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DIFFERENCE IN GRIP STRENGTH BETWEEN ACTIVE AND INACTIVE STUDENTS OF THE FACULTY OF ECONOMICS IN OSIJEK

Original research

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ABSTRACT
Hand grip strength, the force hand muscles apply to grasp an object, provides insight into musculoskeletal health and functional abilities and is essential for numerous everyday tasks. This paper examines the relationship between hand grip strength and general health fitness. Sixty male students of the Faculty of Economics in Osijek participated in this research, where thirty-eight were actively engaged in physical activity, while twenty-two students did not practice any of the physical activities in their free time. The Saehan DHD-1 dynamometer was used to measure hand grip strength, while information on the participants' physical activity was checked with a questionnaire. The results indicate a strong correlation between the grip strength of the dominant and non-dominant hand and a statistically significant difference in the grip strength of the dominant and non-dominant hand. However, no statistically significant difference was observed in hand grip strength considering physical activity. Although this study failed to confirm a statistically significant difference in handgrip strength considering physical activity, further research is needed to examine this association, and it could potentially provide a deeper understanding of the importance of handgrip strength in everyday life.
Keywords: hand grip strength, dominant hand, non-dominant hand, dynamometer, physical activity

INTRODUCTION

Physical activity is the key to health and well-being. In a time characterized by technologically assisted comfort and a sedentary lifestyle, the importance of physical activity cannot be overemphasized (World Health Organization, 2020). This paper examines the relationship between hand grip strength and general health fitness. Hand grip strength is defined as the force applied by the muscles of the hand to grip an object. It provides insight into musculoskeletal health and functional abilities and is essential for numerous everyday tasks. However, it is important to recognize that grip strength is not a specific characteristic but a combination of various elements working together. Genetic predisposition affects aspects such as muscle fiber composition and tendon stiffness, which in turn affects grip strength (Pinto Pereira et al., 2022). Also, age, gender, and body composition form a triangle of factors that contribute to the variability of grip strength. Grip strength typically peaks during early adulthood and gradually declines with age (Thompson et al., 2013). This decline is the result of changes in muscle mass, bone density, and hormonal changes. Furthermore, gender affects variation in grip strength, with men typically exhibiting greater grip strength compared to women (Silva et al., 2010). Hormonal differences, especially testosterone

levels, play a role in this diversity. Finally, body composition, especially the ratio of muscle mass to fat, strongly influences grip strength (Ferraz et al., 2022). People with greater muscle mass usually have greater grip strength due to a greater ability to contract muscles. On the other hand, a higher percentage of body fat can limit grip strength potential. Also, proper nutrition is essential for muscle development and strength, which affects grip strength. Nutrients such as protein, vitamins, and minerals play a key role in the repair and growth of muscle tissue (Tipton and Witard, 2007). Smoking, as well as excessive alcohol consumption, affect grip strength. More precisely, participants who smoke and drink alcohol will exhibit less hand grip strength than those who do not (Green et al., 2003; Romeo et al., 2010). However, regular physical activity can strengthen hand grip strength by promoting muscle growth and general fitness (Rantanen, 1999).

A sedentary lifestyle can contribute to muscle atrophy and reduced grip strength (Danneskiold-Samsøe et al., 2009). Conversely, regular physical activity, especially resistance training, can improve muscle mass, neuromuscular coordination, and grip strength. Several strategies can be employed to improve grip strength, including resistance training, specific exercises for the forearm muscles, progressive increases in load, and proper technique.

Resistance training, also known as strength or weight training, is a fundamental strategy for improving grip strength. With controlled and gradual resistance, the muscles must adapt and grow, resulting in increased grip strength (Peterson et al., 2005).

At its core, dynamometry is based on the use of specialized devices known as dynamometers to quantify muscle strength (Cools et al., 2007). These devices measure the force that muscles generate during contractions, providing a measurable measure of strength. In the context of grip strength assessment, dynamometers provide a standardized and reproducible approach, enabling researchers and clinicians to obtain accurate data. One of the most intriguing applications of dynamometry lies in the comparative analysis of grip strength between active people, who engage in regular physical activities, and inactive people, who lead a sedentary lifestyle. This comparison provides valuable insights into the tangible effects of physical activity on grip strength. By using dynamometers, researchers can delve deeper into the question of whether an active lifestyle is indeed associated with increased grip strength.

METHODS

Participants

Sixty male students of the Faculty of Economics from Osijek participated in this research. To ensure relevant results, we included students who met certain criteria. All participants were healthy, had no injuries in the last 6 months, and voluntarily entered the study, giving their written consent. Out of the total number of participants, thirty-eight are actively engaged in some physical activity, while twenty-two students do not practice any of the physical activities in their free time. The research was conducted in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the Faculty of Kinesiology Osijek (classification code: 029-01/23-01/03, registration number: 2158-110-01-23-21).

Measuring instruments and variables

To measure hand grip strength, the Saehan DHD-1 dynamometer was used, which previously underwent the validation process and proved to be a reliable instrument for such measurements (Vasava et al., 2021). In a series of studies, including that of Vasava et al., this dynamometer has proven to be a reliable tool for accurately measuring hand grip strength in different populations and conditions.

To collect data on students' activities, a questionnaire in the Croatian language, designed for this research, and consisting of four items, was used. Respondents must write their name and surname if they are involved in sports/physical activity, and which one. When asked if they do sports/physical activity, they answer with yes or no, and if they answer yes they write down what sport or activity they do. Further in the questionnaire, there is a table for the dominant and non-dominant hand that the examiner fills in during the measurement. The sample variables consisted of Physical activity, by which we established how many students were physically active or not. The next variable is Sport/physical activity, with which we got an insight into the sport or activity that the student does in free time. In the end, the maximum strength of the dominant hand and the non-dominant hand was measured.

Procedure

Students of the Faculty of Economics in Osijek voluntarily participated in the study on the Physical Education Course. Before measuring the hand grip strength, students fill out a questionnaire on which they must write their name and surname, do they do sports/physical activity, which one, how many times a week, and for how long. After that, researchers perform a hand grip strength test with a dynamometer, and the strength of the dominant and non-dominant hand is measured. The measurement is done three times alternately with the dominant and non-dominant hand with a 3-minute rest.

Statistical analysis

The data were processed in the SPSS Statistics program. The frequency of samples was made

depending on whether they are physically active and, on the sport, or physical activity in which they participate. To determine the relationship and the level of connection between the observed variables, Pearson's correlation coefficient was calculated. Pearson's correlation expresses the relationship between two variables. The following are also usually considered: $r>0.80$ is a strong positive correlation; $0.5<r\leq0.80$, is a medium-strong positive correlation; $0<r\leq0.5$, is a weak positive correlation (Calinski et al., 1990). To evaluate the difference concerning dominant and non-dominant hand and physical activity, Mann-Whitney U test was used. Statistical significance in the context of this test means that the test results show a difference between groups that is unlikely to be due to chance. This means that the probability that the difference is real and not coincidental is high enough to conclude differences between groups.

In other words, if the test result is statistically significant, it suggests that the observed difference in hand grip strength between the groups is not likely to be random and is caused by the factors being studied, such as dominant and non-dominant hand and physical activity.

RESULTS

If we examine data for physical activity, visible in Table 1, 63.3% of respondents are physically active, while 36.7% are not. Also, most respondents engage in fitness and football.

Table 1. Presentation of percentages of active and inactive participants by type of physical activity

		Number	Percent (%)
Sport/ physical activity	Inactive	22	36.7
	Cycling	1	1.7
	Martial arts	3	5.0
	Fitness	15	25.0
	Basketball	1	1.7
	Football	14	23.3
	Volleyball	1	1.7
	Running	2	3.3
	Rowing	1	1.7

Furthermore, the correlation between the grip strength of the dominant and non-dominant hand is high and significant ($r = .87$, $p < .001$). To test the hypotheses, the difference between the dominant and non-dominant hand and physical activity was examined using the Mann-Whitney U test.

Table 2. Ranks of dominant and non-dominant hand

Ranks			
Hand	N	M	ΣR
Dominant hand	60	67.92	4075.00
Non-dominant hand	60	53.08	3185.00
Total	120		

**Legend: N – number of participants, M – mean, ΣR – sum of ranks*

The results of the Mann-Whitney U test indicate the existence of a statistically significant difference concerning the dominant and non-dominant hand, whereby the value of the ranks is higher for the dominant hand ($U = 1355$, $z = -2.34$, $p = .02$).

Furthermore, Table 3 shows the rankings regarding physical activity. The results visible in Table 4 indicate that no statistically significant difference was observed regarding to physical activity.

Table 3. Presentation of ranks regarding to physical activity

		Ranks		
	Physical activity	N	M	ΣR
Dominant hand	Yes	38	32.32	1228.00
	No	22	27.36	602.00
	Total	60		
Non-dominant hand	Yes	38	33.07	1256.50
	No	22	26.07	573.50
	Total	60		

**Legend: N – number of participants, M-mean, ΣR – sum of ranks*

Table 4. Test statistics

	Test statistics	
	Dominant hand	Non-dominant hand
Mann-Whitney U	349	320.50
Wilcoxon W	602	573.5
Z	-1.06	-1.49
p	.29	.14

**Note: grouping variable – physical activity*

DISCUSSION

This research indicates important insights into the connection between physical activity and hand grip strength among students of the Faculty of Economics in Osijek. Through the implementation of statistical analyses, we examined whether there would be a significant difference in the hand grip strength test between active and inactive students.

The null hypothesis (H0) suggests that there will be no statistically significant differences in the hand grip strength test between these two groups of students. This would mean that physical activity would not have a significant impact on hand grip strength. On the other hand, the alternative hypothesis (H1) claims the opposite - that there will be a statistically significant difference.

After the data analysis, we did not find strong enough statistical support to reject the null hypothesis (H0). This means that our results do not show a statistically significant difference in the hand grip strength test between active and inactive students of the Faculty of Economics in Osijek. Although it seems that physical activity can affect the strength of the hand grip, in our sample of students this difference was not pronounced enough to be statistically significant.

In the analysis of collected data on physical activity and its connection with hand grip strength, the research

yielded intriguing results that require a deeper understanding of their complex relationship. Out of the total number of respondents (60), 63.3% of them, are regularly engaged in physical activity, while 36.7% do not declare themselves to be physically active. However, despite this, the analysis of the types of activities practiced by the participants reveals interesting patterns.

For example, most physically active respondents engage in ball sports, and running, while activities such as resistance exercises, often associated with increasing hand grip strength, are less present in this group of respondents than in other activities. This variability in activity types contributes to the conclusion that there are no significant differences in hand grip strength between active and inactive participants.

Although the results indicate this association, it is important to point out that the total number of participants (60) may limit the sensitivity of the statistical tests. Also, the diversity of participant's types of activity can further complicate the detection of significant differences in hand grip strength. Therefore, further research with a larger number of participants and a focus on specific physical activities that could promote hand grip strength could provide a deeper understanding of this association.

In conclusion, the analysis of these data paves the way for further research into the relationship between physical activity and hand grip strength. Through careful evaluation of activity types, sample size, and statistical sensitivity, we may gain deeper insight into this complex interaction and its potential contribution to physical health.

CONCLUSION

Physical activity is not a privilege, but a necessity for maintaining a healthy and fulfilling life. Hand grip strength emerges as an unobtrusive yet powerful measure that not only reflects physical strength but also reflects health and longevity. As research illuminates the profound implications of hand grip strength on health outcomes, it is becoming apparent that a strong hand grip can unlock not only a stronger life but also a longer and healthier one.

Due to the importance of the hand grip strength in health, this study aimed to examine the relationship between handgrip strength and general health fitness. The results of this research indicate a strong correlation between the grip strength of the dominant and non-dominant hand. Also, this research confirms a statistically significant difference in hand grip strength between the dominant and non-dominant hand in the direction that hand grip strength is greater for the dominant hand. On the other hand, this research does not find a statistically significant difference in hand grip strength between physically active participants and those who are not. More specifically, the results of this study suggest that there is no difference in hand grip strength between those students who engage in physical activity and those who do not. In conclusion, this research provides useful insight into why it is important to investigate hand grip strength in the context of physical health.

Understanding these factors not only illuminates variations in grip strength but also highlights the importance of a holistic approach to health and wellness. By recognizing the symphony of influences that shape grip strength, individuals can make informed decisions to optimize their physical abilities and improve their overall quality of life.

REFERENCES

Danneskiold-Samsøe, B., Bartels, E. M., Bülow, P. M., Lund, H., Stockmarr, A., Holm, C. C., Wätjen, I., Appleyard, M., & Bliddal, H. (2009). Isokinetic and isometric muscle strength in a healthy population with special reference to age and gender. Acta Physiologica, 197, 1–68. https://doi.org/10.1111/j.1748-1716.2009.02022.xjudokas.

Ferraz, A., Valente-Dos-Santos, J., Duarte-Mendes, P., Nunes, C., Victorino, S., Coelho-e-Silva, M. J., & Travassos, B. (2022). Body composition and grip strength constraints in elite male rink-hockey players of contrasting ethnicity. PLOS ONE, 17(9), e0274894. https://doi.org/10.1371/journal.pone.0274894

Green, D. J., Walsh, J. H., Maiorana, A., Best, M. J., Taylor, R. R., & O'Driscoll, J. G. (2003). Exercise-induced improvement in endothelial dysfunction is not mediated by changes in CV risk factors: pooled analysis of diverse patient populations. American Journal of Physiology-Heart and Circulatory Physiology, 285(6), H2679–H2687. https://doi.org/10.1152/ajpheart.00519.2003

Pinto Pereira, S. M., Garfield, V., Farmaki, A.-E., Tomlinson, D. J., Norris, T., Fatemifar, G., Denaxas, S., Finan, C., & Cooper, R. (2022). Adiposity and grip strength: a Mendelian randomisation study in UK Biobank. BMC Medicine, 20(1), 201. https://doi.org/10.1186/s12916-022-02393-2

Rantanen, T. (1999). Midlife Hand Grip Strength as a Predictor of Old Age Disability. JAMA, 281(6), 558. https://doi.org/10.1001/jama.281.6.558

Romeo, J., Wärnberg, J., Pozo, T., & Marcos, A. (2010). Physical activity, immunity, and infection. Proceedings of the Nutrition Society, 69(3), 390–399. https://doi.org/10.1017/S0029665110001795

Silva, A. M., Shen, W., Heo, M., Gallagher, D., Wang, Z., Sardinha, L. B., & Heymsfield, S. B. (2010). Ethnicity-related skeletal muscle differences across the lifespan. American Journal of Human Biology, 22(1), 76–82. https://doi.org/10.1002/ajhb.20956

Thompson, P. D., Arena, R., Riebe, D., & Pescatello, L. S. (2013). ACSM's New Preparticipation Health Screening Recommendations from ACSM's Guidelines for Exercise Testing and Prescription, Ninth Edition. Current Sports Medicine Reports, 12(4), 215–217. https://doi.org/10.1249/JSR.0b013e31829a68cf

Tipton, K. D., & Witard, O. C. (2007). Protein Requirements and Recommendations for Athletes: Relevance of Ivory Tower Arguments for Practical Recommendations. Clinics in Sports Medicine, 26(1), 17–36. https://doi.org/10.1016/j.csm.2006.11.003

World Health Organization (2020). "Physical Activity." Downloaded from: https://www.who.int/news-room/fact-sheets/detail/physical-activity

Conflict of Interest

The authors do not have any conflicts of interest to disclose. All co-authors have reviewed and concurred with the manuscript's content, and no financial interests need to be reported.