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Hand Grip Muscle Strength (Dynamometry) as an Indicator of Functional Physical Development in Frequently Ill Preschool Children

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Abstract Assessment of children's physical development should include not only anthropometric indicators such as height and body weight, but also functional characteristics reflecting the physiological reserves of the organism. One of the most informative indicators of functional development is hand grip muscle strength measured by dynamometry. The present study evaluated hand muscle strength in healthy preschool children and frequently ill children (FIC) aged 3–7 years. The results demonstrated that reduced muscle strength was significantly more common among frequently ill children compared with their healthy peers. In the 3–5-year age group, low grip strength was detected in 31.9±4.3% of frequently ill children versus 7.7±3.0% of healthy children. In the 6–7-year age group, the corresponding figures were 37.5±4.8% and 11.1±3.4%, respectively. Statistical analysis confirmed the significance of intergroup differences ($p<0.01$). The findings indicate that recurrent morbidity negatively affects muscular development and overall physical fitness in preschool children.

Keywords Preschool children, Hand grip strength, Dynamometry, Frequently ill children, Functional development, Physical fitness, Muscle weakness, Child health

1. Introduction

Evaluation of child health traditionally focuses on anthropometric parameters such as height, weight, and body mass index. However, these indicators alone do not fully reflect the functional state of the growing organism. In preschool age, when rapid neuromuscular development occurs, assessment of muscle strength provides valuable information regarding general physical fitness, adaptation capacity, and health status.

Assessment of children's health and physical development remains a priority in modern pediatrics, as it reflects not only somatic growth but also the functional state and adaptive capacity of the organism. Traditionally, evaluation of child development has relied on anthropometric parameters such as height, body weight, and body mass index. However, these indicators alone are insufficient to characterize the physiological reserves and functional capabilities of a growing child [1,2]. In recent years, increasing attention has been paid to functional indicators, particularly muscle strength, as a sensitive marker of physical fitness and overall health status [3,4].

Preschool age represents a critical period of rapid neuromuscular development, during which motor skills, coordination, and muscular strength are actively formed.

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Adequate development of the muscular system is essential for proper posture, motor activity, and metabolic balance [5,11,15]. Among various functional indicators, hand grip strength measured by dynamometry has gained recognition as a reliable, simple, and non-invasive method for assessing muscular function in children. Numerous studies have demonstrated that grip strength correlates with overall muscle mass, physical performance, and even long-term health outcomes [6,7].

Reduced muscle strength in early childhood may reflect underlying health problems, including insufficient physical activity, nutritional deficiencies, chronic fatigue, and recurrent illnesses. It has been shown that children with decreased physical fitness are more prone to metabolic disorders, impaired immune responses, and delayed development [8]. Therefore, early identification of reduced functional indicators is essential for timely preventive and corrective interventions.

A particularly important group in pediatric practice is frequently ill children (FIC), who experience repeated episodes of acute respiratory and other infectious diseases throughout the year. This group is characterized by increased morbidity, prolonged recovery periods, and decreased adaptive capacity of the organism [9]. Recurrent infections can negatively affect multiple physiological systems, including the musculoskeletal system, by reducing physical activity, altering metabolism, and impairing nutrient utilization. [12]

Frequent illnesses are often associated with hypodynamia, appetite disturbances, anemia, and deficiencies of essential

micronutrients such as iron, zinc, and vitamins. These factors play a critical role in muscle development and contractile function [10]. In addition, repeated inflammatory processes may lead to metabolic alterations and reduced energy availability, further contributing to muscle weakness and decreased functional reserves. [13]

Despite the recognized importance of functional assessment in children, the use of simple screening tools such as hand grip dynamometry remains limited in routine pediatric practice. There is a need for more widespread implementation of such methods to identify early deviations in physical development, particularly among high-risk groups such as frequently ill children. [14]

Thus, the evaluation of hand grip muscle strength as an indicator of functional physical development in preschool children is of significant scientific and practical relevance. Comparative analysis between healthy children and frequently ill children may provide valuable insights into the impact of recurrent morbidity on muscular development and overall physical fitness, as well as support the development of targeted preventive strategies.

Hand grip dynamometry is a simple, non-invasive, and objective method for assessing muscular strength. It reflects not only local hand muscle performance but also overall skeletal muscle development and functional reserves of the body. Reduced grip strength in children may indicate insufficient physical activity, nutritional deficiencies, chronic fatigue, recurrent illnesses, or delayed physical development.

Frequently ill children represent a specific pediatric group characterized by recurrent respiratory and infectious diseases throughout the year. Repeated episodes of illness may lead to reduced mobility, prolonged inactivity, appetite disturbances, anemia, metabolic imbalance, and delayed development of the musculoskeletal system. Therefore, assessment of muscle strength in such children is of considerable scientific and practical importance.

The aim of the present study was to compare hand grip muscle strength between healthy preschool children and frequently ill children using dynamometric examination.

Aim of the Study. To assess hand grip muscle strength using dynamometry as an indicator of functional physical development in frequently ill preschool children aged 3–7 years, and to compare the obtained results with those of healthy peers in order to determine the impact of recurrent morbidity on muscular development and overall physical fitness.

2. Materials and Methods

The study included preschool children aged 3–7 years divided into two age categories: younger preschool age: 3–5 years, older preschool age: 6–7 years.

Within each age category, children were classified into two groups:

1. Healthy children
2. Frequently ill children (FIC)

The sample distribution was as follows: Healthy children aged 3–5 years (n=79), frequently ill children aged 3–5 years (n=116), healthy children aged 6–7 years (n=83), frequently ill children aged 6–7 years (n=104).

Hand grip muscle strength was measured using a standard pediatric dynamometer. According to age-adjusted reference values, results were categorized into: Normal and Reduced.

Data were expressed as percentages with standard error (M ±m). Statistical significance of intergroup differences was assessed, and $p<0.01$ was considered significant.

3. Results

The obtained data demonstrated clear differences in muscle strength between healthy children and frequently ill children.

Among healthy children aged 3–5 years, normal grip strength was observed in 92.3 ±3.0% of children, while only 7.7 ±3.0% showed reduced values. Similarly, in healthy children aged 6–7 years, normal indicators were recorded in 88.9 ±3.4%, and reduced strength was found in 11.1 ±3.4%.

These findings suggest that in healthy preschool children, muscular development generally corresponds to age-related physiological norms.

In contrast, the frequently ill children group showed substantially poorer results. Among children aged 3–5 years, only 68.1 ±4.3% had normal grip strength, whereas 31.9 ±4.3% demonstrated reduced values. In the 6–7-year-old frequently ill group, the proportion with reduced muscle strength increased further to 37.5 ±4.8%, while normal values were present in only 62.5 ±4.8%.

Thus, reduced grip strength among frequently ill children occurred approximately three times more often than among healthy peers. All differences between healthy and frequently ill groups were statistically significant ($p<0.01$).

4. Discussion

The results of this study indicate that recurrent morbidity in preschool children is associated with decreased functional development of the muscular system.

Several mechanisms may explain the significantly higher prevalence of reduced muscle strength among frequently ill children.

1. Decreased Physical Activity. Children who experience frequent illnesses often remain at home during episodes of disease and recovery. [15] Their participation in outdoor play, sports activities, and organized physical exercises is reduced. Limited movement leads to insufficient stimulation of skeletal muscles and slower strength development.
2. Asthenic Syndrome and Chronic Fatigue. Repeated illnesses may contribute to persistent weakness, fatigue, reduced endurance, and low motivation for active play. Such conditions negatively affect neuromuscular performance and physical fitness.

3. Nutritional Deficiencies. Frequently ill children often have decreased appetite during illnesses. [16] Repeated infections may also increase metabolic demands. As a result, protein-energy insufficiency and deficiencies of iron, calcium, magnesium, zinc, and vitamins may occur, impairing muscle growth and contractile function.
4. Anemia and Tissue Hypoxia. Iron deficiency anemia is common in frequently ill children. Reduced hemoglobin levels limit oxygen delivery to tissues, including skeletal muscles, leading to early fatigue and decreased strength performance.
5. Disturbed Muscle Metabolism. Recurrent inflammatory processes may alter metabolic pathways and recovery mechanisms in muscle fibers, contributing to functional weakness.

Age-Related Trends. An important finding was that older frequently ill children (6–7 years) had even higher prevalence of reduced muscle strength than younger frequently ill children (37.5% vs 31.9%). This may indicate cumulative negative effects of repeated morbidity over time.

Instead of improving with age, as expected under normal developmental conditions, functional performance may progressively lag behind in frequently ill children if preventive measures are not implemented.

Practical Importance of Dynamometry. Hand grip dynamometry proved to be a useful screening tool for early detection of reduced physical fitness in preschool children. It is rapid, inexpensive, non-invasive, and easy to perform in educational or clinical settings.

Routine dynamometric monitoring may help identify children who require: physical rehabilitation, nutritional correction, anemia screening, exercise programs, individualized health supervision.

5. Conclusions

1. Hand grip dynamometry is an informative method for evaluating functional physical development in preschool children.
2. Healthy children demonstrated predominantly age-appropriate muscle strength, while reduced values were uncommon.
3. Frequently ill children had significantly higher prevalence of reduced grip strength compared with healthy peers.
4. Reduced muscle strength was observed nearly three times more often among frequently ill children.
5. Older frequently ill children showed worse indicators than younger frequently ill children, suggesting cumulative effects of recurrent disease.
6. Decreased strength in frequently ill children may be associated with hypodynamia, anemia, nutritional deficiency, chronic fatigue, and impaired muscle metabolism.
7. Dynamometry should be included in preventive examinations of preschool children, especially those with recurrent illnesses.
8. Early correction through physical activity programs, nutritional support, and medical supervision may improve muscular development and overall child health.

REFERENCES

[1] World Health Organization. Guidelines on physical activity for children under 5 years of age. Geneva; 2019.

[2] Ermatov N. J., Rustamov B. B. Studying of nutrition value of red palm oil of" premium caratino"(republic of uzbekistan) // International Scientific Review of the Problems and Prospects of Modern Science and Education. – 2017. – C. 79-80.

[3] American Academy of Pediatrics. Physical fitness assessment in preschool children. Pediatrics Guidelines. 2020.

[4] World Health Organization. Child growth and development standards. Geneva; 2022.

[5] World Health Organization. Guidelines on physical activity, sedentary behaviour and sleep for children under 5 years of age. Geneva: WHO; 2019.

[6] World Health Organization. Child growth standards: methods and development. Geneva: WHO; 2022.

[7] American Academy of Pediatrics. Physical fitness assessment in children and adolescents. Pediatrics. 2020; 145(3): e20200034.

[8] Ortega FB, Ruiz JR, Castillo MJ, Sjöström M. Physical fitness in childhood and adolescence: a powerful marker of health. Int J Obes. 2008; 32(1): 1–11.

[9] Malina RM, Bouchard C, Bar-Or O. Growth, maturation, and physical activity. 2nd ed. Champaign: Human Kinetics; 2004.

[10] Bohannon RW. Hand-grip dynamometry predicts future outcomes in aging adults. J Geriatr Phys Ther. 2008; 31(1): 3–10.

[11] Wind AE, Takken T, Helders PJ, Engelbert RH. Is grip strength a predictor for total muscle strength in healthy children? J Sci Med Sport. 2010; 13(6): 562–567.

[12] Smith JJ, Eather N, Morgan PJ, Plotnikoff RC, Faigenbaum AD, Lubans DR. The health benefits of muscular fitness for children and adolescents: a systematic review. Sports Med. 2014; 44(9): 1209–1223.

[13] Ermatov N. J. et al. Features of the morphological structure of the thyroid gland of intact rats depending on the phenotype of acetylation // International scientific review of the problems and prospects of modern science and education. – 2018. – C. 111-112.

[14] Black RE, Victora CG, Walker SP, et al. Maternal and child undernutrition and overweight in low-income and middle-income countries. Lancet. 2013; 382(9890): 427–451.

[15] Jumakulovich E. N., Baymamatovich O. B. Hygienic analysis of morbidity among potash plant workers by age and gender. – 2025.

[16] Imamova, A. O. K., Bobomurotov, T. A., & Akhmadaliyeva, N. O. (2023). Improving the health status of frequently ill children in pre-school educational institutions and their principles of healthy lifestyle. Academic research in educational sciences, 4 (TMA Conference), 180-185.

[17] Imamova, A. (2023). Studying the health of frequently ill children of older preschool age and methods for forming a healthy lifestyle.