



Interrelation of the club rotation frequency with the power indicators of hands of highly qualified field hockey players

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Abstract

Objective of the study was to establish the relationship between the frequency of rotation of the club and the power indicators of the hands of hockey players on the grass of high qualification.

Methods and structure of the study. 16 hockey players of the Russian national field hockey team took part in the study process. The indicators of the strength of the right and left hand (N) were studied, the force coefficient (%) and the club rotation frequency for 15 s (number of times) were calculated.

Results and conclusions. The conducted correlation and regression analysis showed a statistically significant $p < 0.05$ negative relationship between the differences in the strength of the hands and the number of rotations of the left hand in 15 s ($r = -0.623$). The greater the difference in the level of strength (N) of the development of the left hand in relation to the right hand, the more rotations the athletes perform with their left hand.

Keywords: field hockey, speed, stick rotation frequency, arm strength, right and left hand.

Introduction. Specialists in the field of hockey note certain gaps and a low level of possession of a stick and a puck by young hockey players, which leads to errors in technique and other hockey techniques [1], and this ultimately affects the quality of the game. Methodological approaches to teaching stick handling technique have not changed for many years, not to mention its improvement.

The club is the tool, the object that largely determines the style and variety of games. Without a stick, we cannot imagine ice hockey, field hockey, or Russian hockey, as well as golf, floorball, roller hockey. At the heart of all these games is a stick as a tool for influencing the ball or puck [3]. The stick handling technique is primarily influenced by the physiological mechanisms and anthropometric features of the athlete. The frequency of shifting the ball or puck, the amplitude of movements largely determine the effectiveness of the

opponent's stroke. The frequency of movements is one of the forms of manifestation of speed abilities [2].

To date, technical means are not actively used in training and improving the technique of holding a club [3] and, importantly, there is no quantitative assessment of them. Considering that the basis of stick handling technique is the speed of movements not only of the hands, but of the entire upper shoulder girdle, intermuscular coordination and strength itself, it seemed interesting to us to study the relationship between the above indicators.

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Methods and structure of the study. 16 hockey players of the Russian national field hockey team took part in the study process. The mean age was



23.7 ± 4.0 years. The study was conducted at the Yug-Sport training base in Kislovodsk. The following indicators were recorded: age, dynamometry of the right and left hands, index (connecting the strength of the hands and the athlete's own weight), the frequency of rotation of the club with the left hand in 15 s. Additionally, the difference between the strength of the right and left hand was determined. In table 1 shows the data of descriptive statistics on the considered indicators. The strength of the hands was determined in the isometric mode of operation. A group of muscles of the forearm was studied, including the muscles of the ulnar flexor of the wrist, the radial flexor of the wrist, and the long palmar muscle. The carpal digital dynamometer "Strongman DMER-120" was used. The power index was calculated as the ratio of the average value of the force when compressing the dynamometer with the right and left hands to the body weight of the subject, expressed as a percentage.

The club rotation frequency was determined by the number of "pronation-supination" movements of the left hand. The MPU9250 sensor (manufacturer TDK) providing registration of the rotation of the stick. Information was collected at a frequency of 1000 Hz. Data processing was carried out using an Excell spreadsheet.

Results of the study and their discussion. The analyzed statistical indicators of highly qualified field hockey players at the beginning of the preparatory period of the annual cycle are presented in Table 1.

The registered indicators are well described by the normal distribution. The table shows that the variability of almost all indicators (with the exception of the difference between the strength of the right and left hand) does not exceed 20%, which indicates a typical variation characteristic of most indicators recorded by athletes. The only exception is the magnitude of the difference in strength between the right and left hand. According to the average values of dynamometry, as well as the average difference between them, it can be seen that the values recorded on the left hand of athletes are more often higher than on the right. The magnitude of the difference itself varied greatly: from -59 to +40 N. Comparison of the average values of the differences in the strength of the right and left hand of hockey players was statistically significant ($p < 0.05$). Therefore, it can be argued with a high degree of probability that girls who specialize in field hockey have a more developed left hand than their right hand.

The correlation coefficients calculated according to the analyzed indicators are presented in Table 2.

In the presented correlation coefficients, the relationship between the strength of the right and left hands, as well as their relationship with the index, which takes into account both the strength of the hands and the weight of the athlete himself, is quite obvious. It should be noted a statistically significant negative relationship between the differences in the strength of the hands and the number of rotations of the left hand in 15 s ($r = -0.623$). That is, the greater

Table 1. Statistical indicators of highly qualified female hockey players (n=16)

Index	Age (years)	Strength of the right hand (Newton)	Strength of the left hand (Newton)	Strength index (%)	Club speed (number of times)	The difference between the strength of the right and left hand (Newton)
	23,7	323,2	334,5	55,6	31,4	-16,2
Standard deviation	4,0	52,9	53,8	9,8	6,0	27,9
min	18	219	256	41,7	21	-59
max	33	427	461	74,1	44	40
scope	15	208	205	32,4	23	99
V%	16,7	16,4	16,1	17,7	19,0	171,9



Table 2. Correlation coefficients between the analyzed indicators

Analyzed indicators	Age	Strength of the right hand	Strength of the left hand	Strength index	The speed of rotation of the club	Difference between the strength of the left and the right hand
Age of the athlete	1					
Strength of the right hand	0,029	1				
Strength of the left hand	0,282	0,789	1			
Strength index	0,292	0,737	0,872	1		
Speed of rotation of the club	0,207	-0,141	-0,169	-0,021	1	
Difference between the strength of the left and right hand	-0,423	0,159	-0,356	-0,322	-0,623	1

*significant correlation coefficients ($p < 0.05$) are in bold

the difference between the strength indicators of the left and right hand, the greater the number of “pronations of supinations” performed by the hockey player, and as a result, her technical readiness is better. This pattern sets us the task of studying the fact in more detail. At the same time, the absolute strength indicators of the hands did not matter. For example, for one of the best hockey players in terms of rotation frequency of the stick (42 times), the difference between the left (318 N) and right (259 N) hand was 59 Newtons, and for the second, with a rotation frequency of 39 times, this difference was 61 N, respectively left hand 414 N and right hand 364 N.

This dependence is clearly visible in the diagram shown in the figure.

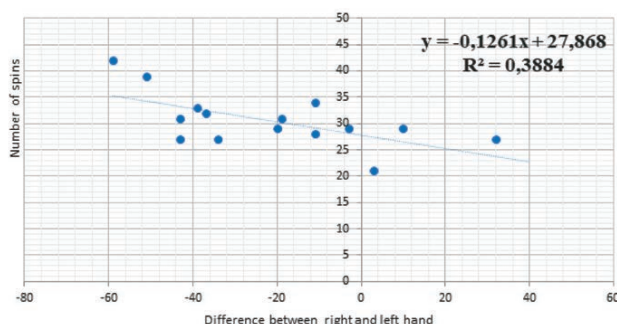


Figure 1. Regression line and regression equation between the difference in strength indicators of the right and left hands and the frequency of rotation of the left hand

It shows the correlation field, the regression line and the regression equation between the difference in the strength of the right and left hands and the fre-

quency of rotation of the left hand. We clearly see a negative relationship between the analyzed indicators. The regression equation shows that an increase in the difference between the strength of the right and left hands by 10 N (about 1 kg) leads, on average, to an increase of 1.3 in the number of turns with the left hand.

It should also be noted that the degree of mutual influence of the indicator of the difference between the strength of the hands and the number of turns of the left hand with the stick is about 40% (38.8%).

It should be emphasized that the noted regularities apply only to female athletes of a given sports qualification and age group. We can assume that the indicator of the power difference between the left and right hand will not be of key importance for young hockey players, therefore, the level of technical mastery of stick handling will not be limited by the power indicators of the upper shoulder girdle.

Conclusions. The values of dynamometry of the left hand of hockey players statistically significantly exceed the values of the right hand. Comparison of these values using the sign test revealed statistically significant differences ($p < 0.05$). According to the results of the study, the difference between the dynamometry of the right and left hands varied from -59 to +40 N. Therefore, the girls who specialize in field hockey have a more developed left hand than the right.

A statistically significant negative relationship was found between the differences in the strength of the hands and the number of rotations of the leading left



hand with the stick in 15 s ($r = -0.623$). This allows us to conclude that the greater the difference between the strength indicators of the left and right hands, the greater the number of “pronation-supination” rotations performed by the hockey player, the higher her technical readiness.

When a certain level of sports readiness was reached, the absolute strength indicators of the hands had practically no effect on the club rotation frequency, therefore, they did not limit their technical mastery.

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