The influence of the means of general physical training on the biomechanical indicators of performing a hit with a club by young golfers

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Abstract

Objective of the study was to develop a methodology for the general physical training of golfers at the initial stage and evaluate its effectiveness in the course of a pedagogical experiment.

Methods and structure of the study. The pedagogical experiment involved 60 golfing boys, whose age was 9.00±0.82 years. In the experimental (EG) and control (CG) groups of 30 people each. During the four-month mesocycle, the developed methodology of physical training was introduced into the training process of the EG. Representatives of the CG trained according to a different methodology, which consisted only of playing golf in the field or using golf simulators. Twice (before and after a four-month training mesocycle) in both groups, pedagogical testing was carried out, indicators of carpal dynamometry, proprioceptive sensitivity, biomechanical indicators of the performance of a blow with a club using a Ruge indoor golf simulator were determined. The studies were carried out on the basis of the golf club in Shenzhen, China.

Results and conclusion. The effectiveness of the developed method of general physical training of 8-10 year old boys involved in golf was assessed in the process of a pedagogical experiment. The analysis of intergroup differences in the results of pedagogical testing showed that in the EG at a statistically significant level relative to the initial data, in comparison with the representatives of the CG, 14 parameters out of 15 studied significantly increased ($p<0.01$). Growth rates, expressed as a percentage, ranged from 4% to 48.9% ($p<0.01$). Also, in the representatives of the EG relative to the athletes of the CG, five indicators of the biomechanical analysis of the club stroke performed with the use of a golf simulator changed at a significantly significant level: the distance that the ball flew and rolled on the ground (yard), the distance of the ball flight (yard), the angle of the ball departure and club shaft angle (^{0}), club head speed (miles·hour^{-1}) ($p < 0.01$).

Keywords: *golf, testing, biomechanical analysis, methodology, training process.*

Introduction. Golf is a popular sport in the world, a kind of recreational activity and physical activity, a means of increasing the level of physical qualities and abilities, the functional state of those involved [1-3]. In the training process of golfers, the emphasis is more on the development of the strength of individual muscle groups, speed-strength abilities, as well as flexibility, and to a lesser extent on coordination abilities [4-6]. To control the general physical fitness of athletes of different qualifications, exercises are widely used to determine the indicators of speed-strength abilities, flexibility, strength [1, 2, 6]. Most of the presented studies contain data from surveys of golfers aged 13 years and older (up to 70 years old) [5-7]. There is a lack of scientific data on the physical training of children involved in golf at the initial stage.

Objective of the study was to develop a methodology for the general physical training of golfers at the initial stage and evaluate its effectiveness in the course of a pedagogical experiment.

Methods and structure of the study. The pedagogical experiment involved 60 golfing boys, whose age was 9.00±0.82 years. In the experimental (EG) and control (CG) groups, 30 people each, while in each group there were 10 people aged 8, 9 and 10 years, respectively. Experience in golf – 1.62±0.36 years. During the four-month period, the boys from the EG trained according to the developed method of physi-

cal training. They practiced 4 times a week (Monday, Wednesday, Thursday and Saturday), while Thursday was only a game day, when the children played golf in the field or on a golf stimulator in the main part of the training session. Representatives of the CG trained according to a different methodology, which consisted only of playing golf in the field or using golf simulators. Twice (before and after a four-month training mesocycle) in both groups, pedagogical testing was carried out, indicators of carpal dynamometry, proprioceptive sensitivity, biomechanical indicators of the performance of a blow with a club using a Ruge indoor golf simulator were determined. The studies were carried out on the basis of the golf club in Shenzhen, China.

Results of the study and their discussion. The analysis of intergroup differences in the results of pedagogical testing of boys aged 8–10 years old, who go in for golf, after a four-month experiment showed that in the EG at a statistically significant level, compared with the representatives of the CG, 14 parameters out of 15 studied significantly increased ($p<0.01$). Growth rates, expressed as a percentage, ranged from 4% to 48.9% ($p < 0.01$).

The analysis of the biomechanical parameters of hitting with a club made it possible to reveal significantly significant differences from the initial data after the experiment both in the EG and in the CG, however, these changes are of a different nature (Table 2). In the EG, the indicator of the ball flight distance increased significantly, which increased by 12.49 yards, which amounted to 33.88% ($p<0.01$). The indicator of the distance that the ball flew and rolled on the ground increased at a significantly significant level at the end of the experiment, the difference was 12.46 yards, which corresponded to 26.37% ($p<0.01$). Significantly changed after the experiment, on average for the group, the angle of departure of the ball. Based on the analysis of scientific literature, for the effective execution of a strike, the optimal ball angle should be in the range from 40 to 600 [1, 2, 6]. In athletes from the EG, at the end of the pedagogical experiment, this biomechanical indicator increased by 6.63 ^{0,} which amounted to 30% ($p<0.01$). The angle of the shaft (shaft) of the club, which should be equal to zero in case of an effective strike, in boys after the experiment significantly decreased at a statistically significant level, the magnitude of the difference was 0.340, which corresponded to 45.9% ($p<0.01$). Another indicator of the effective performance of the blow - the speed of the club head increased by 6.31 mile•hour-1 ($p<0.01$). The value of differences, expressed as a percentage, averaged 17.7% for the group.

As a result of the analysis of intergroup differences, it was revealed that after the experiment, 5 out of 10 studied biomechanical indicators of the club stroke performance in the representatives of the EG relative to the athletes of the CG changed at a significantly significant level (Table 2).

Table 1. *Changes in the biomechanical indicators of the performance of a hit with a club by boys 8–10 years old involved in golf in the course of a pedagogical experiment*

Test	Статистический показатель $\bar{X} \pm \sigma$					
	Experimental group (n = 30)			Control group (n = 30)		
	Before experiment	At the end of the experiment	t	Before experiment	At the end of the experiment	t
The distance that the ball flew and rolled on the ground, yards	47,26±21,89	59,72±21,19	-9,79*	48,95±22,94	44,83±21,45	3,05*
Ball flight distance, yard	36,86±22,27	49,35±21,32	-9,66*	36,04±23,68	31,88±20,78	2,77*
Distance the ball rolled on the ground, yards	10,38±11,30	10,36±11,07	0,09	12,88±13,72	12,95±12,31	0,07
Ball departure angle, ^{0}	22,01±12,02	28,63±8,52	-6,71*	19,36±10,29	20,44±9,74	-1,03
Average ball speed in flight, mile•hour^{-1}	52,02±15,52	53,35±14,55	-7,07*	53,65±16,84	54,81±15,97	-0,61
The number of turns of the ball around the vector, rpm^{-1}	2341,34±988,94	2423,40±943,99	-1,78	2147,18±1123,66	2307,88±1088,13	-1,18
The number of ball turns around the vertical axis, rpm^{-1}	0,42±288,68	0,91±288,46	-0,29	36,16±358,32	32,82±354,21	0,72
Club tip angle during hit, ^{0}	-0,92±12,19	-0,69±11,64	-1,31	-1,19±12,01	-1,43±11,32	0,35
The angle of the shaft (rod) of the club, ^{0}	0,74±13,76	0,40±13,41	2,12**	-0,30±13,58	-1,44±14,23	1,08
Club head speed, mile•hour^{-1}	35,68±9,94	41,98±11,29	-5,64*	36,73±10,94	37,62±10,62	1,09

Note: * - $p<0.01$, ** - $p<0.05$, Student's t-test

Table 2. *Indicators of biomechanical indicators of club stroke performance in golfing boys aged 8–10 after the pedagogical experiment (experimental and control groups)*

Test	Result in testing, $\bar{X} \pm \sigma$			
	Experimental group (n= 30)	Control group (n= 30)	Values of differences	t
The distance that the ball flew and rolled on the ground, yards	59,72±21,19	44,83±21,45	14,89	2,73*
Ball flight distance, yard	49,35±21,32	31,88±20,78	17,48	3,22*
Distance the ball rolled on the ground, yards	10,36±11,07	12,95±12,31	-2,59	-0,86
Ball departure angle, ^{0}	28,63±8,52	20,44±9,74	8,20	3,47*
Average ball speed in flight, mile·hour^{-1}	53,35±14,55	54,81±15,97	-1,46	1,43
The number of ball turns around the vector, rpm^{-1}	2423,40±943,99	2307,88±1088,13	115,53	0,44
The number of ball turns around the vertical axis, rpm^{-1}	0,91±288,46	32,82±354,21	-31,91	0,38
Club tip angle during impact, ^{0}	-0,69±11,64	-1,43±11,32	0,74	1,03
The angle of the shaft (rod) of the club, ^{0}	0,40±13,41	-1,44±14,23	1,84	3,17*
Club head speed, mile·hour^{-1}	41,98±11,29	37,62±10,62	4,36	2,68*

Note: * - p<0.01, Student's t-test

It should be noted that in the EG, the indicator of the distance that the ball flew and rolled on the ground, relative to the average indicator of the CG, increased by 24.93% at the end of the experiment, which is statistically significantly different (p<0.01). The indicator of the ball flight distance also increased significantly, the difference between the data of the control and experimental groups was 35.4% (p<0.01). Another indicator on which the result of a golf stroke depends - the angle of the ball departure, increased in the EG and differs from the data of the CG athletes by 28.6% (p<0.01). The indicator of the club head speed also differs at a statistically significant level among the representatives of the EG, in which, on average in the group, it increased by 10.4% compared to the data of golfers from the CG (p<0.01). Consequently, the developed methodology of physical training, introduced into the training process of 8–10 year old boys who go in for golf, had a positive effect on the angular and speed parameters of hitting with a club.

Conclusions. The effectiveness of the developed method of general physical training of 8–10 year old boys involved in golf was assessed in the process of a pedagogical experiment. The analysis of intergroup differences in the results of pedagogical testing showed that in boys from the EG, at a statistically significant level relative to the initial data, in comparison with the representatives of the CG, 14 parameters out of 15 studied significantly increased (p<0.01). Growth rates, expressed as a percentage, ranged from 4% to 48.9% (p<0.01).

As a result of the analysis of intergroup differences in the biomechanical analysis of the club stroke, performed using a golf simulator, it was revealed that after the experiment, five indicators changed at a significantly significant level among the representatives of the EG relative to the athletes of the CG (p<0.01). These include such indicators as the distance that the ball flew and rolled on the ground (yard), the distance of the ball flight (yard), the angle of the ball and the angle of the shaft (rod) of the club (0), the speed of the club head (mile • hour-1).

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