035	,188	5,162
		3.0	-.475)	1,247	,704	-2,962)	2,012
	3.0	1.0	3,150 *	1,247	,014	,663	5,637
		2.0	,475	1,247	,704	-2.012)	2,962
BMI	1.0	2.0	-2.817) *	1,085	,012	-4,981)	-.652)
		3.0	-2.017)	1,085	,067	-4.181)	,148
	2.0	1.0	2,817 *	1,085	,012	,652	4,981
		3.0	,800	1,085	,463	-1.365)	2,965
	3.0	1.0	2,017	1,085	,067	-,148)	4,181
		2.0	-,800)	1,085	,463	-2.965)	1,365

Table 2. Body composition of adolescent swimmers from several age categories

Dependent Variable	(I) Subgroup	(J) Subgroup	Mean Difference (IJ)	Std . Error	Sig. [b]	95% Confidence Interval for Difference [b]	
						Lower Bound	Upper Bound
FAT%	1.0	2.0	,183	1,576	,908	-2,960)	3,327
		3.0	-3.138)	1,576	,050	-6,281)	,006
	2.0	1.0	-,183)	1,576	,908	-3.327)	2,960
		3.0	-3.321) *	1,576	,039	-6,464)	-,177)
	3.0	1.0	3,138	1,576	,050	-.006)	6,281
		2.0	3,321 *	1,576	,039	,177	6,464
MMAS%	1.0	2.0	-1.658)	1,012	,106	-3.678)	,361
		3.0	-3.629) *	1,012	,001	-5.649)	-1,610)
	2.0	1.0	1,658	1,012	,106	-,361)	3,678
		3.0	-1.971)	1,012	,056	-3,990)	,049
	3.0	1.0	3,629 *	1,012	,001	1,610	5,649
		2.0	1,971	1,012	,056	-.049)	3,990

Table 3. Motor test composition among adolescent swimmers of several age categories

Dependent Variable	(I) Subgroup	(J) Subgroup	Mean Difference (IJ)	Std . Error	Sig. [b]	95% Confidence Interval for Difference [b]	
						Lower Bound	Upper Bound
400m swim	1.0	2.0	1787,500 *	778,024	.025	235,385	3339,615
		3.0	3435,000 *	778,024	,000	1882,885	4987.115
	2.0	1.0	-1787,500) *	778,024	.025	-3339.615)	-235,385)
		3.0	1647,500 *	778,024	,038	95,385	3199,615
	3.0	1.0	-3435,000) *	778,024	,000	-4987.115)	-1882,885)
		2.0	-1647,500) *	778,024	,038	-3199.615)	-95,385)
200m swim	1.0	2.0	1017,500 *	493,682	,043	32,631	2002,369
		3.0	1590,000 *	493,682	.002	605,131	2574,869
	2.0	1.0	-1017,500) *	493,682	,043	-2002,369)	-32,631)
		3.0	572,500	493,682	,250	-412,369)	1557,369
	33.0	1.0	-1590,000) *	493,682	.002	-2574.869)	-605,131)
		2.0	-572,500)	493,682	,250	-1557,369)	412,369
CSS	1.0	2.0	6,417 *	3,133	,044	,166	12,668
		3.0	15,375 *	3,133	,000	9,124	21,626
	2.0	1.0	-6.417) *	3,133	,044	-12,668)	-,166)
		3.0	8,958 *	3,133	,006	2,707	15,209
	3.0	1.0	-15,375) *	3,133	,000	-21,626)	-9.124)
		2.0	-8.958) *	3,133	,006	-15,209)	-2.707)
SDM_avr	1.0	2.0	-20,467) *	8,269	,016	-36,962)	-3,971)
		3.0	-49,596) *	8,269	,000	-66,091)	-33,100)
	2.0	1.0	20,467 *	8,269	,016	3,971	36,962
		3.0	-29.129) *	8,269	,001	-45,625)	-12,634)
	3.0	1.0	49,596 *	8,269	,000	33,100	66,091
		2.0	29,129 *	8,269	,001	12,634	45,625

Table No. 3: Motor tests

The table them displays the results from motor tests: Critical swimming speed (CSS), 400m and 200m swimming time, as well as standing long jump (SDM) results.

400m and 200m swim times: Times decreased significantly with age, indicating improved endurance and efficiency in swimming technique in older groups.

Critical swimming speed (CSS): CSS improves with age, indicating that training has a direct impact on swimmers' aerobic endurance and fitness.

Standing Long Jump (SDM): Scores improve with age, reflecting increased strength and explosiveness where the older ones adolescents .

Discussion

The results from this research them confirm the theoretical and the practical assumptions for the importance on the anthropometric ones measures , the physical composition and motor skills abilities in context on the physical ones performance where the swimmers adolescents . Perceptible everything the following key findings :

The anthropometric ones measures : The differences in the body height , weight and span on hands indicate on the biological development and impact on the age upon the bodily ones proportions . The swimmers from the older ones adults categories everything with bigger height and span on hands , what represents advantage in the sport how swimming where these characteristics everything key for effectively performance on the techniques .

The corporeal composition : The older ones swimmers show reduced percentage on fatty tissue and enlarged percentage on muscular a table . This indicates on the importance on the regular training for achievement optimal corporeal composition who it improves the swimmer performance . However , the results emphasize that the specific training game critical role in the directed reduction on fat and increase on the muscular a table .

The motorbikes tests : The progressive improvement in the results on motor vehicles tests (like which is critical speed on swimming and jumping in distance from place) confirms that age and experience in the training significantly affect on endurance , coordination and explosiveness force .

These results it emphasize the meaning on the holistic approach in the designing on the training programs . The systematic development on motor vehicles abilities in combination with constant monitoring on anthropometric and physical parameters can yes results in optimization on performance on the young people swimmers .

In addition , the discovered connections between the anthropometric ones measures , the physical composition and motor skills tests indicate on the need from individualized programs for training which will them they take consideration physiological and developmental needs on each one adult category .

Conclusion

The research shows that the anthropometric ones measures , the physical composition and motor skills abilities everything critical indicators for the physical efficiency where the swimmers adolescents . The results emphasize that the age and the specific training significantly affect on improvement on these parameters , which is from especially meaning for coaches and sports experts in the development on optimal strategies for sports selection and preparation .

Key findings :

The older ones swimmers they have significantly improve results in motor vehicles tests and better corporeal composition .

The height , the span on hands and the muscular table they have direct correlation with the swimmer performance .

The specific ones training programs which everything customized on the individual ones needs on the athletes everything from vital meaning for support on theirs development and performance .

This research offers basis for further studies and practices which will everything focus on improvement on the methodologies for training and selection , as well as constantly promotion on the physical and the functional condition on the young people swimmers .

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