Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 11, November : 2023

Impact of Backpack Disorders on Schools and College Students

A.Sampath Dakshina Murthy[1], L Sai Poojitha[2], L Sravya[2], Mamatha Kumari[2], M Vamsi Krishna[2]
[1]Assistant Professor, Department of ECE, Vignan's Institute of Information Technology (A), Duvvada, Visakhapatnam
[2]B.Tech Student Department of ECE, Vignan's Institute of Information Technology (A), Duvvada, Visakhapatnam
Email Id: sampathdakshinamurthy@gmail.com , poojithalingampalli254@gmail.com , sravyalagudu005@gmail.com , mamathakumari2004@gmail.com , mvkrishna142@gmail.com

Abstract: Students walk in a very complicated way. The body moves forward when muscle contractions and joint movements work together. Age, gender, height, weight, and exercise level can all change the way you walk. Joint moments and muscle forces are very important to gait research. Forces in joints that make them spin. Muscular forces are what allow for movement. Joint moments and muscle forces can be used to find problems and see how well a person walks. It is very important to look at how children walk to see how joint moments and muscle forces change over time. Students' active lifestyles may cause problems with their walking. Students often have to walk up and down stairs and over rough ground, which can test their walking skills. Find out what makes students walk in different ways. Talk about the effects on students whose walking isn't normal. Student's advice on how to avoid and treat bad walking. Experts are researching issues with walking and damage to the muscles and bones and their muscle forces and joint moments affect their steps.

Key words: Gait Pattern, Joint movements, muscle force, Age gender, Gait analysis.

1. Introduction

Students are often required to carry heavy backpacks, which can have a negative impact on their gait patterns and lead to musculoskeletal problems. This review paper will examine the research on student gait patterns while carrying overweight backpacks, as well as the problems that can arise from doing so, especially in young age groups. People walk in an awkward manner. It entails regularly moving your trunk and limbs. The two basic components of most walking actions are stance and swing. One foot is on the ground, while the other leg supports the upper body in stance. The foot is off the ground, and the leg is in front of the torso during the swing phase in figure 1 [1-5].

The age, height, weight, and size of a student's school bag may all influence how they walk. When school backpacks are overly heavy, they place additional strain on joints and muscles,

altering the way youngsters move. According to research, children with overly hefty school bags had increased hip and knee moments while standing. This might be due to the lower body holding more weight. The research also noticed that overweight people who swung with school backpacks engaged their quadriceps and hamstrings more. Because of the weight of the schoolbag, the leg may need extra power to go forward [6-7].

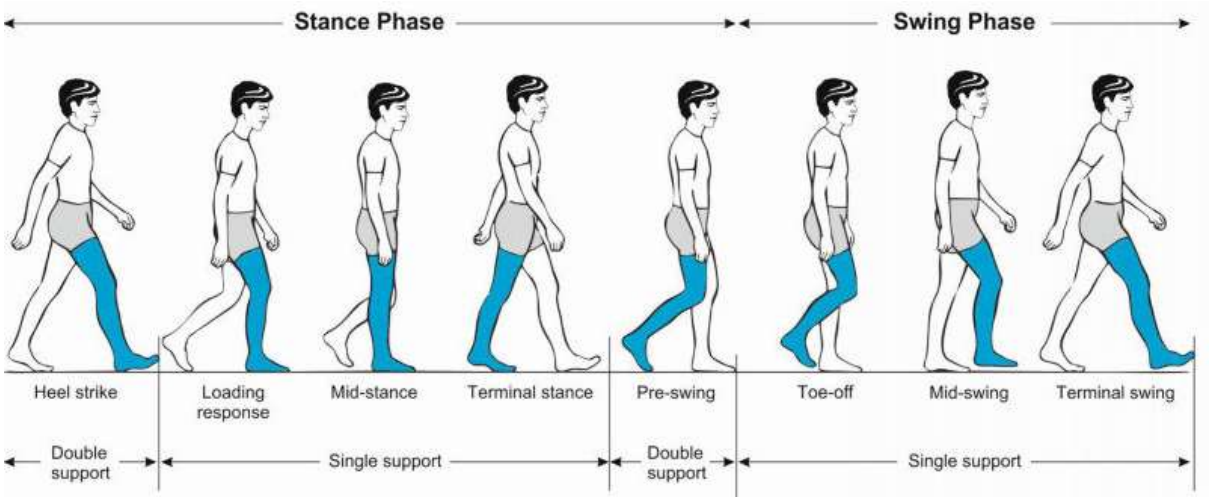

Figure 1. Gait cycle representation in two phases

Another study discovered that carrying large school backpacks helped participants take shorter and quicker steps. This indicates that the steps are shorter and occur more often each minute. This is most likely due to the fact that carrying the school bag makes walking more difficult.

2. Literature survey

In a review of the research on student walking patterns, joint moments and muscle forces are the main topics. It also examines large school bags and the difficulties that 10-year-olds and adults have with them. For readers to completely comprehend the subjects, the paper compiles significant research and highlights crucial difficulties [8].

Research into student gait patterns has highlighted the following key findings:

- Studies on joint moments during walking have investigated their impact on lower limbs and potential long-term effects, especially in growing children.

- Understanding muscle forces during walking can help evaluate biomechanical changes in students carrying heavy school bags.

- Students with large baggage are more likely to develop back discomfort and scoliosis.
- Physical strain may impair attention and academic performance.
- Back pain and arthritis are more likely to happen to students who carry a lot of stuff.
- Heavy bags may alter students walking patterns, compromising their biomechanics and well-being.
- For young children, carrying a lot of material might generate tension and concern.

Numerous studies have examined the impact of heavy school bags on children's gait. One study found that while carrying large school bags, the knees and hips moved more during the standing phase. The increased lower body load may be the reason for this. The research also revealed that heavier backpacks put more strain on the quadriceps and hamstrings during the swing phase in figure 2 [9].

Figure 2 Heavy backpacks are injuring children [10].

A separate study discovered that people's steps became shorter and quicker while carrying hefty school bags. This translates into quicker steps and greater steps per minute. This is most

likely a result of how difficult it is to walk with the school backpack. The way you walk might alter as a result of carrying heavy school bags, which increases your risk of falling and accidents and can cause back discomfort. For elderly individuals, these issues could increase.

3. Different Problems and their Analysis

Case -1

Research has been done on joint moments during walking and how they affect the lower limbs, but the 2018–2023 review study and suggestions have some flaws. Most studies have only looked at adults, leaving out information on kids, who are more likely to get hurt and may have long-term joint problems [11-12]. Children's studies are small and lack resources, which makes them less reliable. Also, people don't agree on how to measure and analyse walking joint moments, which makes it hard to compare data and make suggestions based on facts the leg could need more effort to advance because of the weight of the school bag in figure 3.

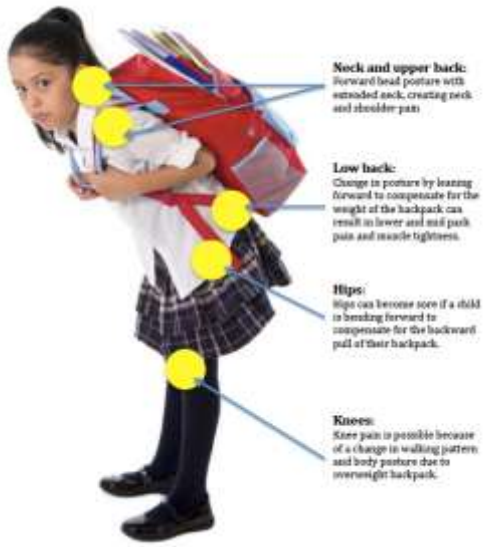

Figure 3 Effects of heavy backpacks in school children [11]

Recommendations for future research to address these problems, future research should:

- Focus on the impact of joint moments on growing children.
- Conduct larger and better-powered studies on children.
- Develop and standardize methods for measuring and analyzing joint moments during walking.

` `The present study suggests some generic solutions to these issues. In particular, developing children should avoid carrying heavy school backpacks. Heavy school backpacks increase lower limb joint moments and injury risk. Growing children need daily exercise. Exercise strengthens the muscles and bones surrounding joints, protecting them from damage. In the meantime, doctors should know about the risks of school bags that are too heavy and other things that can make it harder for growing kids to walk without pain. Clinicians should also show kids and their parents how to carry school bags properly and make them lighter.

Case-2

The effects of physical pressure on children's capacity to focus and do well in school when they carry around big school backpacks are addressed analysed, and ideas are made. Different results come from a small study. Things like bag weight, distance, student age and size, and health and fitness affected focus and academic success. While heavy bags may have short-term effects on focus and schoolwork, It's possible for carrying heavy bags to hurt your back and neck, which can make it harder to focus and do well in school over time [13-15]. These problems by not bringing bags that are too heavy, pausing while moving big bags, spreading the weight of the bag out evenly, and working out regularly. Too much stuff can stress the muscles and bones in your back and neck, which can hurt and make it hard to focus and do well in school. Regular exercise can help strengthen the bones and muscles in your back and neck, which can protect the joints from injury in figure 3.

Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 11, November : 2023

Figure 3 Injury between gait disorders and Abnormalities

Carrying too much weight can result in some back and backbone issues, such as

- When school bags are too heavy, they can put too much stress on the muscles, bones, and joints in the neck, shoulders, and back, which can cause pain and soreness. This can lead to long-term problems, like musculoskeletal illnesses.
- When students hunch over to support their heavy school bags, they can hurt their backs and cause headaches, muscle pain, and other health problems.
- Physical strain can negatively impact attention and academic performance by diverting resources away from the brain to cope with stress.
- Students' balance and coordination are at a much greater risk when their school bags are too heavy. This makes falls and accidents more likely, especially on steps and uneven surfaces.

4. Conclusion

A study on the harmful effects of backpacks on children and young adults aged 5 to 24 has revealed potential health risks associated with carrying heavy backpacks. This age group is particularly vulnerable to musculoskeletal issues, gait disturbances, and discomfort due to the

excessive load on their developing bodies. As they grow older, the long-term consequences of backpack-related problems can manifest in more severe medical issues. The study highlights the importance of addressing these concerns and considering future research and interventions. The weight of the backpack can strain the muscles and bones of the back and neck, leading to pain and discomfort. Over time, this can lead to more serious problems, such as musculoskeletal disorders, poor posture, reduced attention, and academic performance. The long-term effects of carrying a heavy backpack are not yet fully understood.

To eliminate backpack safety issues, children and young people should avoid carrying backpacks that weigh 10–15% of their body weight. Check that the rucksack fits properly and that the weight is distributed evenly over both shoulders if it is heavy. Parents and instructors may help students carry just the necessities and store extraneous items. It is advised to choose an ergonomic backpack with back support. Parents and schools should be aware of the significance of rucksack selection. Load should be limited depending on the age and physical development of the students. To decrease costs, schools should work with educators and health specialists. Regular examinations and prompt responses are critical for health monitoring. Active living and physical education may help to mitigate the negative effects of rucksack use on posture and musculoskeletal health.

5. Future Scope

The long-term health impacts of wearing large backpacks, including their influence on the spine, muscles, and joints, cognitive function, and academic achievement, need further research. Educational programmes that teach correct backpack carrying and provide storage space are two interventions that may assist children and young people in avoiding carrying overweight backpacks. Longitudinal studies should be conducted to examine the health effects of students who wear large backpacks throughout their school years, especially those in their 30s and beyond. Smart backpacks, for example, might aid in the prevention of health problems. Parents, teachers, and healthcare professionals should be educated and made aware of the dangers of heavy backpacks. Students should be taught how to pack and carry their baggage securely in educational programs. Medical strategies and therapies should be developed to address musculoskeletal disorders caused by backpack-related concerns in people aged 30 and above.

References

[1]. Achanta, Sampath Dakshina Murthy, Thangavel Karthikeyan, and R. Vinoth Kanna. "Wearable sensor based acoustic gait analysis using phase transition-based optimization algorithm on IoT." International Journal of Speech Technology (2021): 1-11.

[2]. Achanta, Sampath Dakshina Murthy, and T. Karthikeyan. "A wireless IOT system towards gait detection technique using FSR sensor and wearable IOT devices." International journal of intelligent unmanned systems 8, no. 1 (2019): 43-54.

[3]. Achanta, Sampath Dakshina Murthy, T. Karthikeyan, and R. Vinothkanna. "A novel hidden Markov model-based adaptive dynamic time warping (HMDTW) gait analysis for identifying physically challenged persons." Soft Computing 23 (2019): 8359-8366.

[4]. Sharma, Neha, A. Sampath Dakshina Murthy, T. Karthikeyan, Ch Usha Kumari, and B. Omkar Lakshmi Jagan. "Gait diagnosis using fuzzy logic with wearable tech for prolonged disorders of diabetic cardiomyopathy." Materials Today: Proceedings 9 (2020).

[5]. Murthy, A., B. Jagan, K. Raghava Rao, and P. Satyanarayana Murty. "A virtual reality research of Gait analysis in the medicine fields." In AIP Conference Proceedings, vol. 2426, no. 1. AIP Publishing, 2022.

[6]. Sampath Dakshina Murthy, Achanta, Thangavel Karthikeyan, and R. Vinoth Kanna. "Gait-based person fall prediction using deep learning approach." Soft Computing (2021): 1-9.

[7]. A.Sampath Dakshina Murthy, T. Karthikeyan, B. Omkar Lakshmi Jagan, “Clinical Model Machine Learning for Gait Observation Cardiovascular Disease Diagnosis”, International Journal of Pharmaceutical Research , Volume 12, Issue 4, Pages 3373 – 3378 October-December 2020 . doi.org/10.31838/ijpr/2020.12.04.460

[8]. Sampath Dakshina Murthy, T. Karthikeyan, B. Omkar Lakshmi Jagan et al., Novel deep neural network for individual re recognizing physically disabled individuals, Materials Today: Proceedings 33, pp. 4323-4328, https://doi.org/10.1016/j.matpr.2020.07.447

[9]. Mr.A.Sampath Dakshina Murthy, Dr. M.Hema, Dr. J Sudhakar, Mr B.Omakar Lakshmi Jagan Smart Shoe Application No: 6300158, Authority: United Kingdom.

[10]. Mr.A.Sampath Dakshina Murthy, Dr. M.Hema, J.Vijayasree, Dr. Lokireddi Venkata Venu Gopala Rao, Dr. Palli Srihari,”A Method For Performing Gait Analysis To Identify Physically Disabled Individuals”Application No 2023/00903 South Africa Granted

[11]. A. Sampath Dakshina Murthy,Hema, M., Lakshmi Jagan, B. Omkar “Gait Recognition in the Modern Era” Lambert publications 2023.

[12]. Sampath Dakshina Murthy Achanta, Sudhakar Jyothula , M. Hema, VLSI Design for Gait Analysis: Challenges and Future Directions: Exploring the Boundaries of Wearable Technology, Lambert publications 2023.

[13]. Connolly, Barbara H., Brad Cook, Stacey Hunter, Melinda Laughter, Abigail Mills, Nick Nordtvedt, and Andrew Bush. "Effects of backpack carriage on gait parameters in children." Pediatric Physical Therapy 20, no. 4 (2008): 347-355.

[14]. Ozgul, Bahar, N. Ekin Akalan, Shavkat Kuchimov, Fatma Uygur, Yener Temelli, and Gulden POLAT. "Effects of unilateral backpack carriage on biomechanics of gait in adolescents: a kinematic analysis." Acta Orthopaedica et Traumatologica Turcica 46, no. 4 (2012): 269-274.

[15]. Chow, Daniel HK, Monica LY Kwok, Alexander CK Au-Yang, Andrew D. Holmes, Jack CY Cheng, Fiona YD Yao, and Man Sang Wong. "The effect of backpack load on the gait of normal adolescent girls." Ergonomics 48, no. 6 (2005): 642-656.