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The impact of obesity on the risk of musculoskeletal injuries in children – a review of the literature

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Abstract

Introduction

Childhood obesity is an increasing public health issue that leads not only to metabolic disorders but also to significant orthopedic complications. Excess body weight affects the developing musculoskeletal system, alters biomechanics, limits mobility, and increases the risk of injuries, particularly in the lower limbs.

Aim

The aim of this review is to summarize current evidence on the relationship between obesity in school-aged children and the risk of musculoskeletal injuries, with a focus on lower limb fractures and the biomechanical mechanisms that heighten injury susceptibility.

Material and Methods

This narrative review includes epidemiological studies, cohort analyses, clinical reports, and biomechanical research examining fracture patterns, treatment outcomes, gait alterations, and loading forces in obese pediatric patients.

Results

The available evidence shows that obese children are more likely to experience injuries of the lower extremities, and these injuries tend to be more severe and complex. Increased kinetic energy during falls, altered biomechanics with abnormal load distribution, and reduced balance and neuromuscular control all contribute to this higher risk. Treatment challenges, such as difficulties with casting or surgical procedures, are also more common in this group.

Conclusions

The heightened risk of musculoskeletal injuries among obese children underscores the need for targeted prevention, promotion of healthy lifestyles, and adjustments in clinical care. A multidisciplinary approach involving pediatricians, orthopedists, physiotherapists, and nutrition specialists is essential to reduce injury risk and improve overall health outcomes.

Keywords:

childhood obesity; musculoskeletal injuries; lower limb fractures; biomechanics; injury prevention

1. Introduction

School-age obesity is one of the most important public health challenges in the modern world. Over the last few decades, there has been a significant increase in the number of overweight and obese children and adolescents in both developed and developing countries[1]. In Poland, the percentage of overweight children in the 6–18 age group is already in the double digits, and in some regions even exceeds 20%, making obesity one of the most common chronic diseases of childhood. This increase is associated with numerous environmental factors, including reduced physical activity, a sedentary lifestyle, increased availability of highly processed foods, and poor eating habits [2].

Obesity in school-age children has not only metabolic but also orthopedic consequences. Obese children are more likely to suffer from chronic joint pain, reduced muscle strength, balance and coordination disorders, as well as unfavorable lower limb alignment, such as knock knees or flat feet [4]. These changes increase susceptibility to injuries resulting from both overload and sudden accidents, such as falls during sports or physical activities.
Pediatric literature describes a “vicious circle” mechanism in which excessive body weight limits physical activity, and limited activity contributes to further weight gain [1]. Obese children are more likely to avoid physical activity due to discomfort or reduced fitness, leading to weakening of the muscles that stabilize the joints and balance disorders. This results in a higher risk of microtrauma and more serious fractures from relatively minor mechanical injuries. In addition, psychosocial factors such as low self-esteem, shame, or avoidance of peer group activities exacerbate the problem and limit the possibilities for intervention in the school environment.

Biomechanical aspects of obesity also play a significant role in the increased risk of injury. Computer models and simulations of falls in children with different BMIs have shown that increased body weight increases the kinetic energy acting on the bones during a fall, which may outweigh the protective effect of adipose tissue [5]. The increased force acting on joints and

bones during daily activities and accidents can lead to more severe fractures of the lower limbs, which are more difficult to treat and associated with a longer recovery period.
In view of the above data, the aim of this review is to present the current state of knowledge on the relationship between school-age obesity and the risk of musculoskeletal injuries, with particular emphasis on:

1. Epidemiology of injuries in obese children.
2. Location and nature of fractures and their relationship to body weight.
3. Biomechanical and clinical mechanisms that increase the risk of injury.
4. Implications for prevention, education, and clinical practice.

Expanding this knowledge is essential to develop effective injury prevention strategies and better tailor orthopedic treatment to the needs of obese children. A review of the literature may also help in designing educational and physical activity interventions in school and home settings aimed at reducing the consequences of obesity on the musculoskeletal system.

2. Methods

This article is a review based on an analysis of scientific literature concerning the impact of school-age obesity on the risk of musculoskeletal injuries in children. The study uses data from clinical and observational studies and biomechanical analyses that provide information on the frequency of injuries, the location of fractures, the mechanisms of their occurrence, and the clinical consequences. The publications analyzed included children aged 6 to 18 who were overweight or obese, as well as studies on the impact of increased body weight on the musculoskeletal system, joint stability, and the risk of injury in daily activities and during physical exertion.

The analysis also included studies devoted to the biomechanical aspects of obesity, including the impact of body weight on the forces acting on bones and joints during falls, changes in body posture, and disturbances in balance and motor coordination. In addition, attention was paid to the clinical consequences of injuries, such as the severity of fractures, treatment time, and complications resulting from the additional strain on the body of an obese child. The data analysis was descriptive and synthetic in nature, allowing for a comprehensive picture of the

impact of obesity on the musculoskeletal system of children, taking into account epidemiological and mechanistic aspects as well as practical preventive implications.

3. Epidemiology of injuries and characteristics of fractures in obese children

School-age obesity significantly affects the epidemiology of musculoskeletal injuries in the pediatric population. Retrospective and cohort studies indicate that overweight and obese children are more likely to suffer lower limb injuries, especially to the thighs, shins, and feet, compared to children of normal weight [7]. In large populations of children hospitalized for injuries, the percentage of overweight children ranges from 25% to 30% [3], confirming that obesity is a significant risk factor in this age group.

An analysis of the distribution of injuries shows that fractures of the long bones of the lower limbs are most common, with obese children being more likely to suffer complex fractures requiring surgical treatment [3]. Cohort studies by Pullagur et al. have shown that obese children are more likely to suffer injuries during recreational activities, with typical fractures involving the lower leg, knee joint, and foot bones [8]. At the same time, it was noted that obese children are less likely to suffer upper limb injuries, which may be due to their limited participation in activities requiring high motor skills and high movement dynamics.
Statistical data also indicate that an increase in BMI correlates with an increased risk of lower limb injuries. Logistic regression studies have shown that a higher BMI Z-score is significantly associated with the risk of long bone fractures in the lower limbs, with an odds ratio (OR) of up to 4.8–5.0 [7]. This association indicates that body weight is an independent factor predisposing to injuries, regardless of the child's age or gender.

The characteristics of fractures in obese children also show greater clinical complexity. In the hospitalized population, there are more frequent multiple fractures and dislocations requiring surgical intervention, as well as longer immobilization and hospital stays [3]. Changes in movement biomechanics, joint overload, and reduced neuromuscular coordination in obese children contribute to more severe injuries compared to children of normal weight.
Furthermore, studies indicate that although obese children suffer more severe fractures, there is not always a significant increase in mortality after injuries when the injury severity score (ISS) is taken into account [3]. This means that obesity primarily affects the type, location, and course of the fracture, and not necessarily the risk of death.

Epidemiological data also suggest a role for socioeconomic factors in obese populations. Retrospective studies have shown that children from families with lower socioeconomic status are more likely to be overweight or obese, which indirectly increases the risk of musculoskeletal injuries [8]. However, body weight remains the main independent risk factor for fractures.
In summary, the epidemiology of injuries in obese children indicates that excessive body weight predisposes them to more severe, frequent, and complicated fractures of the lower limbs. This knowledge is crucial for planning injury prevention, educating parents and children, and adapting orthopedic treatment in this age group.

4. Biomechanical mechanisms of increased risk of injury in obese children

School-age obesity affects not only the epidemiology of injuries, but also the mechanisms of their occurrence. Increased body weight causes biomechanical changes and overload in the musculoskeletal system, which significantly increases the risk of injury. Biomechanical analyses have shown that obese children have different gait patterns, impaired balance, and increased forces acting on joints and bones during daily activities and falls [5].

4.1. Increased kinetic energy and body momentum

Computer models and fall simulations have shown that increased body weight generates greater kinetic energy upon contact with the ground, which increases the forces acting on bones and joints [5]. Although adipose tissue acts as a partial shock absorber, the increase in body momentum in obese children may outweigh its protective effect, resulting in more severe fractures, especially of the lower limbs.

4.2. Joint biomechanical disorders

Obesity causes changes in the alignment of the lower limbs, such as knee valgus, flat feet, or an increased pelvic tilt [4]. These changes increase shear and compressive forces in the joints, predisposing them to overload and injury. In addition, weakness of the muscles stabilizing the joints causes obese children to suffer more frequent falls and injuries from seemingly minor trauma.

4.3. Limited neuromuscular control

Studies show that overweight and obese children have reduced motor coordination and decreased muscle strength in the muscles that stabilize the joints [4]. This results in a greater susceptibility to falls during daily activities and sports, and increases the risk of stress injuries such as lower leg fractures and knee injuries.

4.4. Interaction of mechanical and environmental factors

Obesity combined with low physical activity creates a self-perpetuating mechanism – a so-called "vicious circle" – in which lack of exercise weakens muscles and reduces joint stability, which promotes further injuries [1]. In addition, the environment in which the child functions (e.g., lack of adequate supervision, limited space for activity, inappropriate playing field surfaces) can increase the risk of injury.

4.5. The importance of biomechanics in clinical practice

Understanding biomechanical mechanisms is essential for orthopedic practice. Physicians should take increased body weight into account when planning fracture treatment, including the selection of appropriate reduction, casting, and surgical stabilization techniques [3]. In turn, preventive interventions, such as programs to strengthen postural muscles and improve balance, can reduce the risk of injury in the obese pediatric population.

5. Clinical consequences of injuries in obese children

School-age obesity affects not only the frequency and nature of musculoskeletal injuries, but also the clinical course and prognosis after injuries. Retrospective and cohort studies indicate that obese children suffer more severe lower limb fractures, more often requiring surgical intervention, and also have longer hospitalisation and rehabilitation times [3].

5.1. More severe fractures and complex injuries

Clinical analyses show that multiple fractures and dislocations requiring surgical reduction are more common in obese children [3]. Increased body weight leads to greater forces acting on the bones during injury, resulting in more complex fracture patterns. In the case of lower leg or femur fractures, obese children require surgical intervention more often than their normal-weight peers, which is an important factor in planning orthopedic treatment.

5.2. Prolonged treatment and rehabilitation

Obese children often require longer periods of immobilization and rehabilitation. Increased body weight hinders proper plaster stabilization and the mastery of non-invasive methods, which prolongs healing time and increases the risk of complications such as secondary displacement of fragments or limited range of motion in the joints [3]. Longer rehabilitation may limit the child's physical activity, exacerbating the “vicious circle” of obesity and further risk of injury.

5.3. Difficulties in diagnosis and treatment

Obesity can hinder diagnostic imaging of injuries—a thick layer of subcutaneous tissue reduces the clarity of radiological images, which can delay an accurate diagnosis [6]. In addition, surgical procedures require the adaptation of surgical techniques and equipment to the patient's increased body weight. The consequence is a higher risk of postoperative complications, including infections, wound healing difficulties, and prolonged recovery time.

5.4. The importance of comorbidities

In obese children, musculoskeletal injuries may coexist with other health problems, such as hypertension, insulin resistance, or metabolic disorders [2]. The presence of these diseases may further complicate the treatment process, e.g., through increased susceptibility to wound healing complications or prolonged recovery time. Therefore, comprehensive medical care should take into account both orthopedic and metabolic aspects.

5.5. Impact on quality of life

The consequences of injuries also have a psychosocial dimension. Obese children often experience limited physical activity after injuries, which affects their functioning in school and social environments [3]. Limited movement and prolonged recovery times can lead to a decrease in motivation to participate in physical activity, increasing the risk of further weight gain and orthopedic complications.

6. Injury prevention and practical recommendations

In light of the growing prevalence of obesity in children and the increased risk of musculoskeletal injuries, prevention is a key element of health strategies. Interventions can be implemented at several levels: individual, family, school, and systemic.

6.1. Promotion of physical activity

Regular physical activity plays an important role in the prevention of both obesity and injuries. Exercise programs tailored to the abilities of obese children improve muscle strength, coordination, and joint stability, which reduces the risk of falls and injuries [1]. The literature emphasizes the need to gradually increase the intensity of exercise and to choose activities with a low risk of injury, such as swimming, cycling, or general physical exercise.

6.2. Education of parents and children

Education about the consequences of obesity and the importance of physical activity is key to effective prevention. Parents should be informed about the impact of excess weight on the risk of injury and encouraged to introduce healthy eating habits and regular physical activity at home. Children, on the other hand, should be taught the basics of safety in physical activities and encouraged to view exercise as a pleasant rather than stressful activity [2].

6.3. School interventions

School is a key environment for injury and obesity prevention. Introducing physical education programs tailored to obese children, monitoring body weight, and regularly assessing physical fitness can reduce the risk of injury. It is also recommended that physical education teachers be educated on how to modify exercises to make them safe and effective for overweight children [3].

6.4. Adapting the environment and equipment

Prevention also includes creating safe conditions for physical activity. Appropriate playing field surfaces, shock-absorbing flooring, and the use of protective equipment (helmets, pads, seat belts in transport) can reduce the risk of serious injuries. It is also important to adapt equipment to the child's body weight, e.g., appropriate sizes of bicycles, roller skates, or sports equipment.

6.5. Interdisciplinary cooperation

Effective prevention of injuries and obesity requires interdisciplinary cooperation. Pediatricians, orthopedists, dietitians, physical therapists, and teachers should work together to develop strategies for monitoring children's health, planning physical activity, and health education. Early identification of overweight children allows for the implementation of preventive measures before more serious orthopedic consequences arise [3].

6.6. The importance of prevention in clinical practice

Understanding the mechanisms of increased risk of injury in obese children allows for better treatment planning and minimization of complications. Physical and educational prevention, implemented in the family and school environment, can reduce the incidence of severe injuries, shorten treatment time, and improve the quality of life of children. Physicians should also consider obesity when developing injury treatment and rehabilitation strategies, adjusting the intensity of exercise to the child's abilities and monitoring progress during recovery.
This approach not only reduces the risk of injury, but also breaks the “vicious cycle” of obesity and physical inactivity, improving long-term musculoskeletal health.

7. Conclusions and directions for further research

School-age obesity is a significant risk factor for musculoskeletal injuries in children, and its consequences include both an increased incidence of lower limb fractures and more severe treatment and longer recovery times. The mechanisms of this phenomenon include biomechanical changes associated with joint overload, weakening of stabilizing muscles, and limited motor coordination, as well as modifications in physical activity behavior resulting from discomfort and reduced fitness. As a result, obese children experience more serious injuries that can negatively affect their quality of life, limit their ability to participate in physical activity, and perpetuate the cycle of increasing obesity.

Conclusions drawn from the literature review indicate the need for early prevention, education, and a comprehensive clinical approach. Promoting safe and appropriately adapted physical activity, educating children and parents about healthy lifestyles, adapting the environment and sports equipment, and interdisciplinary cooperation between doctors, physiotherapists, dieticians, and physical education teachers can significantly reduce the risk of injuries and improve the overall health of obese children.

At the same time, the literature points to the need for further research to better understand the mechanisms of increased susceptibility to injury and to develop effective prevention strategies. Prospective cohort studies monitoring obese children over time, biomechanical analyses taking into account different types of falls and patterns of physical activity, as well as studies assessing the impact of obesity on the healing process, complications, and quality of life after injuries are necessary. The implementation of such studies will not only improve clinical practice, but also enable the development of preventive and educational programs in schools and families that will effectively counteract the negative effects of obesity on children's musculoskeletal system.

In summary, childhood obesity increases the risk of musculoskeletal injuries, but at the same time creates an opportunity to implement comprehensive preventive measures that improve both the health and quality of life of young patients. Effective prevention requires a multifaceted approach combining physical, educational, and social aspects, which is crucial in reducing the consequences of obesity in the pediatric population.

Disclosure

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References:

1. Otyłość wieku szkolnego – epidemiologia, konsekwencje zdrowotne, metody prewencji https://endokrynologiapediatryczna.pl/contents/files/a_1559.pdf
2. Witt CE, Arbabi S, Nathens AB, Vavilala MS, Rivara FP. Obesity in pediatric trauma. J Pediatr Surg. 2017 Apr;52(4):628-632. doi: 10.1016/j.jpedsurg.2016.11.037. Epub 2016 Nov 23. PMID: 27914588; PMCID: PMC5386804.
3. Backstrom IC, MacLennan PA, Sawyer JR, Creek AT, Rue LW 3rd, Gilbert SR. Pediatric obesity and traumatic lower-extremity long-bone fracture outcomes. J Trauma Acute Care Surg. 2012 Oct;73(4):966-71. doi:10.1097/TA.0b013e31825a78fa. PMID: 22902734; PMCID: PMC3748582.
4. Rana AR, Michalsky MP, Teich S, Groner JI, Caniano DA, Schuster DP. Childhood obesity: a risk factor for injuries observed at a level-1 trauma center. J Pediatr Surg. 2009 Aug;44(8):1601-5. doi: 10.1016/j.jpedsurg.2008.11.060. PMID: 19635312; PMCID: PMC3717372.
5. Kim JE, Hsieh MH, Soni BK, Zayzafoon M, Allison DB. Childhood obesity as a risk factor for bone fracture: a mechanistic study. Obesity (Silver Spring). 2013 Jul;21(7):1459-66. doi: 10.1002/oby.20355. Epub 2013 May 29. PMID: 23512354; PMCID: PMC3740028.
6. Zonfrillo MR, Seiden JA, House EM, Shapiro ED, Dubrow R, Baker MD, Spiro DM. The association of overweight and ankle injuries in children. Ambul Pediatr. 2008 Jan-Feb;8(1):66-9. doi: 10.1016/j.ambp.2007.08.003. PMID: 18191784; PMCID: PMC2234453.
7. Yang W, Zhou Z, Gu W, Wang X, Ni L. The impact of childhood obesity on different fracture sites. Sci Rep. 2025 Jul 20;15(1):26338. doi: 10.1038/s41598-025-11203-7. PMID: 40685394; PMCID: PMC12277405.
8. Pullagura M, Gopisetti S, Bateman B, van Kampen M. Are extremity musculoskeletal injuries in children related to obesity and social status? A prospective observational study in a district general hospital. J Child Orthop. 2011 Apr;5(2):97-100. doi: 10.1007/s11832-010-0320-4. Epub 2011 Jan 1. PMID: 22468152; PMCID: PMC3058206.