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Evaluation of specialized physical training for high-ranking male judo athletes

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Abstarct- The goal of our research was to develop and test assessment norms for identifying the strengths and weaknesses of athletes in order to scientifically develop their specialized physical training, and to find the relationship between the level of athletes' physical training and their success in competitions. For the purpose of the research 57 male athletes (25 high-ranking) from light, middle and heavy-weight classes were randomly selected. The test was conducted in two stages. In the first stage, the results of the *movement test* are converted into scores on the assessment scale, which serves as an initial score, while during the second stage, the scores obtained during the first stage are compared with the norm, which determines the final score. The standards for assessing the special physical training of athletes were developed in four stages and classified into 5 levels based on the normal distribution of athletes' achievements. By converting an athlete's performance in high-level competitions into points, it is possible to determine the average performance of athletes and compare it with their specialized physical training level. The results collected were analyzed using the SPSS-26 software. After the analysis it was determined that there is a correlation between specialized physical training of the athletes and the athletes sport achievements (r=0.536, p=0.001). The correlation was proven by athletes with specialized physical training score of 8.1 and above showing high sport achievements.

Keywords- Specialized training, Level, high-ranking, Judo, Normative

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1. INTRODUCTION

One of the key conditions for determining the results of sports coaching is the assessment of athletes' specialized training levels. With the help of the specialized training assessments coaches are able to compare the athletes' physical training level to the previous results, clarify, and adjust the training methods accordingly.

The results of a survey conducted among coaches training high-ranking athletes showed that 60% of coaches do not specifically assess the physical condition of each athlete, 20% assess it by observing the training and competition process, 10% assess it by the success archived by the athletes in competitions, and only 10% assess the specific physical condition of athletes according to appropriate procedures. This shows that the process of determining and assessing the level of specialized physical training of high-ranking athletes and conducting periodic monitoring during training is lagging. [1]

Achieving a high level in specialized physical training increases the athlete's ability to perform technical and tactical exercises with maximum strength, speed, and range, and is an important foundation for improving sports skills. Achieving success in any sport is not possible without adequate development of an athlete's physical capabilities, including speed, endurance, flexibility, and strength, regardless of the quality of technical and tactical training. [2]

Furthermore, it is essential for the coach to acquire detailed information regarding the physical capabilities of each athlete during training in order to select the most effective training methods based on this data. [3]

In his work, "Study on the Development of Special Endurance in Judo Athletes", Shiyan developed a formula and methodology for determining the coefficient of special endurance in wrestlers. Through extensive observation and experimental research, he concluded that assessing the level of special endurance in high-ranking wrestlers can serve as a predictor of their success in competitions. [4]

For wrestlers, good level of specialized training is one of the key factors in achieving high results in competitions. Wrestlers of the same level may differ greatly in physical abilities, but their individual styles differ. During the experiment, the increase in the results of special physical training of wrestlers in the experimental group was significantly higher in all tests - from 6% to 14%, and in the control group - from 2% to 3%.[5]

When determining the specialized physical training of high-ranking boxers of different weight classes, light (46-60 kg) the explosive power of a single punch was determined by the right and left straight punches, whereas the power and speed-endurance of series of punches was determined by the performance in the first 30 seconds of a one minute workout; middle-weight (60—70) explosive power and speed-power was determined by the power of a single punch; heavy-weight (over 70kg) power endurance was determined by the number of repetitions of a series of punches performed in one minute [6]. This shows that it is possible to divide the weight categories of judo athletes into light, medium, and heavy.

Although Mongolian researchers have conducted studies on the physical development (Lkhagvasuren., 1999), (Nyam., 1999), (Khalzan., 2004), (Tuul., 2011), (Bat-Otgon., 2013), general training, and performance of elite athletes, there has been a notable gap in research focused on assessing the level of specialized physical training in high-ranking athletes and the development of corresponding evaluation standards. When analyzing the research documents conducted in the field of physical education and sports in Mongolia, there are few studies that have thoroughly studied the specialized physical training of Mongolian athletes who are achieving sports success on the world stage. The goal of our research was to develop and test assessment norms for identifying the strengths and weaknesses of athletes in order to scientifically develop their specialized physical training, and to find the relationship between the level of athletes' physical training and their success in competitions.

2. LIMITATONS OF THE RESEARCH

a. This study examines the specialized physical training levels of high-raking athletes only and does not include other athletes who have been training for several-years.
b. This study examined the specialized physical training levels of high-ranking judo athletes, who are rapidly climbing in ranks in Mongolia. In the future, it is necessary to comprehensively study the technical, tactical, and psychological training of high-ranking athletes.
c. The lack of specific movement tests to assess the specialized physical training level of high-ranking judo athletes is thought to be related to the competitive nature of the sport. This limits the ability to compare results with internationally recognized test results.

3. RESEARCH METHODS

- Document and original literature research methods, to clarify the research status of the topic and establish the context;
- Questionnaire method, to assess the physical fitness of the athletes and to clarify the future needs;
- Interview method, to apply results of the research to training and coaching, and to identify the needs for specialized physical training;
- Movement testing methods to determine the level of specialized physical training of athletes and develop evaluation standards;
- The use of programs such as Adobe Premier Pro CC (high quality video editing and slowing down) and Sketchpad (an automatic geographic drawing software to analyze the amplitude angle of movement) when processing the research results .
- The statistical analysis of the collected data was performed using the SPSS-22 program.

4. RESULTS

The study involved 16 male judo athletes with high ranks. In terms of sports ranks and titles, 12.5% were Khudulmuriin Baatar (Heroes of Labor), 6.25% were Gaviyat tamirchin (Honored Athletes), and 81.25% were Olon ulsiin master (International Masters). The average age of the athletes was 25.06±1.13, and the average time they had been practicing the sport was 10.62±1.24 years.

In comparison to the study conducted by Lkhagvasuren G. in 2002, the average age of high-ranking athletes in freestyle wrestling, judo, and boxing who won medals at the Olympics and World Championships was relatively younger in 2016 (24.37 years) compared to 2002 (25.6 years) [7]. However, in terms of the duration of their athletic careers, these athletes had 0.54 fewer years of experience, with an average of 25.06 years of practice in 2016 compared to 2002.

These figures align with the findings of researchers who state that 'an athlete must engage in a specific sport for 9-12 years to achieve significant success.' Additionally, they suggest a potential correlation between an athlete's age and the amount of time required to attain a high level of specialized physical training.

For male judo athletes, the weight categories changed a total of 5 times from 1956 to 2014. Initially, there were 4 different weight categories: 63 kg, 80 kg, 93 kg, and absolute. Since 2010, the weight categories have been increased to 7: up to 60 kg, 60-66 kg, 66-73 kg, 73-81 kg, 81-90 kg, 90-100 kg, and over 100 kg.

The weight categories seen a total of 5 changes during the 1964-1992 Olympic Games. From 1996, 7 weight categories were introduced: 60 kg, 66 kg, 73 kg, 81 kg, 90 kg, 100 kg, and +100 kg. [8]

Based on the above-mentioned weight categories, we divided the athletes in the study into three categories: lightweight (60; 66 kg), middleweight (73; 81 kg), and heavyweight (90; 100≤ kg).

Athletes with good strength endurance can hold their opponent for an extended period of time, while athletes with good special endurance can wrestle out of their opponent's holds and maintain their own for prolonged periods. For judo athletes, strength endurance helps to improve muscle strength, speed-strength helps to maintain movement speed for long periods, while general endurance helps to maintain mental stability. As such, we speculate that one of the conditions for athletes to achieve high success in competitive sports is to improve their speed-strength endurance training levels. Short term endurance or endurance while performing high intensity movements from 45 seconds to 2 minutes, in an oxygen-free environment, strength was chosen to account for 33.3%, speed - 33.3%, and endurance - 33.3%. The following results were observed when determining the speed-strength endurance level of high-raking judo athletes using a three-minute dummy-lifting movement test (Table 1).

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Table 1. Average speed-strength endurance of high-ranking male judo athletes (throwing the dummy over the shoulder, times in 3 minutes)

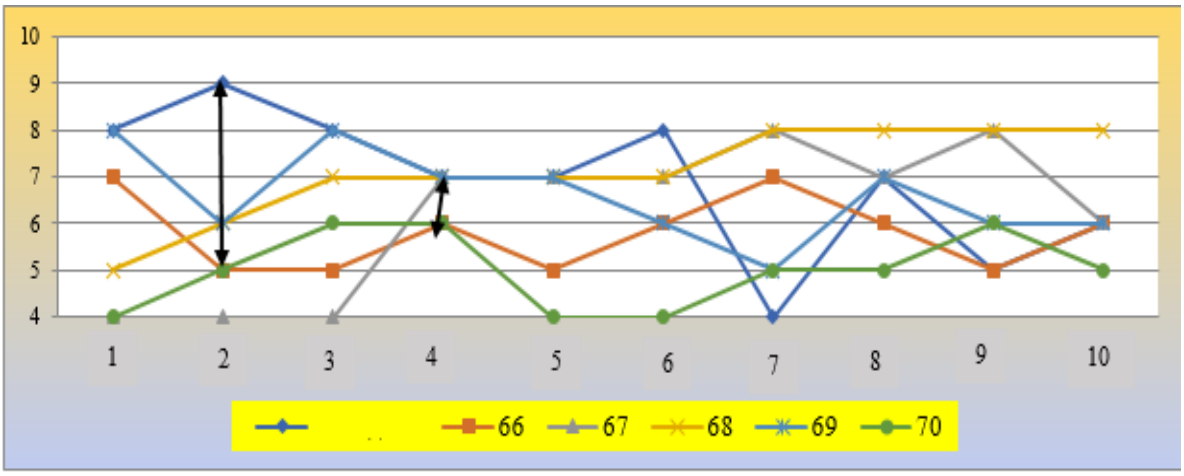
Descriptive Statistics						ANOVA		Decision
Weight class	N	Minimum	Maximum	Mean	Std. Deviation	F	Sig	
Light	7	30.00	35.00	32.7143	1.79947	42.475	.000	different
Middleweight	6	44.00	53.00	47.6667	3.01109			
Heavyweight	4	44.00	57.00	50.0000	6.55744			

High-ranking male judo athletes performed the exercise of throwing a dummy alternately over their right and left shoulders an average of 33.7 times in 3 minutes for lightweight athletes, 47.6 times for middleweight athletes, and 50 times for heavyweight athletes. When examining whether speed-strength endurance depends on weight class using ANOVA analysis showed F=42.475, p=0.000 for male athletes. From this, it was observed that the speed-strength endurance of athletes depends on weight class. A wrestler with strength endurance can maintain a hold for a longer time, and a wrestler with special endurance can perform all of the wrestling techniques at high speed regardless of the opponent. In addition to assessing the specialized physical training of athletes in a normative manner, in order to check the objective quality of the assessment, each physical ability was evaluated using the “T” scale of scientist V.N. Platonov (Platonov, 2004, p. 312). In addition, a quantitative and qualitative assessment was done to each criterion.

The results of a study that comprehensively identified and evaluated the level of specialized physical training of high-ranking judo athletes:

- First – assessing each ability that influence the specialized physical training of an athlete, identifying strengths and weaknesses
- Second - athlete evaluation density,
- Third - A map of the athlete's specialized physical training.,
- Fourth - You can see the average score of each athlete's comprehensive assessment of their specialized physical training.

For example, in the example below, when analyzing the density of the athlete's scores, the following results were observed.



1-movement coordination; 2-flexibility, right; 3-felxibility, left; 4-speed, right; 5-speed, left; 6-speed-strenght right; 7-speed-strenght left; 8-reaction speed right; 9-reaction speed left; 10-speed strenght endurance

Figure 1. Evaluation indicators (points) for each physical ability of high-ranking middleweight male judo athletes

For middleweight male athletes, the least spread can be seen in the speed ability (±1), while the most spread can be observed in the flexibility (right) ability (±5). In this movement test, the right leg of all male athletes was +3.96° more flexible than the left leg. When testing whether there was a difference in the flexibility of the right leg of the athletes compared to the left leg, the Paired Samples t test showed that the lightweight athletes t=-0.602, p=0.569; the middleweight athletes t=-0.064, p=0.952; and the heavyweight athletes t=-1.160, p=0.330. This indicates that there is no statistically significant difference between the variables. (figure 1) The average scores for the specialized physical training assessment of high-ranking male judo athletes in each weight category can be seen in Figure 2.

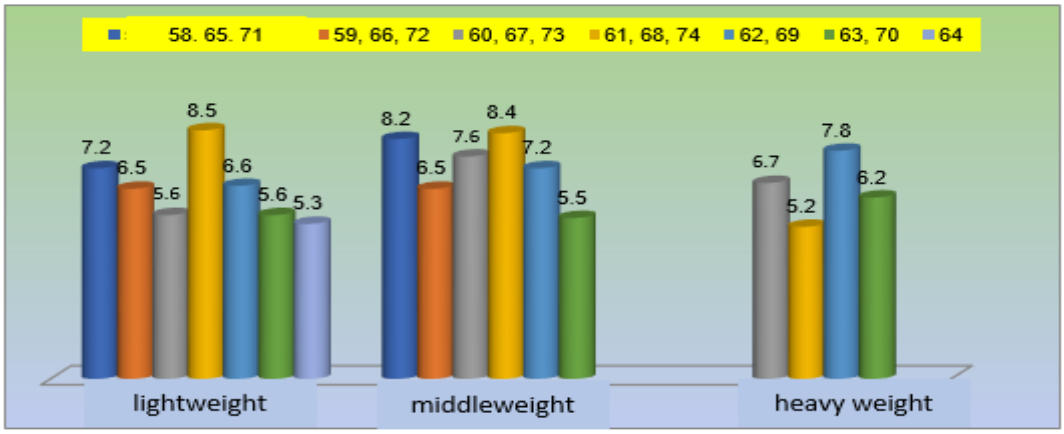


Figure 2. Average specialized physical training assessment score of high-ranking male judo athletes (points)

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The average specialized physical training scores for high-ranking male judo athletes range from 5.3 to 8.5 points (average: 6.47) for lightweight athletes, 5.1 to 8.4 points (average: 7.23) for middleweight athletes, and 5.2 to 7.8 points (average: 6.2) for heavyweight athletes. Analysis of the correlation between physical ability scores and differences in sport rankings reveals an F-value of 6.373 and a P-value of 0.004, indicating a significant correlation between physical ability and sport rank. Additionally, 83.33% of middleweight male athletes were classified as international masters (figure 2).

Mongolian athletes have consistently showcased their talents on the global stage, achieving remarkable success by winning gold, silver, and bronze medals. The performance of medal-winning athletes, who contribute points to their national team, serves as a key indicator of the level of sports development in their country. To evaluate this, we considered each athlete's achievements in their five most prestigious competitions and converted these accomplishments into points. By quantifying an athlete's performance in high-level competitions, we can determine their average success rate and compare it with their specialized physical training indicators, providing valuable insights into their overall development and effectiveness.

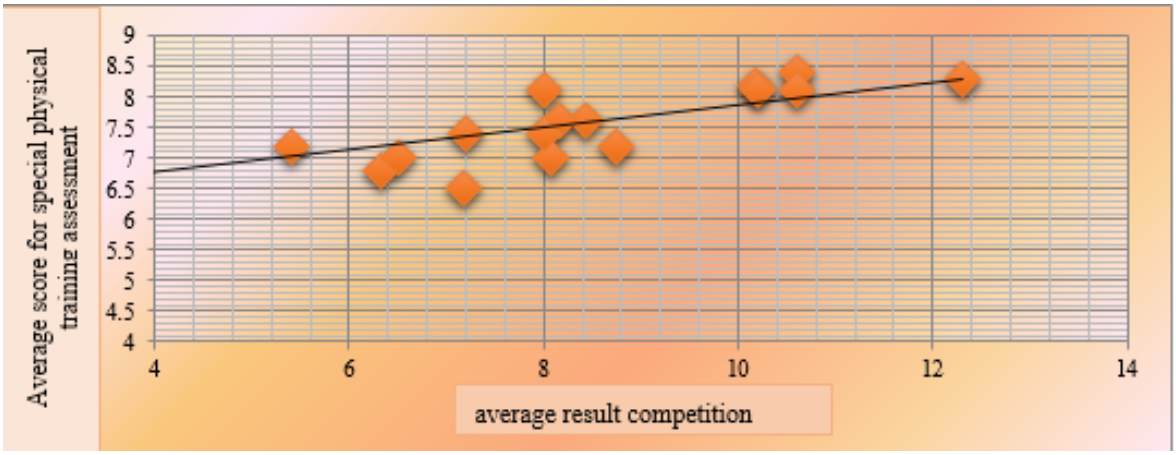

Figure 3. Average score of competition success and average score of specialized physical training of high-ranking judo athletes

An analysis using the Pearson correlation coefficient method to determine whether the average competition success score of high-ranking judo athletes is influenced by the average assessment of their specialized physical training revealed a strong positive correlation for male athletes ($r = 0.789$, $p = 0.021$).

5. CONCLUSION

First, After determining the current level of specialized physical training of high-raking judo athletes in terms of speed, reaction speed, speed-strength, speed-strength endurance, and movement coordination:

- There is a tight correlation between the athletes' speed and speed-strength ability $r = 0.583^{*}$ $p = 0.014$
- When analyzing the speed and movement coordination of heavyweight athletes using ANOVA, the results showed $F = 0.549$ and $p = 0.761$, indicating that muscle mass has an effect on these abilities.
- When examining the difference in agility between the right and left limbs of male athletes across all weight classes using the Paired Samples t-test, the results yielded $t = -2.324$ and $p = 0.103$, indicating that there is no statistically significant difference in the agility of the right and left limbs. This lack of difference is likely attributable to the fact that athletes perform similar movements with both limbs during training and competition.

Second, The results of the specialized physical training assessment conducted on high-ranking judo athletes are as follows: 8.0% achieved a very-high level, 4.0% demonstrated a high level, 40% were rated as good, 32% performed at an above-average level, and 16% were classified at an average level.

Third, Among the high-ranking judo athletes that participated in the assessment, only 12% had a high specialized physical training score. This indicates that more attention needs to be paid to the training of high-ranking athletes.

Forth, Indicates that the average assessment of an athlete's specialized physical training is significantly associated with their average competition success score. In other words, enhancing an athlete's specialized physical training is likely to lead to an improvement in their average competition success score

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