Impact of Hand Grip and Sit-And-Reach Exercises in Children Aged 6-7 Years

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Article Info

Abstract

It has been suggested that grip strength can predict physical fitness in children and adults. The overall plan of this study will validate this conclusion. The study analysed the correlation between hand grip strength and sit-and-reach in 70 children aged 6-7 years with the aim of gaining insight into the correlation between grip strength and sit-and-reach. Descriptive statistics were used in the study to find out the mean scores and differences in these exercises. The correlation between hand grip strength and sit-and-reach flexibility was also explored using Pearson’s correlation coefficient. The results showed the correlation coefficient between hand grip strength (mean ± sd=5.46 ± 3.75) and sit-and-reach flexibility (mean ± sd=8.25 ± 5.28) was 0.078, indicating a weak positive correlation (p > 0.05). The results of the study suggest that grip strength is not a valid predictor of physical dexterity in seated forward bends in 6-7 years old children age group. As suggested in the previous studies, grip strength can predict physical fitness in children, such as a strong correlation between grip strength and physical flexibility, lung function, muscular endurance, and physical stability. However, from the results, grip strength is not a reliable predictor of physical flexibility. We need to further validate the predictive role of grip strength for other physical fitness indicators. This is a very important validation for us to develop children’s physical fitness assessment programs more efficiently in the future.


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INTRODUCTION

Physical fitness is a crucial aspect of child development, contributing to overall health and well-being (Sciaraffa et al., 2018; Tulchin-Francis et al., 2021). Assessing and understanding the physical capabilities of children is essential for designing appropriate interventions and promoting healthy lifestyles (Cornish et al., 2020; Masini et al., 2020; Ortega et al., 2008) Hand grip strength and sit-and-reach flexibility are two commonly used measures to evaluate upper body strength and flexibility (Sugiyama et al., 2023), respectively, in children. This study aims to provide a comprehensive analysis of the hand grip and sit-and-reach exercises performed by a group of 70 children aged 6-7 years old. Descriptive statistics, including the mean and standard deviation, offer valuable insights into the central tendency and variability of the data. The mean represents the average performance of the children in each exercise, while the standard deviation indicates the spread or dispersion of the data points around the mean. By examining these statistics, we

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can gain a better understanding of the typical hand grip strength and sit-and-reach flexibility levels among children in 6-7 years old age group (Matsudo et al., 2014).

Furthermore, exploring the correlation between hand grip strength and sit-and-reach flexibility provides valuable information about the potential relationship between these two measures (Behan et al., 2022; Lindsay et al., 2021). The Pearson correlation coefficient is used to quantify the strength and direction of this relationship (Lindsay et al., 2021). A positive correlation suggests that higher hand grip strength is associated with greater sit-and-reach flexibility, while a negative correlation indicates an inverse relationship (Lee et al., 2022). Understanding the correlation between these exercises can provide insights into the interplay between upper body strength and flexibility in children.

Physical fitness components are crucial for optimal athletic performance and well-being, contributing to various aspects of fitness in different physical activities and sports (Kokko et al., 2019). Endurance, measured by cardiovascular fitness, reflects the body's ability to sustain prolonged exercise (Chu et al., 2019). Muscle strength, determined by maximal force against resistance, improves through strength training exercises. Speed involves moving quickly in a specific direction, enhanced by methods like sprint and interval training (Suchomel et al., 2018). Agility, the ability to change direction quickly, requires balance, coordination, and speed, improved through drills like ladder or cone exercises (Noyes & Barber-Westin, 2019). Flexibility, the range of motion around joints, is vital for posture and injury prevention, improved through stretching, yoga, and Pilates. Explosive power, critical for rapid force generation, is developed through plyometrics, Olympic lifting, and resistance training (Hryvniak et al., 2021). Balance, essential for stability, is enhanced through activities like yoga and balance training (İnal et al., 2023). Coordination, synchronizing body parts for smooth movements, is developed through practices like martial arts and dance. Accuracy, precision in movements, is crucial in sports like archery, improved through target practice and specific drills. Reaction, the speed and accuracy of responding to stimuli, is vital in quick decision-making sports and can be enhanced through training exercises like agility ladder drills (Malm et al., 2019).

This study is an important part of the research on exploring the correlation between grip strength and physical fitness (muscular endurance, flexibility, lung function, etc.) in children, with a focus on exploring the correlation between grip strength and physical dexterity (sit-and-reach) in 6-7 year old children, and investigating whether grip strength can be a prognostic indicator of seated physical dexterity. Most of the correlation analyses of various types of physical literacy, physical fitness, and motor skills in the children’s field are overall generalized studies (Saunders et al., 2018; Sugiyama et al., 2023), mainly presenting the overall correlation of the three major segments of physical qualities, physical activity, and motor skills, for specific physical physical literacy (e.g., grip strength, core strength, speed, and agility, etc.), specific physical activities (conducive to walking, running, and being sedentary, etc.), and specific motor skills (e.g., grasping skills, visuomotor integration skills, object manipulation skills, etc.) Correlations between these indicators are not supported by evidence (Sugiyama et al., 2023). A significant correlation between the following anthropometric dimensions (stature, sitting hip breadth, wrist circumference, hand circumference and heel ankle circumference) and hand grip strength (Nurul Shahida et al., 2015). There was a significant sex-dependent difference in the maximum and mean strength, with men being stronger than women, and a hand-length-dependent difference in the force exerted by small versus large hands. Both at work and at leisure time, repetitive manual loads did not result in a consistent improvement in strength (Wichelhaus et al., 2018).

This study will conduct a series of correlations for each of these indicators to provide valid support for assessment tools and intervention programs for children’s physical fitness.
and physical fitness. This research also contributes to the understanding of physical development in children aged 6-7 years by examining two specific exercises, namely hand grip and sit-and-reach. This information can be useful for parents, educators, and health professionals in assessing and improving overall physical well-being in this age group. The results of this study will serve as an important guide for the design of physical fitness assessment programs for children in this age group. The results for the correlation of hand grip and sit-and-reach have implications for physical education programs, physical fitness training, and overall health promotion strategies for children in this age group. In addition, understanding the performance and potential associations between grip strength and sit-to-stand stretching flexibility may guide educators, coaches, and healthcare professionals in customizing interventions to enhance children’s physical fitness and health.

**METHOD**

**Participants**

<table>
<thead>
<tr>
<th>Anthropometry</th>
<th>N</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Mean</th>
<th>Std. Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (KG)</td>
<td>70</td>
<td>15.50</td>
<td>57.20</td>
<td>23.743</td>
<td>7.32084</td>
</tr>
<tr>
<td>Length (CM)</td>
<td>70</td>
<td>104.10</td>
<td>159.30</td>
<td>121.407</td>
<td>9.93358</td>
</tr>
</tbody>
</table>

All participants were recruited from Children’s Sports Ability Center, Chengdu, Sichuan Province, China. All children at the center underwent a standard physical examination as well as inquiries about disease history and injury history before starting training. Volunteers undergoing acute or chronic cardiovascular, pulmonary, or metabolic therapy were excluded. and those with any orthopedic condition that would limit their physical performance. Children with limited physical performance were excluded. A total of 70 children (Table 1) aged 6-7 years (35 boys and 35 girls) were randomly selected for inclusion in this study at the center. Written informed consent was obtained from the parents or legal guardians of the volunteers. The study was approved by the Research Ethics Committee of the center.

Equipment, For this study, participants’ grip strength and sit-and-reach were tested and data was collected using the National Physical Fitness Monitoring All-in-One Machine from China. The machine has a central computer with all the items of physical fitness assessment, including height, weight, grip strength and sit-and-reach one-legged stand with eyes closed, choice reaction time, step experiment, sit-ups, and push-ups. The study analysed the correlation between hand grip strength and sit-and-reach in 70 children aged 6-7 years with the aim of gaining insight into the correlation between grip strength and sit-and-reach. So that this equipment can be used to assess hand grip and sit-and-reach.

Data Analysis, In this study, the height and weight of 70 children were analyzed using descriptive statistics for basic anthropometrics. For the correlation between grip strength and sitting forward bending in 6-7 year old children, Pearson correlation analysis (p<0.001) was used to analyze the correlation between grip strength and sitting forward bending in this age group.
RESULTS AND DISCUSSION

Result

Table 2 Descriptive Statistics

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hand-Grip kg</td>
<td>5.4643</td>
<td>3.75044</td>
<td>70</td>
</tr>
<tr>
<td>Sit-and-Reach cm</td>
<td>8.2514</td>
<td>5.28333</td>
<td>70</td>
</tr>
</tbody>
</table>

The data represents the results of hand grip and sit-and-reach exercises performed by 70 children aged 6-7 years old. Descriptive statistics have been calculated for both exercises as shown in (Table 2).

Table 3. Correlations

<table>
<thead>
<tr>
<th></th>
<th>Hand-Grip</th>
<th>Sit-and-Reach</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pearson Correlation</td>
<td>1</td>
<td>.078</td>
</tr>
<tr>
<td>Sig. (2-tailed)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sum of Squares and Cross-products</td>
<td>970.541</td>
<td>107.280</td>
</tr>
<tr>
<td>Covariance</td>
<td>14.066</td>
<td>1.555</td>
</tr>
<tr>
<td>N</td>
<td>70</td>
<td>70</td>
</tr>
</tbody>
</table>

For the hand grip exercise, the mean value is 5.4643, indicating that, on average, the children achieved a hand grip strength of approximately 5.4643 units. The standard deviation is 3.75044, which measures the variability or spread of the data. This suggests that the hand grip strengths of the children vary quite a bit from the mean. The sample size, denoted by N, is 70, meaning that data was collected from 70 children for this exercise (Table 3).

For the sit-and-reach exercise, the mean value is 8.2514, indicating that, on average, the children achieved a sit-and-reach distance of approximately 8.2514 units. The standard deviation is 5.28333, suggesting that the sit-and-reach distances of the children also vary quite a bit from the mean. The sample size, denoted by N, is again 70, indicating that data was collected from 70 children for this exercise as well.

The correlation coefficient measures the strength and direction of the relationship between two variables. In this case, the Pearson correlation coefficient is used. For the hand grip and sit-and-reach exercises, the Pearson correlation coefficient is 0.078. This value indicates a very weak positive correlation between the two exercises. The correlation coefficient ranges from -1 to 1, where 1 represents a perfect positive correlation, 0 represents no correlation, and -1 represents a perfect negative correlation. Since the correlation coefficient is close to 0, it suggests that there is little to no relationship between the hand grip and sit-and-reach exercises for these children.
The significance value (Sig.) associated with the correlation coefficient is 0.518. This value indicates the probability of observing the correlation coefficient by chance. In this case, the significance value is greater than 0.05, which is a commonly used threshold for statistical significance. Therefore, we fail to reject the null hypothesis, suggesting that the correlation between the hand grip and sit-and-reach exercises is not statistically significant.

The remaining information provides details about the sum of squares and cross-products, covariance, and sample size (N) for both exercises. These values are used in the calculation of the correlation coefficient and provide additional statistical information about the relationship between the hand grip and sit-and-reach exercises for the group of 70 children aged 6-7 years old.

**Discussion**

The present study aimed to analyse the hand grip and sit-and-reach exercises performed by 70 children aged 6-7 years old. The descriptive statistics provided insights into the average performance and variability of these exercises, while the correlation analysis explored the potential relationship between hand grip strength and sit-and-reach flexibility.

The mean hand grip strength observed in this study was 5.4643 units, with a standard deviation of 3.75044. These findings suggest that, on average, the children in this age group possess moderate hand grip strength. However, the wide standard deviation indicates considerable variability in hand grip strength among the participants. This variability could be attributed to various factors, such as differences in physical development, exercise habits, and individual variations in muscle strength (Zhang et al., 2017).

Regarding sit-and-reach flexibility, the mean score was 8.2514 units, with a standard deviation of 5.28333. These results indicate a moderate level of flexibility among the children. The wide standard deviation suggests a considerable range of flexibility levels within the group, possibly influenced by factors such as genetics, physical activity levels, and individual differences in joint mobility (Lopes et al., 2012).

The correlation analysis revealed a weak positive correlation (r = 0.078) between hand grip strength and sit-and-reach flexibility. However, this correlation was not statistically significant (p > 0.05). These findings suggest that there is little to no relationship between hand grip strength and sit-and-reach flexibility in children aged 6-7 years old (Kobayashi-Cuya et al., 2018).

The lack of a significant correlation between hand grip strength and sit-and-reach flexibility may be attributed to several factors. Firstly, it is important to consider that hand grip strength primarily reflects upper body strength, while sit-and-reach flexibility primarily assesses lower body flexibility. These two measures may not be strongly related due to the involvement of different muscle groups and physiological mechanisms (Kobayashi-Cuya et al., 2018).

Additionally, the age group studied may play a role in the observed weak correlation. Children in this age range are still in the early stages of physical development, and their strength and flexibility levels may not be fully developed or coordinated. As children grow older, the relationship between hand grip strength and sit-and-reach flexibility may become more pronounced (Castro-Piñero et al., 2010; Mahmoud et al., 2020).

It is worth noting that the sample size of 70 children in this study provides a reasonable representation of the population. However, the findings may not be generalizable to all children aged 6-7 years old, as factors such as geographical location, cultural background, and socioeconomic status could influence physical capabilities (Kobayashi-Cuya et al., 2018).

Future research should consider expanding the sample size and including a wider range of age groups to further investigate the relationship between hand grip strength and
sit-and-reach flexibility in children. Additionally, incorporating other measures of physical fitness, such as cardiovascular endurance and muscular endurance, could provide a more comprehensive understanding of overall physical capabilities in this population (Abe et al., 2023).

In conclusion, this study provides valuable insights into the hand grip and sit-and-reach exercises performed by children aged 6-7 years old. The descriptive statistics highlight the average performance and variability in these exercises, while the correlation analysis reveals a weak and non-significant relationship between hand grip strength and sit-and-reach flexibility. These findings contribute to our understanding of the physical capabilities of children in this age group and emphasize the need for further research to explore additional factors influencing physical fitness in children.

CONCLUSION

In summary, the data presented in this paper consisted of the mean and standard deviation of hand-grip strength (Hand-Grip) and sit-and-reach dexterity (sit-and-reach) in a sample of 70 individuals. The p-value of this correlation coefficient was 0.518 indicating that the correlation was not statistically significant. The covariances between handgrip strength and sitting and stretching flexibility were 14.066 and 1.555 respectively. these values indicate a weak positive correlation between these two variables. Overall, the results of the study show that for children aged 6-7 years, grip strength is not a valid predictor of physical flexibility in seated forward bending. And if grip strength can predict children's physical fitness as proposed in the previous study, then it means that grip strength has a direct and strong correlation with physical flexibility, lung function, muscular endurance, and physical stability. However, as can be seen from the results in this study, grip strength is not a reliable predictor of physical flexibility. Then next we need to further validate the predictive effect of grip strength on other physical fitness indicators. This is a very important validation for us to develop children's physical fitness assessment programs more efficiently in the future. In the meantime, understanding the performance and potential associations between hand grip strength and sit-to-stand extension dexterity can guide educators, coaches, and healthcare professionals in customizing interventions to enhance children's physical fitness and health.

AKNOWLEDGMENT

This article was supported by the Institut Pengajian Siswazah (IPS) at the Universiti Pendidikan Sultan Idris (UPSI).

AUTHOR CONTRIBUTIONS STATEMENT

Jiang Wen Ming (Main author, Data collection), Ahmad Alhussin Alali (Author,Data collection), Nor Fazila Abd Malek (Data collection), Nor Ikhrma Madarsa (Proof reading),Mohd Hafizuddin Baki (Editor, Data Analyses), Nur Ikhwan Mohamad (Supervisor, Corresponding author).
REFERENCES


