The Relationship between Wrist Flexibility and Hand Eye Coordination on Table Tennis Backhand Drive Shot Results in Disabled Table Tennis Athletes at NPC Club

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The Relationship between Wrist Flexibility and Hand-Eye Coordination on Table Tennis Backhand Drive Shot Results in Disabled Table Tennis Athletes at NPC Club

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ABSTRACTS

Purpose: This study aims to determine the relationship between wrist flexibility and hand-eye coordination on the results of backhand drive shots.

Materials and Methods: This research includes quantitative research with a correlation approach. The population of this study was 20 table tennis athletes of the Lubuklinggau City NPC Club. To determine the sample, purposive sampling was used, namely active athletes as many as 16 athletes. The data analysis used is the correlation test.

Result: Based on the results of data analysis, wrist flexibility has a relationship to the results of backhand drive shots with a correlation value (r) = 0.661, a significant relationship and a strong level of relationship. Hand-eye coordination is a relationship to the results of the backhand drive with a correlation value (r) = 0.591, a significant relationship and a moderate level of relationship. The results of the multiple correlation test between wrist flexibility and hand-eye coordination, based on the results of the backhand drive correlation value (r) = 0.506, show a significant relationship with a moderate level of relationship.

Conclusion: There is a significant relationship between Wrist Flexibility and Hand-Eye Coordination in Table Tennis Backhand Drive Stroke Results

Keywords: Drive Shot; Coordination; Flexibility.

INTRODUCTION

National Paralympic Committee Indonesia (NPCI), more often than not truncated as NPCI, is an organization that encourages the sports of competitors with extraordinary needs in Indonesia. Based on information from NPC Indonesia.NPCI was initially shaped beneath the title YPOC (Impaired Sports Establishment). Prof. Dr. Soeharso shaped YPOC on October 31, 1992, which was based on the numerous casualties of war which come about in numerous physically crippled conditions within the Indonesian individuals and the condition of polio which was predominant in Indonesia. Polio itself is a paralyzing and deadly disease, so many polio sufferers experience paralysis of the limbs, which makes limited activities that sufferers can do.

Indonesia and the condition of polio, which is an endemic disease in Indonesia, causes a lot of paralysis for sufferers. To improve achievements in sports for people with disabilities, a sports

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organization is needed that can be a place for people with disabilities to achieve in sports. Then, on October 31, 1992, a foundation called the Disabled Sports Development Foundation (YPOC) was formed. At that time, there was no apparent budget or source of funds from anywhere, so in 1993, YPOC changed its name to BPOC (Badan Pembina Olahraga Cacat) in order to get funding assistance from the centre through KONI. In 1996, BPOC was no longer under the auspices of KONI (Indonesian National Sports Committee) but under the auspices of the minister of social affairs, so BPOC was still following rehabilitation sports and not entering disability sports; this resulted in BPOC not developing (Mustafa et al., 2019). After that, in 2008, BPOC changed to NPC Indonesia. Then, on July 28, 2010, at the KONI munaslub, it was determined that BPOC had changed to NPCI or NPC Indonesia. (Purdihabsari, 2015) The National Paralympic Committee of Indonesia (NPCI) is the parent organization that helps the Government of the Republic of Indonesia to cultivate and create sports accomplishments for competitors with Indonesian disabilities.

(Pilarsumsel.com, 2023) Lubuklinggau is one of the cities that pays special attention to people with disabilities, one of which is the implementation of the Kejurprov II Paralympic Championship in Lubuklinggau City in May 2023. Various efforts have been made to provide good services for people with disabilities, and a forum for fostering achievements for people with disabilities is evidenced by the Lubuklinggau City NPC (National Paralympic Committee). Through institutions or agencies such as the National Paralympic Committee (NPC), people with disabilities were initially considered less able to contribute to the surrounding environment. However, since the existence of the NPC, athletes with disabilities have been able to contribute to the environment, including contributions to the country through achievements achieved in various special sports championships. (Inbar Bechar & Emilai Florina G, 2015) The participation of athletes with physical limitations in sporting events is one of the efforts to develop themselves to overcome the problems and challenges in their lives, giving rise to the desire to interact to achieve achievement. NPC (National Paralympic Committee) Lubuklinggau City is one area that contributes a lot to athletes' participation in city, provincial, and even national-level competitions. Many achievements were obtained by athletes from NPC (National Paralympic Committee) representatives at the event, especially from the table tennis sport.

Based on observations at the Lubuklinggau City Table Tennis NPC Club, there are still many athletes who have not been able to hit backhand drives correctly; for example, there are still many errors in coordination of punch movements such as improper ball contact with the bet, the ball cannot pass the net, hand movements are hampered or cannot adapt, and there are still players who cannot direct the ball to the goal to be achieved. (Istvan Kovacs. et al., 2019) the quality of the athlete's stroke contributes to and is the determining factor of the athlete's victory. Numerous components impact this, particularly the athlete's need for movement. As a result, many negative impacts are caused, such as being unable to hit backhand drives effectively, making it difficult to win matches and losing confidence. This exploration can be used as reference material for coaches regarding the importance of wrist flexibility and good coordination from hand-eye so that the backhand drive is done correctly.

METHODS

Study Participants: The population in this study was all table tennis athletes who used the wheelchair NPC Lubuklinggau City, which amounted to 20 athletes. The sampling technique in

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this study used purposive sampling, which means that the sampling technique is carried out using the criteria of athletes who are still actively participating in training. Based on the sampling technique above, the sample in this study amounted to 16 people.

Study Organization: This research is included in quantitative research because, in this study, researchers used data collection obtained by conducting direct research in the field using the test method, which was then processed in the form of numbers to obtain further data or results. The type of research is correlational quantitative research.

Statistical Analysis: The instrument used to collect data in this study using the wrist flexibility test is geometry with test reliability of 0.51 and test validity of 0.97 (Fadillah, 2015); the hand-eye coordination test that will be used in this study is the Ballwerfen Und-fangen Test or the tennis ball catch throwing test from (Ismaryati, 2018) with test reliability of 0.985 and a test validity of 0.812, and through a validity coefficient of 0.62 and a reliability coefficient of 0.78, this test aims to measure the ability to hit a backhand drive (Amalia, 2016).

RESULT

This study uses the wrist flexibility test, namely the goniometer test, a tool, a hand-eye coordination test using a table tennis ball, and a backhand drive test. This research was conducted at the Megang Sports Park. Athletes perform the Wrist Determination test, and then the athlete performs a hand-eye coordination test and continues the test. The dependent variable is the Table Tennis Backhand Drive test after being given instructions for carrying out the test. I was accompanied by the head of the Lubuk Linggau NPC club, Mr Agus Tri Mulyanto. Athletes who participated in the study as many as 16 were sampled in this study. Based on the results that 16 samples have carried out, each person conducts a hand flexibility test using a goniometer two times; the following results are obtained:

Table 1. Wrist Flexibility Frequency Distribution Table

No	Interval	Frequency	Frelative	Description
1	92-99	3	18%	Very good
2	84-91	3	18%	Good
3	76-83	4	25%	Medium
4	68-75	3	18%	Poor
5	60-67	3	18%	Very Poor
Total		16	97%	

Based on Table 1 above, the data obtained from the wrist flexibility test results are that there are three athletes in the "Very Poor" category, three athletes are in the "Poor" category, four athletes are in the "Moderate" category, three athletes are in the "Good" category, and three athletes are in the "Excellent" category. When presented in the form of a bar chart, it is as follows :

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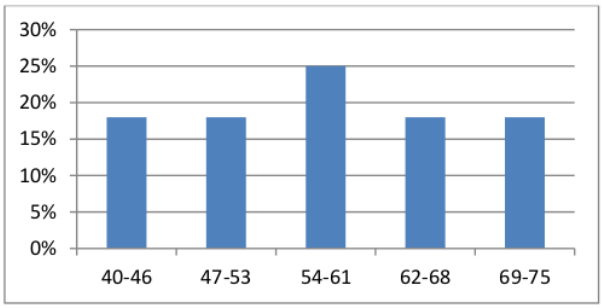

Figure 1. Wrist Flexibility Frequency Distribution Diagram

Based on the picture above, the data obtained from the wrist flexibility test results are that 18% of athletes are in the "Very Poor" category, 18% of athletes are in the "Poor" category, 25% of athletes are in the "Moderate" category, 18% of athletes are in the "Good" category, and 18% of athletes are in the "Excellent" category.

Based on the results that 16 samples have carried out, each person conducts a hand-eye coordination test using a tennis ball two times within 30 seconds; the following results are obtained :

Table 2. Hand-Eye Coordination Test Frequency Distribution Table

No	Interval	Frequency	Frelative	Description
1	20-22,4	3	18%	Very good
2	16,5-18,9	3	18%	Good
3	14-16,4	3	18%	Medium
4	11,5-13,9	3	18%	Poor
5	9-11,4	4	25%	Very Poor
	Total	16	97%	

Based on Table 2 above, the data obtained from the wrist flexibility test results are that there are four athletes in the "Very Poor" category, three athletes are in the "Poor" category, three athletes are in the "Moderate" category, three athletes are in the "Good" category, and three athletes are in the "Excellent" category. When presented in the form of a bar chart, it is as follows :

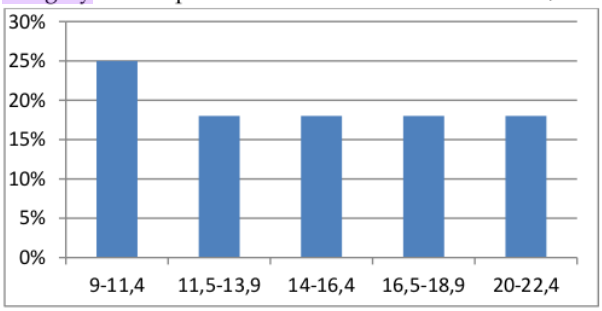

Figure 2. Frequency Distribution Diagram of Hand-Eye Coordination

Based on the picture above, the data obtained from the wrist flexibility test results are that 25% of athletes are in the "Very Poor" category, 18% of athletes are in the "Poor" category, 18% of athletes are in the "Moderate" category, 18% of athletes are in the "Good" category, and 18% of athletes are in the "Excellent" category.

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Based on the results that 16 samples have carried out, each person takes the backhand drive test a total of 10 times, and the total value is taken; the results are as follows:

Table 3. Frequency Distribution Table of Backhand Drive Test

No	Interval	Frequency	Frelative	Description
1	29-33,4	2	12%	Very Good
2	24,5-28,9	3	18%	Good
3	20-24,4	7	43%	Medium
4	15,5-19,9	3	18%	Poor
5	11-15,4	1	6%	Very Poor
Total		16	97%	

Based on Table 3 above, the data obtained from the wrist flexibility test results, namely, there is one athlete in the "Very Poor" category, three athletes are in the "Poor" category, seven athletes are in the "Moderate" category, three athletes are in the "Good" category, and two athletes are in the "Excellent" category. When presented in the form of a bar chart, it is as follows :

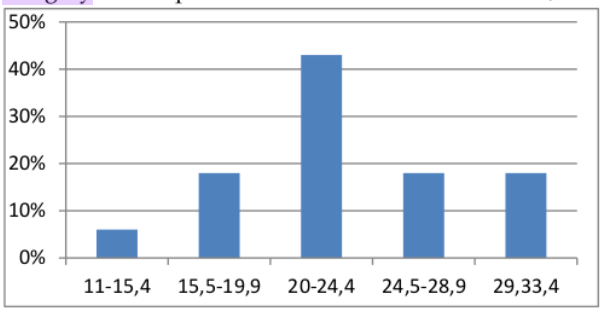

Figure 3. Frequency Distribution Diagram of Backhand Drive Test

Based on the picture above, the data obtained from the wrist flexibility test results show that 6% of athletes are in the "Very Poor" category, 18% of athletes are in the "Poor" category, 43% of athletes are in the "Moderate" category, 18% of athletes are in the "Good" category, and 12% of athletes are in the "Excellent" category.

Prerequisite Test :

1. Normality Test

Based on the calculations utilizing Liliefors, the results are normally distributed. This can be seen in the following table :

Table 4. Pretest and Posttest Normality Test Results

Tes	L_{hitung}	L_{abel}	Criteria
Wrist Flexibility	0,085	0,213	Normal
Hand-Eye Coordination	0,170	0,213	Normal
Backhand Drive	0,162	0,213	Normal

The results of the normality test on the wrist flexibility data with n = 16 at a significant level α = 0.05 obtained Lcount = 0.085 < Ltable = 0.213. L-label can be seen in Appendix 12, page 76, so it can be concluded that the scores obtained from the wrist flexibility test data are typically distributed.

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The results of normality testing on coordination data with n = 16 at a significant level α = 0.05 obtained Lcount = 0.170 < Ltable = 0.213. L-label can be seen in attachment 12, page 76, so it can be concluded that the scores obtained from the hand-eye coordination test data are normally distributed.

The normality test results on the backhand drive data with n = 16 at a significant level α = 0.05 obtained Lcount = 0.162 < Ltable = 0.213. L-tabel can be seen in attachment 12, page 76, so it can be concluded that the scores obtained from the backhand drive test data are typically distributed.

2. Linearity Test

Table 5. Linearity Test Results

Tes	Fcount	Ftable	Description
Wrist Flexibility and Backhand Drive Stroke	10,86	4,60	linear
Hand-eye coordination and Backhand Drive	11,21	4,60	linear

From the above calculations, the results of Fcount between the two variables X1 and Y and X2 and Y are 10.86 and 11.21, while Ftabel with dk = (n-2) = 14 obtained F table is 4.60. F count> F table. Ftabel can be seen in Appendix 13, page 77, so it can be concluded that the data is linear.

3. Single Correlation Test

a. The Relationship of Wrist Flexibility to Backhand Drive Punches

Table 6. Single Correlation Test X1Y

Correlation	correlation coefficient	$R-Count$	$R-table$	conclusion
X_1 with Y	0,661	0,661	0,497	significant

The correlation of research data obtained a correlation coefficient on wrist flexibility on backhand drive shots with a strong relationship with the results of 0.661. The value is consulted with r table product moment with a significance level of 5% and N of 16 obtained r_{-count} 0.661> r_{-table} 0.497 states there is a significant relationship and a strong level of relationship between variable X1 and variable Y. The correlation coefficient on wrist flexibility on the backhand drive has a strong relationship with the results of 0.661. The value is consulted with the r product moment table with a significance level of 5% and N of 16 obtained r_{-count} 0.661> r_{-table} 0.497 states that there is a significant relationship and a strong level of relationship between variable X1 and variable Y.

b. Hand-Eye Coordination Relationship to Backhand Drive Punches

Table 7. X2Y Single Correlation Test

Correlation	correlation coefficient	$count$	r_{-table}	conclusion
X_2 with Y	0,591	0,591	0,497	significant

Based on the table above, the correlation analysis of the research data obtained the correlation coefficient on hand-eye coordination on the backhand drive with a moderate level of relationship with the results of 0.591; the value is consulted with the r product moment table with a significance level of 5% and N of 16 obtained r_{-count} 0.591> r_{-table} 0.497 states that there is a significant relationship and a moderate level of relationship between variable X2 and variable Y.

c. Double Correlation of Wrist Flexibility and Hand-Eye Coordination to Backhand Drive Stroke Results

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Table 8. Multiple Correlation Test

Correlation	correlation coefficient	Coefficient of Determination	*count*	*table*	conclusion
X_1 and X_2 with Y	0,506	25,6%	2,19	1,76	significant

Based on the table above, the correlation analysis of the research data obtained by wrist flexibility and hand-eye coordination on the results of the backhand drive shows a moderate level of relationship with the results of 0.506. Then, the obtained t_{-count} 2.19> t_{-table} 1.76 states a positive and significant relationship. This means that wrist flexibility and hand-eye coordination have a relationship of 25.6% to the results of the backhand drive.

DISCUSSION

The results showed that together, flexibility and hand-eye coordination were significantly related to the table tennis backhand shot results, as evidenced by the analysis results, which obtained the count price of 2.19> Table 1.76. Multiple Correlation (R) between the independent and dependent variables has a moderate correlation; this can be seen from the calculation results of 0.506. This implies a relationship between wrist flexibility and hand-eye coordination when table tennis drives come about for athletes at the Lubuklinggau City NPC Club. The contribution is moderate, and the r-value is positive; thus, if the athlete has good wrist flexibility and hand-eye coordination, it will contribute to the results of the table tennis backhand drive. A good backhand drive will allow athletes to improve accuracy in returning serves and strokes in table tennis (Kong & Ma, 2024).

Based on taking data from each variable and then testing the data with normality and linearity tests as a condition of data analysis, after testing, it turns out that the data is usually distributed and linear. Then, looking for the correlation, it can be continued with the double correlation significant test, namely by comparing the t-count value of 2.19 with the t-table of 1.76 seen from the data that the t-count is greater than the t-table, which means significant. All independent variables of hand flexibility and hand-eye coordination are significant in determining the results of table tennis backhand shots. Improving table tennis backhand shots requires wrist flexibility and hand-eye coordination. Wrist flexibility strongly correlates with 0.661, while hand-eye coordination correlates with 0.591. Together, the two independent variables provide a correlation relationship of 0.506. Good wrist flexibility has a good impact, especially for table tennis athletes; the good strokes characterize this carried out, mainly our serves, making it difficult for opponents (Nasution et al., 2024).

Based on the data, wrist flexibility and hand-eye coordination are related to the results of table tennis backhand drives. This is because eye-hand coordination refers to the ability of our visual system to coordinate information received through the eyes to control, guide, and direct arm and hand movements when performing a given task so that good eye-hand coordination creates excellent flexibility for table tennis athletes (Copaci at al., 2024). this can be a reference for the coach in determining the types of exercises to be used in the training program to improve the backhand strokes of athletes with table tennis disabilities

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CONCLUSION

This study found that wrist flexibility and hand-eye coordination significantly affect the results of backhand drive shots in table tennis athletes at the Lubuklinggau City NPCI Club.

CONFLICT OF INTEREST

The authors announce that there are no intrigue clashes with respect to this consideration's distribution.

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