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**The Impact of School Bag's Weight on Musculoskeletal Symptoms in
Secondary-Level Students**

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Bachelor of Science in Physiotherapy.



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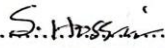
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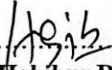
We the undersigned certify that we have carefully read and recommended to the Faculty of Medicine, University of Dhaka, for acceptance of this thesis entitled, “**The Impact of School Bag’s Weight on Musculoskeletal Symptoms in Secondary-Level Students**” Submitted by **Rakibul Islam**, for the partial fulfillment of the requirements for the degree of Bachelor of Science in Physiotherapy (B.Sc. PT).



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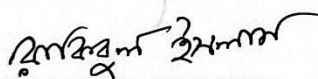
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Declaration

I hereby declare that the research work entitled “**The Impact of School Bag’s Weight on Musculoskeletal Symptoms in Secondary-Level Students**” has been carried out by me as a part of my academic requirements.

This study is original and has not been submitted in any form to any other university or institution for any degree or diploma. All sources of information and data have been duly acknowledged and referenced.

I also declare that ethical approval was obtained and all participants gave informed consent before taking part in the study.

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Acronym

MSD = Musculoskeletal Disease

LBP = Low Back Pain

ABSTRACT

Background: Musculoskeletal disorders (MSDs) among adolescents are a growing public health concern, particularly those arising from carrying heavy school bags. Secondary-level students are at increased risk due to ongoing musculoskeletal development, suboptimal posture, and prolonged exposure to biomechanical stress from schoolbags. **Objective:** This study aimed to examine the relationship between school bag weight and musculoskeletal symptoms among secondary-level students in Bangladesh. **Methodology:** A cross-sectional descriptive study was conducted among 280 students aged 13–17 years from two secondary schools. Data were collected using a semi-structured questionnaire, objective body and bag weight measurements, and the modified Nordic Musculoskeletal Questionnaire (NMQ). Descriptive and inferential statistics, including Pearson Chi-square tests, were applied using SPSS 25. **Results:** The mean body weight of participants was 51.94 kg, and the average bag weight was 4.31 kg. A significant proportion (67.5%) of students reported musculoskeletal pain, predominantly in the shoulder (60.7%), neck (35.7%), and back (18%). The prevalence of pain increased with bag weight; 78.2% of students with heavy bags experienced discomfort, compared to 32.1% with lighter loads ($p < 0.001$). Poor posture, prolonged carrying duration, and asymmetrical carrying methods further exacerbated symptoms. **Discussion:** The findings reveal a strong association between excessive school bag weight (particularly 7–15% of body weight) and musculoskeletal symptoms. Although many students used both shoulders for carrying, this did not eliminate pain risk, highlighting the multifactorial nature of the issue. The study underscores the importance of ergonomic education, bag weight regulation, and school infrastructure improvements to prevent MSDs among students.

Keywords:

Schoolbags, Musculoskeletal symptoms, Adolescents, Ergonomics, Backpack weight, Postural stress.

1.1 Background

Musculoskeletal disorders include many illnesses that impact the muscles, bones, tendons, ligaments, and other supportive elements of the body. These illnesses are frequently linked to working environments and can be exacerbated by elements such as inadequate ergonomics, repetitive strain, and occupational stress (Morabito et al., 2021). Musculoskeletal issues among students in school resulting from carrying school bags are a considerable concern, as evidenced by multiple studies.

The prevalence of musculoskeletal discomfort among students is dramatically elevated, with factors including the weight of the school bag, time of carrying, and poor posture playing a substantial role in the problem. A study in Thailand revealed that 66.67% of elementary school students suffered musculoskeletal discomfort, with risk factors included the transportation of bags over 10% of their body weight and carrying them for more than 20 minutes everyday (Mongkonkansai et al., 2024). The predominant concerns identified include neck, shoulder, and back pain, commonly experienced by students whose backpacks surpass 10% of their body weight (Hanif et al., 2024) (Roodbandi et al., 2018).

Musculoskeletal problems during adolescence are noteworthy due to their incidence, tendency for chronic illnesses and effects on physical and mental well-being. Adolescence is a crucial phase of growth and development, making individuals especially vulnerable to musculoskeletal illnesses, which may present as rheumatic diseases, chronic pain syndromes, and orthopaedic complications, among others (Demir, 2012). Research demonstrates that a significant percentage of teenagers suffer from musculoskeletal discomfort, with prevalence rates between 55% and 58.4%, impacting regions such as the knees, neck, and shoulders (Martins et al., 2017) (Amani et al., 2018).

These diseases are frequently linked to multiple causes, including inadequate posture, the burden of school bags, and physical activities like sports, which may result in injuries and discomfort (Albuquerque et al., 2019). Health authorities and various studies recommend that the weight of a school bag shouldn't exceed 10% to 15% of a

child's body weight. This guidance addresses concerns regarding the potential health effects of carrying heavy backpacks, which may lead to musculoskeletal problems, including back pain, neck pain, and shoulder discomfort (Lavigne, 2014). Furthermore, factors such as the time of transport, the backpack's design, and the manner in which it is worn significantly influence the likelihood of pain and damage, indicating that guidelines based solely on weight may be inadequate (Dockrell et al., 2016).

The burden of heavy school backpacks significantly impacts the biomechanics of children and adolescents, adversely affecting their posture, locomotion, and musculoskeletal health. The weight and type of school bags affect electromyographic activity in muscles including the rectus abdominus, paraspinal, and lower limb muscles, and modify kinematic and kinetic parameters during ambulation, such as trunk, neck, ankle, and knee angles, along with step length and frequency (Sayyadi et al., 2021). Excessively weighted school bags correlate with increased physical discomfort, notably in the neck, shoulders, and back, which are common among school-aged children and adolescents (Siraj, 2022). The weight of the backpack influences standing posture by elevating the cranio-horizontal angle and diminishing walking speed and stride length, however these alterations are not exclusively dependent upon the rucksack's weight (Cuenca-Martínez et al., 2023). Moreover, transporting big backpacks may result in postural abnormalities, including thoracic kyphosis, lumbar lordosis, and forward head posture, especially when the duration of carrying is extended if the bag is carried on one side (Sheikhoseini, Sayyadi and Piri, 2021). The incidence of musculoskeletal diseases and postural abnormalities is significantly greater in girls, with factors such as bag-carrying techniques and modes of transit to school being substantial contributors to physical discomfort (Sheikhoseini, Sayyadi and Piri, 2021).

A survey conducted in Islamabad revealed that 89.8% of students transported bags weighing more than 15% of their body weight, with shoulder soreness being the most commonly reported issue (Khan et al., 2021). The length of time spent lugging these bags and the absence of amenities such as lockers in schools exacerbate these issues (Choudhary et al., 2022). (Mwaka et al., 2014). Gender inequalities also influence outcomes, as females frequently report greater levels of discomfort (Mongkonkansai et al., 2024) (Ibrahim et al., 2015).

Excessively heavy school bags are frequently linked to neck, back, and shoulder pain, in addition to bad posture in children. A research of secondary school students showed that 64% suffered from neck pain, 53% from upper back pain, and 19% from shoulder pain attributed to carrying large bags, with a notable correlation between the time of carrying and bad posture in these areas (Zaheer et al., 2022). In Islamabad, elementary school children showed a significant prevalence of shoulder soreness (67.3%) associated with carrying bags that exceeded 15% of their body weight, with forward leaning identified as the predominant posture (Khan et al., 2021).

A primary factor contributing to musculoskeletal problems is the substantial weight of textbooks, workbooks, and other educational materials that students are mandated to transport everyday, frequently surpassing the advised limit of 10% of body weight (Sahib, 2016). This is exacerbated by the disorganisation of homework assignments and inadequate storage facilities at schools, compelling students to transport all their materials again (Ojha, 2021). The selection of school bags, including wheeled varieties, might exacerbate weight issues, as they are frequently preferred for their storage capacity above ergonomic advantages (Ruttanaseeha et al., 2009). Socioeconomic factors, including the work status of parents, especially mothers, affect the weight of school bags, since children of employed mothers typically carry heavier bags (Alami et al., 2020). Regarding awareness and instructions from the World Health Organisation, numerous students continue to transport bags that above permissible weight thresholds, resulting in possible long-term health complications (Barbosa et al., 2019).

The understanding of the risks linked to large school backpacks among children, parents, and instructors is a complex topic, as demonstrated by multiple studies. Parents, educators, and students have expressed worries regarding the physical strain of large school bags, associated with musculoskeletal discomfort and possible long-term health complications, including back pain, neck pain, and bad posture (Ojha, 2021) (Mongkonkansai et al., 2024). Notwithstanding this understanding, a disparity exists in the implementation of efficacious strategies to alleviate these dangers. Many parents recognise the advised weight limits for school bags; however, a considerable proportion of children continue to carry bags that surpass these limits, frequently exceeding 15% of their body weight, resulting in prevalent reports of shoulder and neck discomfort (Alsiddiky et al., 2019) (Chalise et al., 2020). Teachers' perspectives of the issue are varied; although some recognise the pain associated with large backpacks, the

organisation of assignments and storage facilities in schools is still insufficient (Muppidi et al., 2019). Despite a general awareness of the risks, the implementation of practices and policies to mitigate the issue is inconsistent, highlighting the necessity for more extensive educational campaigns and stricter enforcement of guidelines to safeguard children's health (Alsiddiky et al., 2019) (Chalise et al., 2020).

The incidence of musculoskeletal disorders (MSDs) associated with school bag weight is a considerable issue in South Asia, particularly in Bangladesh, as evidenced by numerous research. Excessively heavy schoolbags, frequently above the advised 10% of body weight, are associated with musculoskeletal discomfort and abnormal spinal alignment in students, with prevalent pain locations including the cervical spine, shoulders, and lower back (Hammill et al., 2017). A study conducted in Karnataka, India, revealed that 86% of young people experienced musculoskeletal discomfort, with 91% carrying backpacks exceeding the allowed weight, suggesting a possible risk for future musculoskeletal disorders (George, Nayak and Shetty, 2015b). A survey conducted in India revealed that 97.8% of school backpacks over the acceptable weight limit, with 48% of children experiencing discomfort and pain, especially in the shoulder area (Muppidi et al., 2019). The problem is exacerbated by factors like the type of bag carriage, with single shoulder carrying being especially harmful (Hammill et al., 2017). The prevalence of musculoskeletal disorders associated with school bag weight in South Asia is a critical concern that necessitates collaborative action from educational authorities, parents, and health professionals to establish effective preventive measures (Muppidi et al., 2019).

Neglecting early musculoskeletal symptoms in school-aged children may result in substantial and varied consequences, affecting their immediate wellbeing and long-term health. Musculoskeletal discomfort in children is common, with studies reporting a prevalence rate between 11% to 48%, varying by geography and specific circumstances (Murugan et al., 2020) (Azabagic et al., 2016). If untreated, these symptoms may result in chronic pain issues that continue throughout adulthood, especially in females and individuals with benign joint hypermobility syndrome (Sperotto et al., 2013). The persistent nature of such pain is frequently linked to many risk factors, including psychological stress, sedentary habits, and ergonomic concerns such as heavy schoolbags and extended periods of sitting (Ståhl et al., 2008). Neglecting these symptoms results in both physical and psychological repercussions, since

musculoskeletal pain can adversely affect children's emotional and social functioning, reflected in diminished scores on health-related quality of life evaluations (Murugan et al., 2020). Consequently, prompt identification and intervention are essential to prevent the advancement of musculoskeletal symptoms into more serious disorders, thereby providing improved health outcomes for schoolchildren (Goff et al., 2013).

Educational institutions and health authorities are crucial in preventing issues related to school bags by establishing guidelines, enhancing awareness, and enforcing rules to reduce the health concerns linked to large school bags. Furthermore, educational initiatives like the "Pack it Light, Wear it Right" campaign in the United States have proven beneficial in advocating for appropriate backpack usage and mitigating health hazards (Jayaratne et al., 2012). Educational institutions may offer storage or locker facilities to alleviate the necessity for students to transport all their resources daily and ensure that educators synchronized homework assignments to limit unnecessary burdens (Ojha, 2021). Health authorities can facilitate these initiatives by doing frequent evaluations of schoolbag weights and offering training for educators and parents regarding the significance of adhering to weight regulations (Dockrell et al., 2016). Furthermore, cooperation among educational institutions, healthcare practitioners, and parents is crucial to instruct children on the proper techniques for carrying backpacks, including the use of both shoulder straps and ensuring a proper fit (Aundhakar et al., 2015).

1.2 Rationale

In recent years, we have shown increasing concern regarding the physical burden imposed on schoolchildren by the weight of their everyday backpacks. Students at the secondary level, often aged 11 to 17, are undergoing a critical phase of physical growth and development. At this stage, their bones, muscles, and joints are still developing, making them more susceptible to external stress and mechanical pressure. Transporting school bags that are too heavy—frequently beyond 10–15% of one's body weight—can lead to many musculoskeletal problems, including cervical pain, shoulder discomfort, upper and lower back pain, and inadequate posture. Ultimately, this may result in more severe ailments, including postural abnormalities, chronic back issues, and diminished physical performance.

Although the counsel of health professionals and international health organizations, understanding of appropriate school bag weight and ergonomic norms remains inadequate in numerous areas, particularly in developing nations. Students often bear substantial burdens due to academic requirements, insufficient locker facilities, and a lack of knowledge about safe carrying techniques. This issue is frequently disregarded by parents, educators, and school administrations, hence perpetuating its existence. Furthermore, there has been insufficient local research examining the impact of school bag weight on students' physical health, particularly within the scope of secondary schooling.

This study aims to enhance the existing literature on children and backpacks, while also contributing to the establishment of acceptable load limits for children and examining the impact of school bag weight and carrying ways on the backs of secondary-level students. This study aimed to evaluate the correlation between school bag weight and musculoskeletal problems in secondary-level students. This study will enable the researcher to establish the recommended weight for school bags in children, determining whether it is bearable or unbearable. It aims to raise awareness among students, parents, teachers, and policymakers, potentially guiding the formulation of school health policies, ergonomic interventions, and educational programs to prevent future musculoskeletal issues in children.

1.3 Research question

What is the impact of school bag weight on the musculoskeletal symptoms of secondary school students?

1.4 Aim

To evaluate the correlation between school bag weight and musculoskeletal problems in secondary school students.

1.5 Objectives

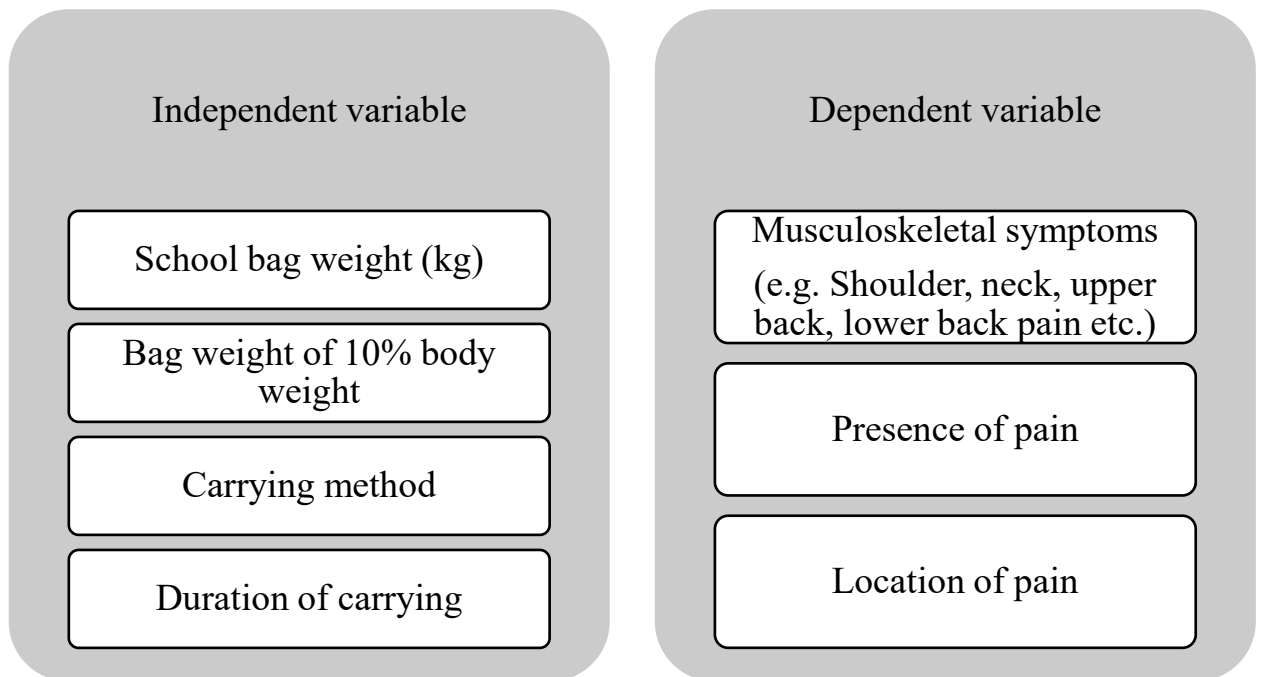
1.5.1 General Objective

To examine the usage of school bags and their estimated weight for children, as well as the prevalence of musculoskeletal problems among secondary-level students.

1.5.2 Specific Objectives

1. To determine an average weight of school bags among secondary-level students.
2. To evaluate musculoskeletal symptoms (e.g., discomfort in the back, neck, and shoulders) mentioned by students.
3. To ascertain the correlation between the weight of school bags as a percentage of body weight and musculoskeletal symptoms.
4. To determine discomfort due to backpack or schoolbag carriage.
5. To identify the preferred posture of carrying a backpack.

1.6 Conceptual framework



1.7 Operational definition

School Bag:

A school bag is defined as any backpack, shoulder bag, or hand-carried bag regularly used by students to carry educational materials such as books, notebooks, and stationery to and from school.

Musculoskeletal Symptoms:

Physical complaints reported by students that affect the muscles, bones, joints, or connective tissues, such as pain, soreness, tingling, or discomfort in areas including the shoulder, neck, back, arms, or legs.

Secondary-Level Students (Adolescents):

Refers to adolescents aged between 13 and 17 years, enrolled in classes 8 to 10, who are in a critical phase of physical and musculoskeletal development and are routinely exposed to ergonomic stressors due to schoolbag use.

Ergonomics:

The science of designing the load (schoolbag) and its method of carriage to fit the physical capabilities of the adolescent students. It includes proper posture, appropriate bag design, and safe load limits.

Backpack Weight:

The total weight of the schoolbag, including books and supplies, measured in kilograms using a calibrated scale.

Postural Stress:

The biomechanical strain experienced by the body due to improper posture while carrying or wearing a schoolbag. It includes observable positions such as stooping, leaning forward or sideways, and is linked to increased risk of musculoskeletal symptoms.

The developing educational demands for students have resulted in heavier schoolbags, which are substantially contributing to musculoskeletal health problems in children and adolescents. Research conducted in diverse areas such as Pakistan, Uganda, India, and Iran consistently indicates a significant incidence of musculoskeletal pain linked to the burden of large schoolbags, frequently above the advised limit of 10% of body weight (Mwaka et al., 2014) (Padankatti et al., 2019). The predominant regions impacted are the neck, shoulders, and back, with a considerable proportion of students indicating discomfort and pain in these areas (Mwaka et al., 2014). The method of transporting bags, including dependency on one shoulder or inadequate weight distribution, aggravates these problems, resulting in poor posture and increased vulnerability to musculoskeletal disorders (MSDs) (Sheikhoseini et al., 2022). Moreover, the prolonged time of transporting these heavy loads, frequently resulting from extended journeys or the absence of school lockers, exacerbates the pressure on the musculoskeletal system (Sundas et al., 2019). Ergonomically constructed support belts have demonstrated potential in alleviating these problems by optimizing weight distribution and minimizing muscle tension (Kumawat et al., 2024). Nonetheless, the acceptance of these solutions is limited, requiring constitutional interventions to address underlying issues, such the reduction of academic burdens and the provision of sufficient storage facilities in schools (Padankatti et al., 2019).

Concentrating on secondary-level children for a study regarding the effects of schoolbag weight on the musculoskeletal system is essential due to many developmental and contextual factors specific to this demographic. Students in secondary school, often aged 11 to 20 years, have considerable physical growth and musculoskeletal development, rendering them especially vulnerable to external stressors like large schoolbags (Nauzeer & Jaunsky, 2021) (Panicker & Sandesh, 2014). This demographic frequently transports schoolbags that surpass the advised 10% of their body weight, posing a considerable risk for the onset of musculoskeletal diseases (Soy et al., 2024). Moreover, secondary students often lack access to lockers, compelling them to transport heavy burdens for prolonged durations, therefore raising the likelihood of musculoskeletal problems (Whittfield et al., 2001). Furthermore, habits established during these years, such as the method of carrying schoolbags, may

have enduring health consequences, perhaps resulting in persistent musculoskeletal issues in adulthood (Purba & Lestari, 2021). Consequently, focusing on secondary-level students facilitates the recognition and alleviation of these hazards during an important developmental phase, offering a chance to establish preventive strategies that can enhance their short-term wellbeing and long-term health results (Choudhary et al., 2022).

There is no universal standard for the acceptable weight of schoolbags as a percentage of body weight; however, several standards and research propose limits between 10% and 15% of a child's body weight. The predominant recommendation is that the weight of a schoolbag should not surpass 10% of a child's body weight, a guideline corroborated by numerous studies and reviews that emphasize the risk of musculoskeletal discomfort and postural alterations when this threshold is exceeded (Silva et al., 2015) (Brackley & Stevenson, 2004) (Malinowska-Borowska & Flajszok, 2020). A research in Poland revealed that a considerable proportion of students exceeded the 10% criteria for schoolbag weight, with 78.3% of Grade 1 students carrying backpacks that constituted 13.1% of their body weight (Lasota, 2014). Despite these recommendations, research indicates that a significant proportion of children transport schoolbags that surpass these thresholds, with findings from the Czech Republic revealing that 85.1% to 100% of boys and 86.8% to 95.4% of girls aged 6-11 carry bags exceeding 10% of their body weight (Kasović et al., 2019).

Studies reveal that a considerable number of children transport schoolbags that surpass the advised weight threshold, generally established at 10% of their body weight. A research in Udupi District, Karnataka, found that 91% of students carried large backpacks, correlating with musculoskeletal discomfort in 86% of participants (George et al., 2015). A research in Malta indicated that more than 70% of students carried bags over the recommended limit of 10% of their body weight, with 32% of these students suffering from back pain (Spiteri et al., 2017). In Portugal, it was noted that 5th-grade students frequently carried loads exceeding 10% of their body weight, with female students and those classified as overweight typically carrying bigger burdens (Barbosa et al., 2019). A research in Davangere revealed that 74.7% of children carried bags over 15% of their body weight, with younger children (8-10 years) more prone to carrying bags beyond 25% of their body weight (Bhat et al., 2018). The findings correlate with a critical narrative review indicating that students frequently transport over 15% of their

body weight, hence increasing the risk of musculoskeletal injuries (Perrone et al., 2018).

The type of schoolbag, length of use, and technique of carrying substantially affect musculoskeletal stress in secondary school students. Carrying backpacks, especially over one shoulder, is linked to heightened musculoskeletal discomfort due to alterations in skeletal posture and increased muscle activity, especially in the trapezius and erector spinae muscles (Hardie et al., 2015). Research demonstrates that carrying a backpack that exceeds 10% of a student's body weight correlates with increased occurrences of shoulder, neck, and back discomfort, with shoulder pain being the most common (Hamzat et al., 2014) (Spiteri et al., 2017). The length of time spent carrying these heavy objects is crucial; extended carriage worsens musculoskeletal symptoms, with considerable discomfort reported when backpacks are worn for over 10 minutes (Sundas et al., 2019). The mode of carrying, whether utilizing both shoulders or a single shoulder, influences muscular activity and discomfort severity. A two-shouldered backpack is advised to alleviate muscle tension and potential discomfort, as it evenly distributes weight and reduces the asymmetrical load that may cause postural deviations (Hardie et al., 2015). The weight of the backpack is a crucial aspect, so as greater loads elevate shoulder strap tension and exacerbate musculoskeletal discomfort, especially during dynamic activities such as walking and running (Tang et al., 2024).

The musculoskeletal areas most frequently impacted by large schoolbags in adolescents are the shoulders, neck, and back. These regions are especially susceptible during puberty because of rapid growth and development in the musculoskeletal system, which can be intensified by the additional stress of bearing high loads. Numerous studies indicate the predominance of pain in these areas, with shoulder discomfort being the most commonly reported issue, followed by neck and back pain (Roodbandi et al., 2018) (Khan et al., 2021). Moreover, psychosomatic variables have been recognized as contributors to musculoskeletal discomfort, indicating that the psychological stress associated with carrying heavy baggage may potentially be a cause (Gent et al., 2003). The interaction of physical and psychological variables during this crucial developmental phase makes the shoulders, neck, and back especially susceptible to the detrimental impacts of heavy schoolbag transport in adolescents.

The point prevalence of low back pain (LBP) in Iran has been estimated to be 15%, with 7.7% of individuals experiencing radiating pain to the legs (Nesami et al., 2007). The severity of lower back pain (LBP) averaged 32.8 mm on a Visual Analogue Scale, with symptoms generally last for 1 to 12 hours (Nesami et al., 2007). In Islamabad, substantial backpacks were associated with musculoskeletal complaints, with 62.4% of students experiencing back discomfort and 67.2% reporting neck pain (Hanif et al., 2024).

Longitudinal studies that emphasize the long-term orthopedic outcomes of musculoskeletal problems resulting from excessive schoolbag weight in secondary-level students are limited; nevertheless, various cross-sectional studies offer significant insights into the immediate effects and possible long-term implications. The biomechanical effects of large schoolbags might result in unusual postures, including kyphosis and lordosis, potentially predisposing kids to chronic illnesses (Bajin et al., 2022). Moreover, inadequate carrying methods aggravate these problems, indicating that educational initiatives may reduce hazards (Kanani, n.d.). Although these studies emphasize immediate issues, additional longitudinal research is essential to comprehensively comprehend the long-term orthopedic implications of these musculoskeletal problems.

The weight of schoolbags substantially affects postural alignment and gait biomechanics in adolescents, with multiple studies emphasizing both acute and chronic implications. Research demonstrates that carrying a backpack causes postural alterations, including an elevation in the cranio-horizontal angle during standing, and influences gait by reducing walking speed and stride length, although these modifications are not constantly correlated with the backpack's weight (Cuenca-Martínez et al., 2023). Excessive loads, especially those over 10-15% of body weight, correlate with significant changes in posture and gait mechanics, including enhanced forefoot and heel forces, modified force ratios, and slowed gait speed (Grobler & Kramer, 2023). Moreover, transporting burdens over 10% of body weight may result in postural misalignments, including anterior head and body orientation, and impact the lumbar region, potentially resulting in lumbar syndrome due to heightened intervertebral pressure (Bajin et al., 2022).

A study including children aged 7-10 years revealed notable variations in stride length, stride width, and stride rate when carrying backpacks that constituted 10% to 20% of their body weight, signifying modifications in spatiotemporal and kinematic parameters (Najafabadi, Sadeghi and Tehrani, 2021). Although recommendations that establish a maximum backpack weight of 10% of body weight, numerous students surpass this threshold, resulting in biomechanical alterations that may have enduring consequences on their musculoskeletal health (Ahmed et al., 2024). These findings highlight the necessity of adhering with prescribed weight limitations to reduce negative biomechanical effects on students.

The probability of developing musculoskeletal complaints from school bag usage is affected by various factors, including gender, what kind of school, and socioeconomic position. Gender disparities are apparent, with numerous research indicating that females have a greater susceptibility to musculoskeletal discomfort than males. Studies conducted in India and Nigeria indicated that females experienced greater occurrences of shoulder pain and other discomforts, indicating a gender predilection to these symptoms (Hamzat et al., 2014). Socioeconomic status, frequently associated with the type of school attended, might affect the resources available for reducing heavy schoolbag difficulties, such as the availability of lockers or educational interventions, which are less prevalent in lower socioeconomic environments (Choudhary et al., 2022). The weight of the schoolbag in relation to the child's body weight is a significant determinant in multiple situations, as excessive weights correlate with heightened feelings of pain and discomfort, irrespective of gender or kind of school (Spiteri et al., 2017). The findings emphasize the complex factors contributing to musculoskeletal complaints associated with schoolbag usage, indicating the necessity for tailored treatments that address demographic and socioeconomic elements to reduce the risk of pain and long-term health complications in schoolchildren.

Psychosocial pressures and academic workload significantly correspond with physical problems associated with schoolbag use, particularly musculoskeletal discomfort and psychosomatic anguish. Research demonstrates that psychosomatic elements, including stress and psychological issues, exhibit a stronger correlation with neck, shoulder, and back symptoms than the actual weight of schoolbags. A study indicated that psychosomatic factors had a more significant link with these complaints than the nature and weight of schoolbags, implying that psychological stressors are essential in the

emergence of physical problems in teenagers (Gent et al., 2003). Additionally, academic stressors, such as bullying and workload pressure, have been associated with greater psychosomatic discomfort and psychological issues, with bullying being an especially critical factor (Hjern et al., 2007). Moreover, the perception of schoolbag weight and the duration of carrying it correlate with spinal pain, with extended carrying and sedentary movement methods intensifying these problems (Haselgrove et al., 2008). While physical activity did not moderate the association between academic pressure and psychosomatic complaints, it demonstrated an inverse relationship with these complaints, suggesting that encouraging physical activity may mitigate certain stress-related physical symptoms (Birgersson et al., 2024). These findings highlight the necessity of treating psychosocial pressures and encouraging physical activity to alleviate the physical issues related to schoolbag usage.

Interventions in schools designed to alleviate muscular complaints associated with schoolbags among secondary students have predominantly concentrated on ergonomic teaching, minimizing backpack weight, and encouraging correct posture. Ergonomic education programs have shown beneficial in enhancing sitting posture and decreasing schoolbag weight, as illustrated by a study including students aged 8 to 11, who showed significant changes following the intervention (Syazwan et al., 2011). Educational treatments containing practical examples, sports guidance, and postural habits have shown beneficial in diminishing backpack weight and alleviating back pain, especially among first-year students and third-year females (Rodríguez-Oviedo et al., 2018). Moreover, interventions that instruct students on organizing their bags in accordance with their schedules and utilizing lightweight materials have given rise to a notable decrease in schoolbag weight, consequently reducing the prevalence of musculoskeletal issues (Saini et al., 2023). Although these initiatives, the incidence of heavy backpack usage persists at higher levels, with 66-80% of students transporting bags that surpass 10% of their body weight, underscoring the necessity for ongoing and potentially more extensive interventions (Rodríguez-Oviedo et al., 2018). Although educational treatments exhibit potential, their efficacy may be constrained, prompting a multidimensional strategy to thoroughly manage the issue (Bettany-Saltikov et al., 2019).

School administrations and health education programs are essential in reducing the risks of musculoskeletal problems associated with schoolbags through the enforcement of educational interventions and regulatory modifications. School-based ergonomic education initiatives have proven beneficial in minimising these dangers by instructing students on correct posture and schoolbag management strategies. A study in Malaysia revealed notable enhancements in students' sitting posture and a decrease in schoolbag weight after an ergonomic modification (Syazwan et al., 2011). Furthermore, educational initiatives concentrated on back health, ergonomics, and postural habits can reduce the incidence of musculoskeletal problems by enhancing students' understanding and behaviours of back care (Bettany-Saltikov et al., 2019). Consequently, school administrators need to think about regulatory initiatives, such as implementing weight restrictions for schoolbags, similarly to the Khyber Pakhtunkhwa government's legislation that establishes precise weight limits according to grade levels (Ali, 2023). The participation of teachers and parents is crucial, as their views and behaviours greatly impact the efficacy of these treatments (Padankatti et al., 2019). A comprehensive approach involving educational initiatives, policy development, and community engagement is essential to successfully tackle the issue of musculoskeletal disorders connected to schoolbags in children.

The awareness of students and parents concerning the possible hazards of heavy schoolbags is typically minimal, which considerably impacts their behaviour and the incidence of musculoskeletal problems in students. Research suggests that although most parents acknowledge that excessively large schoolbags might lead to back issues, their comprehension of particular weight thresholds and appropriate carrying methods is frequently insufficient. A little proportion of parents understand that the optimal weight of a schoolbag should not surpass 10-15% of a child's body weight (Alsiddiky et al., 2019) (Chalise et al., 2020). This deficiency in awareness is evident in the conduct of both parents and children, as many fail to routinely inspect schoolbags for superfluous things, resulting in youngsters bearing burdens that beyond suggested limits (Alsiddiky et al., 2019). Although some parents recognise the recommended weight and handling guidelines for schoolbags, a considerable percentage of students continue to carry bags that exceed these recommendations, leading to frequent reports of shoulder and neck pain (Chalise et al., 2020). The problem is exacerbated by the inadequate enforcement of current restrictions, such as those in Khyber Pakhtunkhwa,

Pakistan, designed to restrict schoolbag weights but having implementation difficulties (Ali, 2023). It is important to implement educational initiatives for parents, teachers, and students to enhance knowledge and alleviate the health concerns linked to large schoolbags (Javadijala et al., 2012). Enhancing awareness and conducting effective steps are essential for alleviating the detrimental impacts of heavy schoolbags on children's health.

The existing literature regarding the influence of schoolbag weight on the musculoskeletal system of secondary-level adolescents indicates numerous geographical and contextual deficiencies. Although research has been executed in diverse locations such as Malta, India, Indonesia, Egypt, and Iran, there exists a significant deficiency of thorough investigations in other regions, especially in Western nations and Africa, thereby constraining the ability to generalise of results across varied cultural and educational contexts (Spiteri et al., 2017) (Purba & Lestari, 2021). Moreover, although certain studies have examined the correlation between schoolbag weight and variables involving gender and body mass index, there is an a shortage of research on other potential moderating factors, such as socioeconomic status, which may affect both the weight of schoolbags and the resources available to alleviate their effects (Spiteri et al., 2017). The methodological quality of current studies varies considerably, with some exhibiting insufficient design and inadequate data analysis, recommending the implementation of more stringent study procedures in future investigations (Perrone et al., 2018) (Guleria et al., 2023). Addressing these gaps through geographically broadened, longitudinal, and methodologically rigorous research may lead to a comprehensive understanding of the effects of schoolbag weight on the musculoskeletal health of secondary-level students worldwide.

The relationship between schoolbag weight surpassing specified limits and musculoskeletal problems in secondary-level pupils in Bangladesh is strong, with differences noted by gender and methods of carrying bags. A research of 626 students revealed that those carrying backpacks above 15% of their body weight faced a greater probability of back discomfort, indicated by an odds ratio of 4.3459. A considerable proportion of these students reported back pain, resulting in school abandonment (Bahatkar et al., 2014). Gender disparities are significant, with females reporting higher incidences of dorsal and lower back pain compared to males, especially during puberty (Korovessis et al., 2004). The technique of transporting the bag is significant; carrying

it on one shoulder may result in uneven spinal alignment, aggravating postural problems (Ahmed et al., 2024). A study in Karnataka demonstrated that 91% of children carried heavy backpacks, with 86% experiencing musculoskeletal discomfort, indicating a significant correlation between heavy bags and discomfort (George et al., 2015). The incidence of musculoskeletal pain is affected by the ratio of bag weight to body weight, exhibiting a greater frequency in females (Panicker & Sandesh, 2014). These findings illustrate the necessity for educational interventions and regulatory changes to alleviate the health concerns linked to large schoolbags among students in Bangladesh.

3.1 Study design

This study conducted a cross-sectional descriptive approach to evaluate the correlation between school bag weight and musculoskeletal symptoms in secondary school students. The design facilitated the simultaneous collection of data regarding both exposure (e.g., bag weight, carrying behaviours) and outcomes (e.g., pain or discomfort) at a singular time point. It was selected for its practicality, cost-efficiency, and compatibility for academic study. This design, while unable to establish causality, facilitates the identification of connections and prevalence, so establishing the foundation for future studies.

3.2 Study area

This study has been carried out in two secondary educational institutions in Savar, Bangladesh. The schools have been named are BPATC School and College and ACED School. These two institutions were selected because of their substantial and varied student demographics. The region encompasses both public and private educational institutions, facilitating a representative sample. The urban environment, together with characteristics such as extended travels and lack of locker access, established it appropriate for examining the impact of school bag weight on students' musculoskeletal health.

3.3 Study Period

The study period extends from February 2025 to April 2025.

3.4 Study population

The study population involved secondary school students aged 13 to 17 years. This demographic was selected because of their developmental phase and the common practice of carrying heavy school bags, which may lead to musculoskeletal problems. The study population comprised students from two educational institutions in the Savar region. Students from both public and private institutions were incorporated to assure a diverse sample, reflecting differing socioeconomic origins and bag-carrying habits.

3.5 Method of sampling

Convenience sampling was appropriate for this study due to its practicality, time efficiency, and accessibility to the target population. Given the limited time frame and resource constraints, this non-probability sampling method allowed the researcher to recruit participants who were readily available and willing to participate, such as students from selected schools in Savar. This approach is commonly used in cross-sectional studies to gather data efficiently from a specific population subgroup, especially when random sampling is not feasible due to logistical limitations (Etikan, Musa and Alkassim, 2016).

3.6 Selection Criteria

Inclusion Criteria

1. Students between the ages of 13 and 17, enrolled in classes 8 to 10. (Ahmed *et al.*, 2024)
2. Participants include both male and female individuals. (Toghroli *et al.*, 2021)
3. Students who regularly transport a school bag. (El-Nagar, 2017)
4. Students who consent to participate and fulfil the study requirements. (Mwaka *et al.*, 2014)

Exclusion Criteria

1. Participants who refused to participate.
2. Students having impairments or chronic illnesses which affect posture or mobility. (Bajin *et al.*, 2022)
3. Students were missing on data collection days.
4. Students are unable to transport a school bag because of injuries or medical conditions. (Toghroli *et al.*, 2021)

3.7 Sample size and calculation

The mathematical equations for calculating sample size are provided below

$$n = \left\{ \frac{z(1-\frac{\alpha}{2})}{d} \right\}^2 \times pq$$

Here,

$$Z(1-\frac{\alpha}{2}) = 1.96$$

P = 0.606 (here, P = prevalence) (Patil et al., 2016)

$$q = 1-P$$

$$= 1- 0.606$$

$$= 0.394$$

$$d = 0.05$$

We know,

$$n = \left\{ \frac{z(1-\frac{\alpha}{2})}{d} \right\}^2 \times pq$$

$$n = \left(\frac{1.96}{0.05} \right)^2 \times 0.606 \times 0.394$$

$$n = 1536.64 \times 0.606 \times 0.394$$

$$n = 366.89$$

Therefore, the calculated minimum required sample size was approximately 367. However, due to practical and time constraints, 280 participants were included in the final analysis.

The above formula is a standard method for determining sample size in prevalence studies and is well-validated in epidemiological research (Pourhoseingholi, Vahedi & Rahimzadeh, 2013).

3.8 Data collection methods and outcome measurement tools

Data has been collected by objective measurements and a semi-structured questionnaire. Students' weights were assessed using a digital scale, whereas bag weight was measured with a calibrated bag scale. The modified Nordic Musculoskeletal Questionnaire (NMQ) was employed to evaluate musculoskeletal symptoms. The data accumulating procedure was standardised, with guidance offered to students for ensuring accuracy and constancy. The necessary tools for the study included a consent form, a questionnaire, paper, pen, file, calculator, and weighing scale.

3.9 Data collection procedure

The data collection commenced following the acquisition of approval from educational administrators and informed consent from the students. Height, weight, and school bag weight measurements were recorded, accompanied by an observation of schoolchildren's posture while transporting their bags. The modified Nordic Musculoskeletal Questionnaire (NMQ) was subsequently employed to evaluate musculoskeletal discomfort. Support has been provided as required, and all data were carefully recorded for study.

3.10 Questionnaire

The research employed a semi-structured questionnaire comprising eight sections: personal information, demographic data, patterns of school bag usage, weight of the school bag, duration of carrying the school bag, method of carriage, posture, and a modified Nordic Musculoskeletal Questionnaire (NMQ) to evaluate pain in various body regions. The administration was conducted in the local language, with assistance offered as necessary, and it was pilot-tested to make sure clarity and appropriateness for the students.

3.11 Data analysis procedure

Data will be analysed using the Statistical Package for the Social Sciences (SPSS) Version 25 and Microsoft Excel Worksheet 16. A descriptive and inferential statistical analysis will be performed. The statistical choice will be determined by the characteristics of the data, using objective assessments and expert opinions.

3.12 Ethical consideration

The ethical guideline of WHO (World Health Organization), IRB (Institutional Review Board) & BMRC (Bangladesh Medical Research Council) was strictly followed. The research proposal was submitted to the ethical review committee of Bangladesh Health Professions Institute (BHPI) for approval and to CRP's ethical committee for getting permission for data collection. After the proposal was approved to carry on with the study, the researcher had moved the study. Researcher takes concern of participants prior to collect interview who are interested to participate in the study. Before starting the interview, signatures obtained from each participant on a Bangla consent form. It is clearly explained to the participants that their information may be publishing, but their name and address not be connecting with the research study. It informed that the participant has the right to withdraw the study any time if he or she would want to. In that consent form, the researcher committed to the participant about confidentiality, participant's right and potential benefits of the study that is all informed to the participant during interview. All the participants gave their consent to participate in the interview. Before participating in the study, the researcher had provided them a written consent form to sign. The researcher had also signed in the consent form. Only the investigator had access of that information. The raw data destroyed after the completion of the research & all the data on computer file were deleted. Considering all those ethical norms & values no ethical problems arises as there were some personal & sensitive questions. The participants were informed that they have the right to withdraw consent & discontinue participation at any time without any prejudice.

4.1 Socio-Demographic Baseline Characteristics

Table 1: Socio-Demographic Baseline Characteristics

Sociodemographic baseline					
Variables	Minimum	Maximum	Range	Mean	Std. Deviation
Student's age	13	17	4	15	1.397
Body weight in kg	24.00	100.00	76.00	51.94	11.09
Bag weight in kg	1.50	10.00	8.50	4.31	1.27

The table shows sociodemographic baseline data for three variables: age of the student, body weight, and weight of the bag. The students' ages range from 13 to 17 years, with a mean age of 15 years, indicating a very limited age range within this group. The standard deviation of 1.397 indicates some variation in the ages. The body weight ranges from 24.00 kg to 100.00 kg, with a mean of roughly 51.95 kg and a standard deviation of 11.10 kg, reflecting a varied distribution of body weights among students. The bag weight ranges from 1.50 kg to 10.00 kg, with a mean of 4.32 kg and a standard deviation of 1.28 kg, indicating variety in the weights of school bags carried by children. This data highlights the diversity in age, body weight, and bag weight among the study group.

4.2 Age of participants

This bar chart illustrates the age distribution of a group of students. The x-axis represents the age range of 13 to 17 years, whereas the y-axis represents the quantity of students at each age. The peak frequency of students occurs at age 15, totaling 144 individuals. Age 16 has 70 students, and age 14 consists of 57 students. The student population declines markedly at age 13, with merely 7 pupils, and age 17 has the lowest occurrence, with only 2 students. The graphic illustrates a distinct concentration of students at age 15, accompanied by a significant decline in frequency as age diverges from this apex.

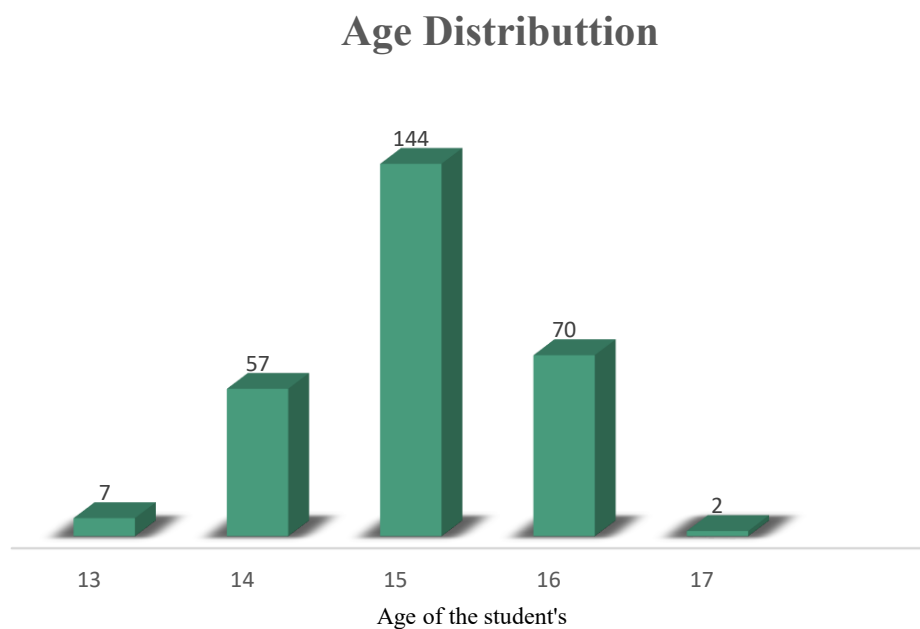


Figure 1: Age distribution of participants

4.3 Gender of participants

The pie chart illustrates the gender distribution within a sample group, clearly illustrating the proportions of boys and girls. In the whole sample, 63.60% (n= 178) are male, denoted by the green portion, whilst 36.40% (n=102) are female, illustrated by the red section. This indicates a higher prevalence of males relative to girls in the sample, with the male population being almost double that of the female population. The chart offers a clear visual comparison between the two genders, enabling a rapid understanding of the group's gender composition.

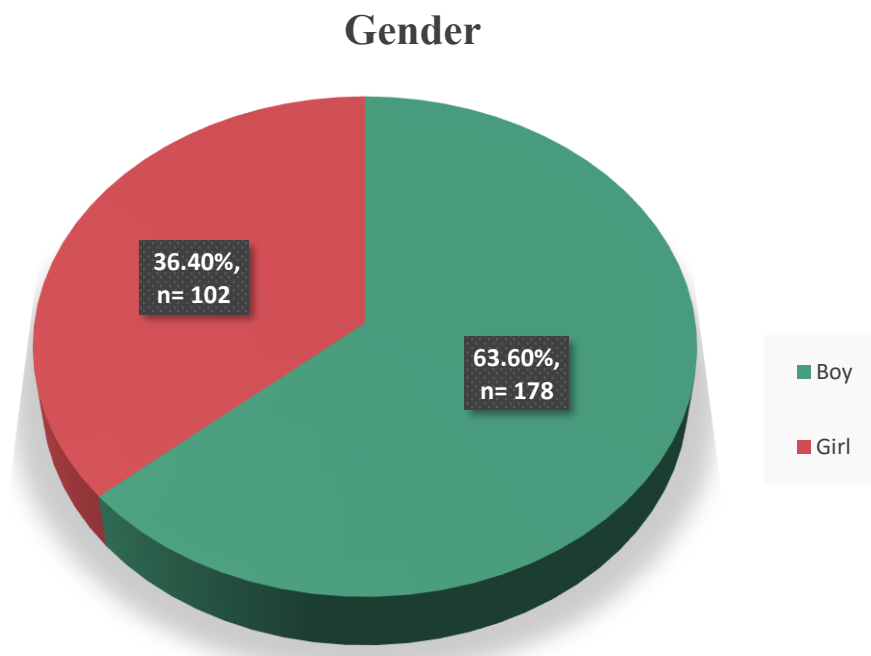


Figure 2: Gender distribution of participants

4.4 Body weight in Kg

This bar chart illustrates the distribution of body weight in kilograms among the group of students. The x-axis indicates various weight ranges, while the y-axis indicates the quantity of students in each weight category. The greatest number of students, 117 (41.79%), is situated within the 46-56 kg weight category, represented by a gray bar. The second-largest cohort of pupils, numbering 79 (28.21%), is situated within the 35-45 kilogram range, indicated in orange. The 57-67 kg category comprises 60 (21.43%) students, indicated in yellow. A diminished number of students are categorized into the following weight ranges: 24-34 kg (5 students, blue), 68-78 kg (13 students, green), 79-89 kg (3 students, light green), and 90-100 kg (3 students, dark blue). This signifies that most students possess a body weight within the 35-56 kg and 46-56 kg intervals.

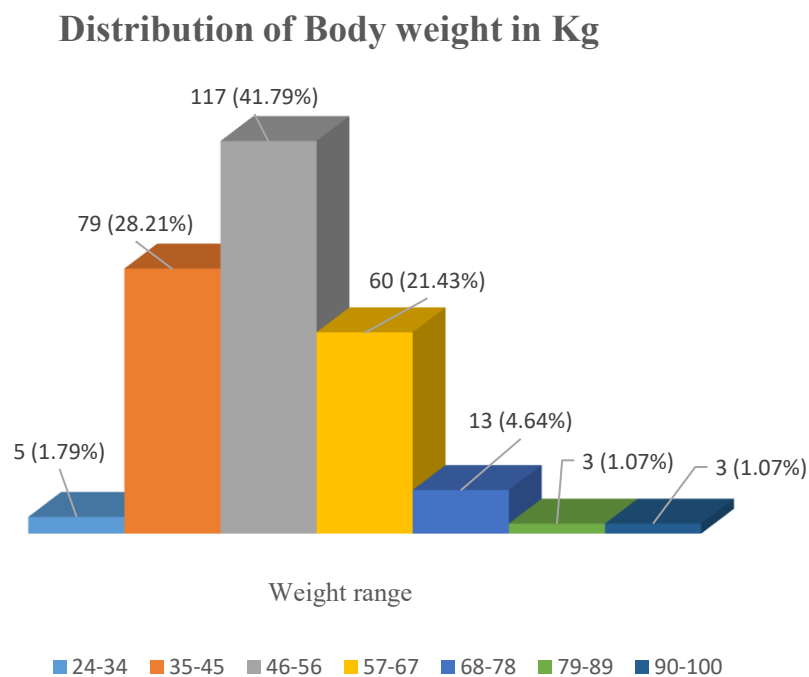


Figure 3: Body weight in Kg

4.5 Bag weight in Kg

This bar chart illustrates the distribution of students according to the weight of their bags. The x-axis explores various weight groups (1-3 kg, 4-6 kg, and 7-10 kg), whilst the y-axis indicates the student quantity. The largest group with 164(58.57%) students, transports bags weighing between 4-6 kg, indicated by a red band. The subsequent largest group has 111(39.64%) kids, possessing bags that weigh between 1 and 3 kg, depicted in blue. The smallest group with of 5(1.79%) students, transports bags weighing between 7-10 kg, indicated by a purple band. This graphic indicates that the majority of students carry bags weighing between 4 and 6 kg, whereas a smaller number of students have bags that are either lighter or heavier

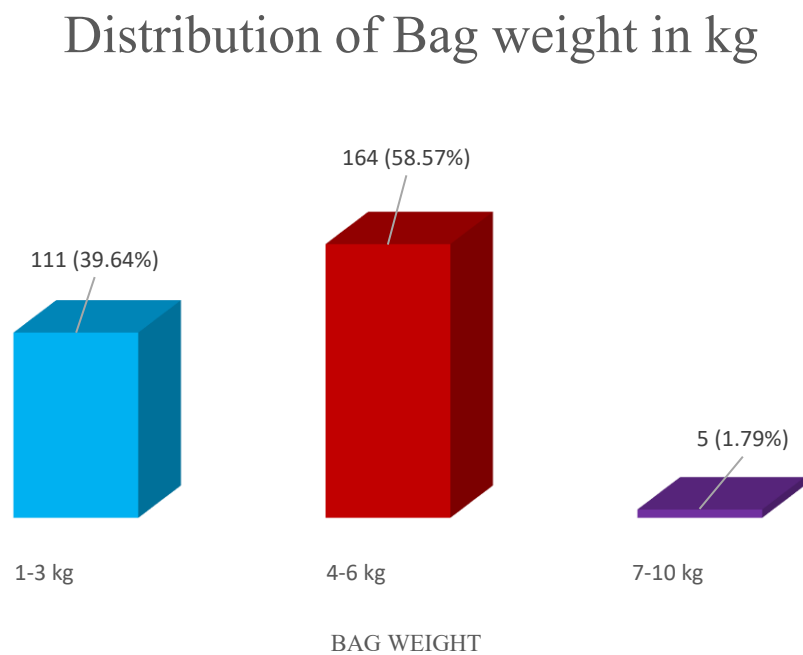


Figure 4: Bag weight in Kg frequency

4.6 Bag weight in a normal day

This pie chart shows the allocation of bag weights on an average day among students. The chart categorizes bag weights into three classifications: light, medium, and heavy. The predominant segment, accounting for 47.5% (n=133), belongs to hefty bags, represented in blue. The medium-weight bags represent 42.5% (n=119) of the total, indicated in orange. The minimal segment, 10% (n=28), implies light bags, illustrated in gray. This graphic demonstrates that a substantial proportion of students choose heavy or medium-weight bags, whereas a considerably lower fraction choose light bags.

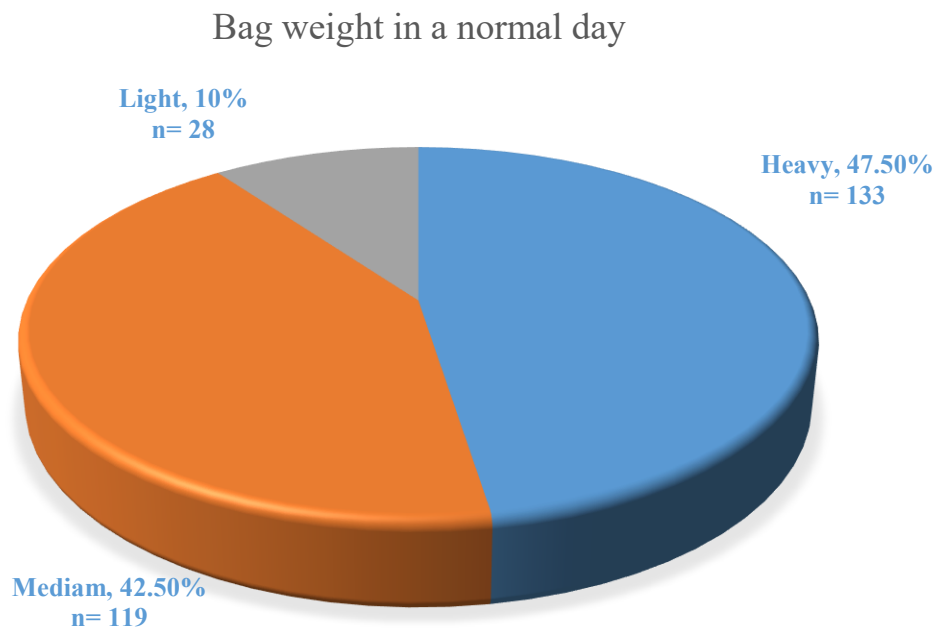


Figure 5: Bag weight in a normal day

4.7 Time of carrying bag during travelling to school

The bar graph illustrates the allocation of time students dedicate to transporting their school bags throughout their route to school, represented as a percentage of the overall sample. A significant proportion of students (40.7%, n=114) indicated that they carry their bags for 25 minutes or longer, reflecting a considerable amount of load-bearing. Subsequently, 22.5% (n=63) of students transport their bags for 15 to 24 minutes, while 21.4% (n=60) do so for 11 to 15 minutes. A lesser percentage, 11.4% (n=31), indicated that they carried their bags for 6 to 10 minutes, whereas merely 3.9% (n=11) of students carried their bags for less 5 minutes. The statistics indicate that a considerable proportion of kids experience extended durations of carrying their school bags, which may lead to musculoskeletal strain or discomfort over time.

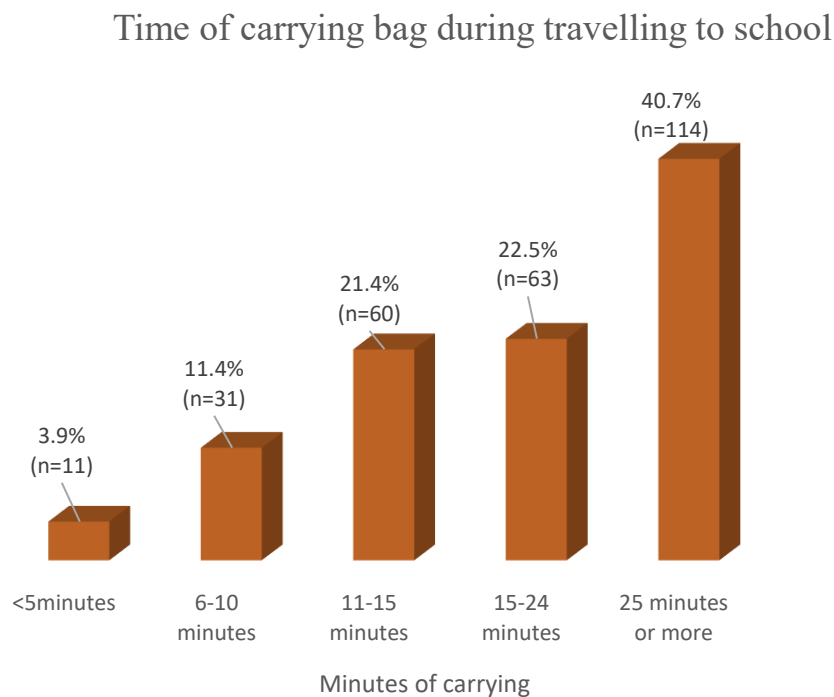


Figure 6: Time of carrying bag during travelling to school

4.8 Methods of carrying school bag

The graphic illustrates the distribution of methods chosen by students to transport their bags. A majority of students (56.4%, n=158) utilized a dual-shoulder carry for their bags, which is typically regarded as the most ergonomic and balanced approach. A significant percentage (27.1%, n=76) transported their bags over the right shoulder, whereas 13.6% (n=38) utilized the left shoulder, suggesting a considerable number of students employing single-shoulder techniques that could result in uneven loading. A minor proportion (1.8%, n=5) indicated transporting their baggage in front utilizing both hands. Uncommon ways comprised transporting the bag with the right hand (0.7%, n=2) and in the left hand (0.4%, n=1). The data indicate that although the majority of students utilize the advised strategy (both shoulders), a considerable percentage continue to carry their bags in manners that may lead to musculoskeletal pain.

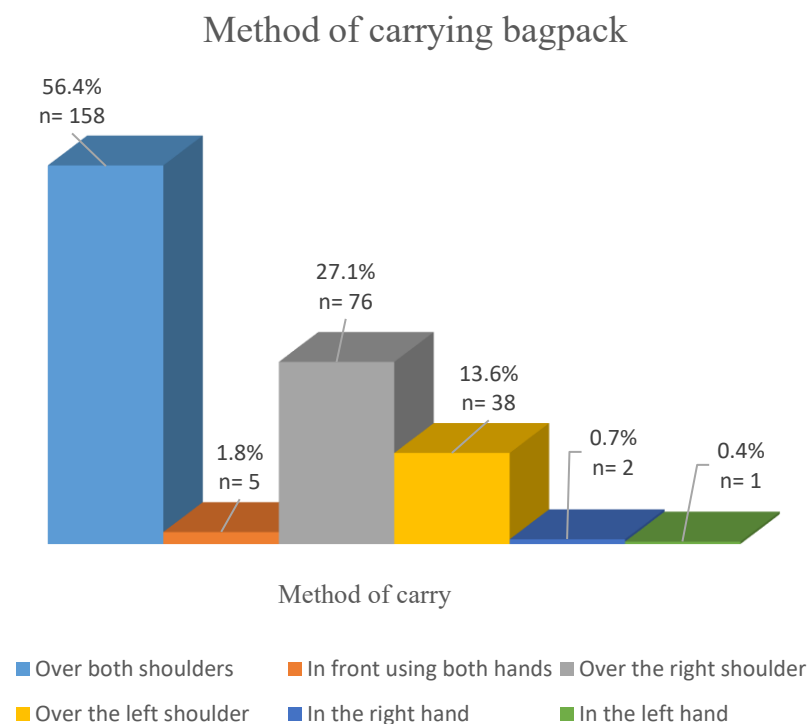


Figure 7: Methods of carrying backpack

4.9 Maintain good posture while carrying school bag

The pie chart illustrates the distribution of replies concerning the significance of sustaining proper posture while transporting a school bag. The graphic indicates that 68.20% (n=191) of respondents highlighted the significance of sustaining proper posture, illustrated by the bigger blue segment of the chart. Conversely, 31.80% (n=89) of participants did not prioritise maintaining proper posture while carrying their school bags, as evidenced by the smaller orange segment. This indicates that most individuals acknowledge the importance of maintaining correct posture to avert potential health problems linked to carrying heavy school bags.

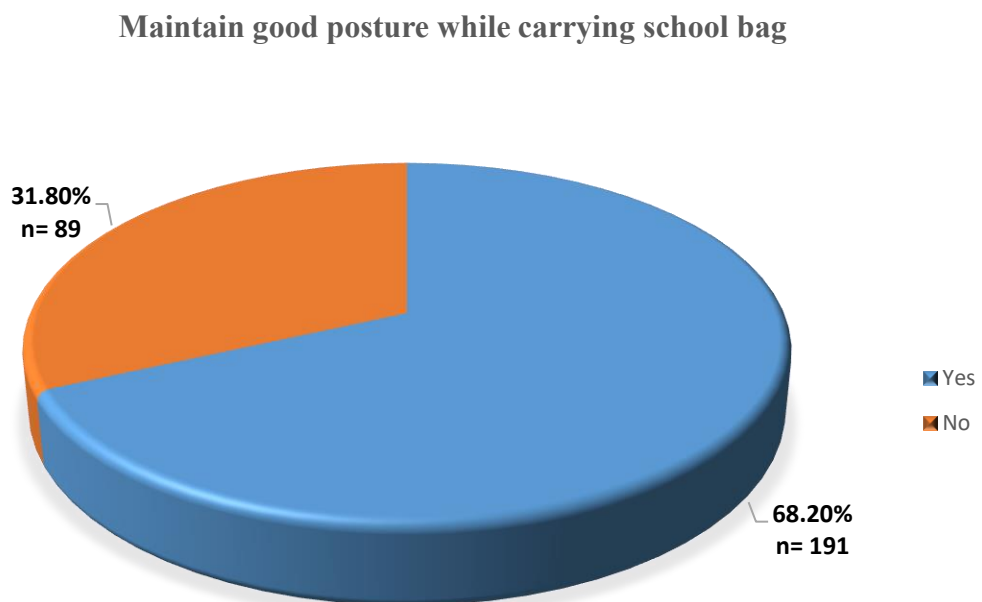


Figure 8: Maintain good posture while carrying school bag

4.10 Position maintained while walking with school bag

The bar chart use distinct colors to illustrate the varied postures pupils adopt while carrying their school bags. The green bar signifies kids who are stooping, with a total of 80 (28.57%) students exhibiting this posture. The yellow bar represents students who are leaning forward, totaling 24 (8.57%) individuals in this category. The blue bar denotes students leaning sideways, totaling 41(14.64%) individuals in this posture. The longest red bar signifies the category none of the above, with 135 (48.21%) students choosing for this choice, indicating that they do not display any of the enumerated poor postures when walking with their school bags. The color difference in the graphic facilitates the obvious identification of the various postures, with the red bar emphasizing the majority of students who do not exhibit any of the problematic postures.

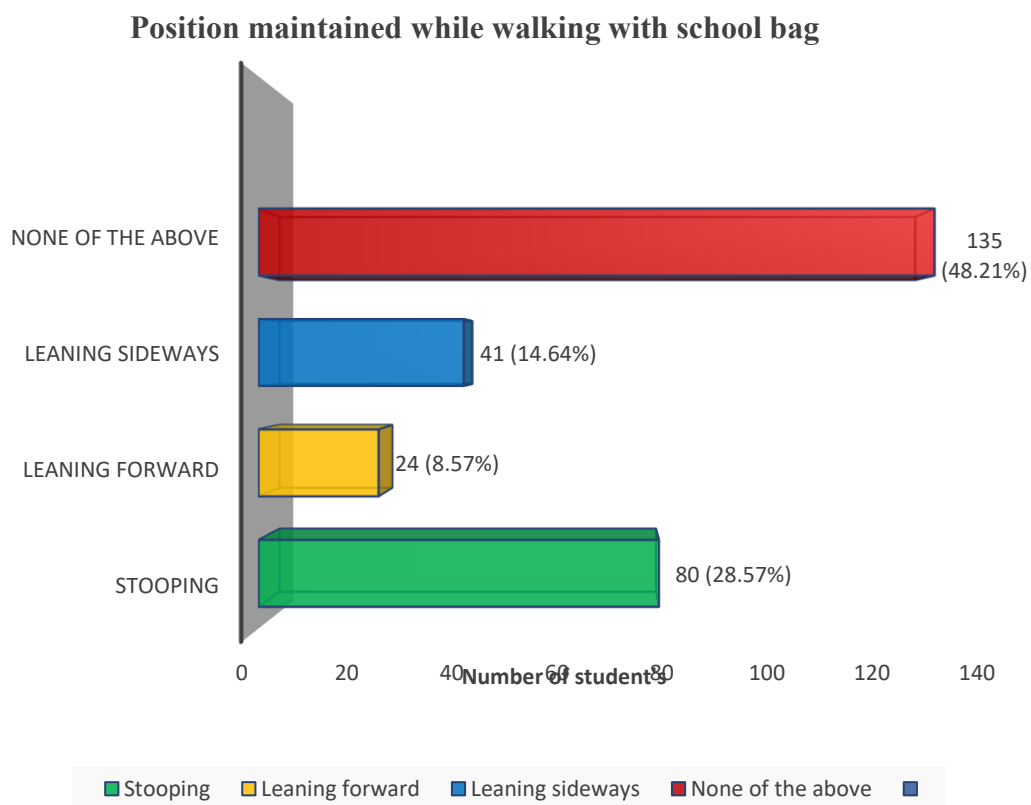


Figure 9: Position maintained while walking with school bag

4.11 Pain caused due to school bag

The bar chart shows the quantity of students who indicated suffering pain due to carrying their school backpacks. A substantial majority of kids (exceeding 200) affirmed "Yes", indicating that they encountered pain associated with the use of school bags. Conversely, a smaller cohort, fewer than 100 students—indicated "No", signifying the absence of such pain. This significant difference indicates that transporting school bags is a significant source of physical discomfort or musculoskeletal pain for numerous students.

Pain caued due to carrying school bag

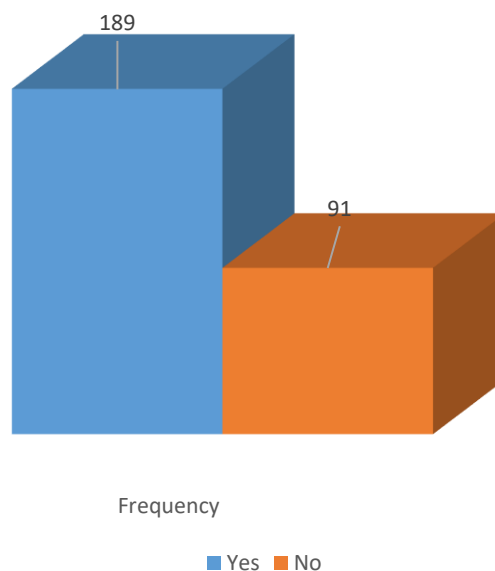


Figure 10: Pain caused due to carrying school bag

The pie chart illustrates the prevalence of discomfort among those who carry school backpacks. The graphic indicates that 67.50% of respondents reported having discomfort, as represented by the larger blue segment labelled "Yes." Conversely, 32.50% of respondents reported no pain, indicated by the orange segment labeled "No." This indicates that a substantial majority of persons experience discomfort or pain due to carrying school bags, highlighting a potential issue related to the weight or usage of these bags.

Pain caused due to carrying school bag

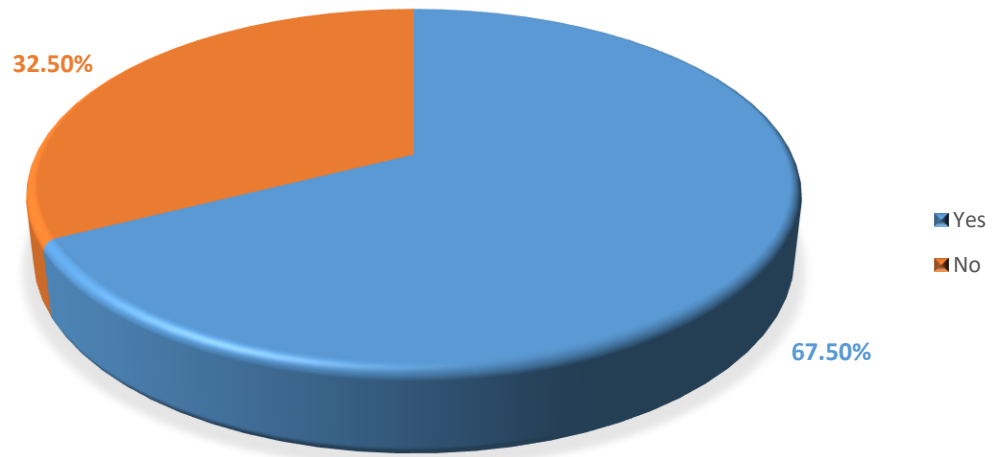


Figure 11: Pain caused due to carrying school bag

4.12 Position maintained while carrying School bag

The bar chart illustrates the postures assumed by students while transporting their school backpacks, with each posture denoted by a distinct color. The yellow bar, denoting "None of the above," signifies that 48.2% of students did not adopt any of the specified postures, making it the most commonly reported response. The blue bar, representing "Stooping," indicates that 28.6% of students assumed this stance. The gray bar, indicating "Leaning sideways," comprises 14.6% of the student population. Finally, the orange bar, representing "Leaning forward," is the least prevalent posture, reported by merely 8.6% of the students. The visual data indicates that although nearly half of the children adopt a neutral posture when carrying their school bags, a considerable number still display postural abnormalities that may lead to musculoskeletal discomfort.

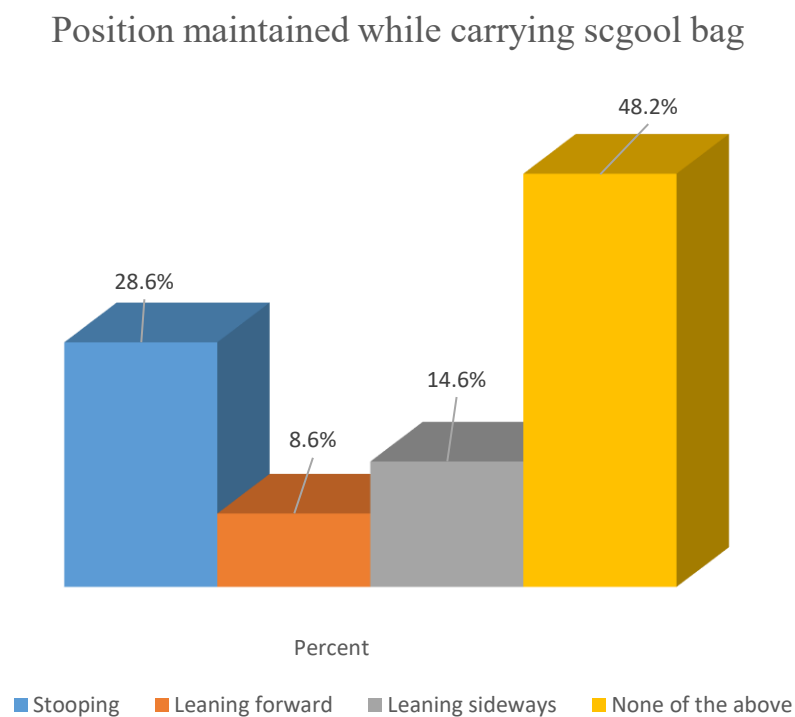


Figure 12: Position maintained while carrying School bag

4.13 Musculoskeletal symptoms

Table 2: Musculoskeletal symptoms

Musculoskeletal symptoms among students		
Symptoms	Percentage (%)	Frequency (n)
Muscle soreness	12.9%	36
Shoulder pain	60.7%	170
Neck pain	35.7%	100
Arm pain	4.3%	12
Elbow pain	0.7%	2
Wrist/Hand pain	2.1%	6
Upper back pain	18.9%	53
Lower back pain	18.2%	51
Hip/Thigh pain	1.1%	3
Knee pain	5%	14
Ankle/Feet pain	3.6%	10
Tingling in the arms/legs	1.8%	5
Others	2.5%	7

The data about musculoskeletal problems in students indicates a variety of physical problems, predominantly linked to the burden of carrying school bags. The predominant complaint recorded is shoulder discomfort, impacting 60.7% (170 students), followed by neck pain (35.7%, 100 students) and muscle soreness (12.9%, 36 students). Upper and lower back discomfort are significant, reported by 18.9% (53 students) and 18.2% (51 students), respectively. Infrequently mentioned symptoms encompass arm discomfort (4.3%), knee pain (5%), and ankle/foot pain (3.6%). A minimal number of students indicated experiencing elbow discomfort (0.7%), hip/thigh pain (1.1%), wrist/hand pain (2.1%), or limb tingling (1.8%). An extra 2.5% (7 students) indicated other undefined symptoms. The findings underscore the considerable incidence of musculoskeletal discomfort in the shoulder and neck among children, indicating a necessity for ergonomic interventions and education on appropriate school bag usage.

4.14 Association Between Backpack Weight and Musculoskeletal Pain in Students

Table 3: Association Between Backpack Weight and Musculoskeletal Pain in Students

Association of Backpack Weight and Pain Prevalence								
Pain caused due to carrying backpack	Response	Heavy	Medium	Light	Total	Pearson Chi-square	p value	df
	Yes	78.2%	63.9%	32.1%	67.5%			
No	21.8%	36.1%	67.9%	32.5%				
Total		100%	100%	100%	100%			

The table explores the correlation between backpack weight and the incidence of pain among individuals. It classifies respondents according to the weight of their backpacks—heavy, medium, or light—and presents the percentage of individuals reporting pain within each classification. Of those with heavy backpacks, 78.2% experienced pain, whereas 63.9% of persons with medium-weight backpacks and 32.1% with light backpacks reported pain. The overall prevalence of pain across all categories was 67.59%. A Pearson Chi-square test was conducted to evaluate the correlation between backpack weight and the prevalence of discomfort, resulting in a Chi-square value of 21.736 and a p-value of 0.000. This outcome signifies a statistically significant correlation, indicating that an increase in backpack weight correlates with a higher probability of suffering pain.

4.15 Distribution of Pain Caused by Carrying a School Bag Based on the Method of Carrying

Table 4: Distribution of Pain Caused by Carrying a School Bag Based on the Method of Carrying

Pain Caused due to Carrying backpack	Methods of carrying backpack							
	Response	Over both shoulders	In front using both shoulders	Over the right shoulder	Over the left shoulder	In the right hand	In the left hand	Total
Yes	52.9%	1.6%	29.6%	15.3%	0.0%	0.5%	100	%
	47.1%	98.4%	70.4%	84.7%	100	99.5	100	%
	Total	100%	100%	100%	100%	100	100%	100

The crosstabulation of discomfort resulting from backpack carrying and the carrying mode uncovers significant tendencies. Among students who reported suffering pain, the largest percentage (52.9%) utilized both shoulders for carrying their bags, a method generally advised for optimal weight distribution. However, this result suggests that even the “correct” method may still contribute to discomfort if other factors such as bag weight or duration of carriage are not optimal. A lesser percentage of students experiencing pain carried the backpack on the right shoulder (29.6%) or the left shoulder (15.3%), suggesting that unilateral carrying correlates with musculoskeletal complaints, presumably due to asymmetrical load stress. Notably, about 1.6% of students who utilized a dual-shoulder front-carrying strategy for their backpacks experienced pain, rendering it the least unpleasant approach, albeit less frequently employed. None of the students who carried their bags in their right hand reported pain, and just 0.5% of those carrying them in their left hand did, indicating that these approaches may present minimal danger, despite their infrequent application. Conversely, among individuals who reported no pain, the majority transported their

bags in front using both shoulders (98.4%) or in their hands (100% and 99.5%), further substantiating the notion that alternate carrying ways may alleviate musculoskeletal strain. These findings underscore the necessity of promoting appropriate carrying techniques while also considering load, duration, and ergonomics for a holistic preventive strategy.

4.16 Relationship Between Pain Caused by Carrying a Backpack and Maintaining Good Posture

Table 5: Relationship Between Pain Caused by Carrying a Backpack and Maintaining Good Posture

Relationship of Pain Caused by Carrying a Backpack and Maintaining Good Posture							
Pain Caused due to Carrying backpack	Maintaining of good posture while carrying backpack				Pearson Chi-square	p value	df
	Response	Yes	No	Total			
	Yes	60.7%	82.0%	67.5%			
No	39.3%	18.0%	32.5%				
Total	100%						

The table presents the association between pain caused by carrying a backpack and the maintenance of good posture among students. Findings show that 67.5% of respondents reported experiencing pain, while 32.5% did not. Among those who maintained good posture, 60.7% experienced pain compared to 39.3% who did not. However, the proportion of pain was notably higher among students who failed to maintain good posture, with 82% reporting pain and only 18% reporting no pain. The Pearson chi-square test value of 12.543 with a p-value of 0.000 indicates a statistically significant association between posture maintenance and pain occurrence, suggesting that poor posture while carrying backpacks contributes significantly to the development of musculoskeletal discomfort.

4.17 Pain Caused by Carrying a Backpack Based on the Type of Bag Commonly Used

Table 6: Pain Caused by Carrying a Backpack Based on the Type of Bag Commonly Used

Pain Caused due to Carrying backpack	Types of bag that is commonly used			
	Response	Backpack	Others	Total
Yes		67.7%		67.5%
No		32.3%	100%	32.5%
Total			100%	

The table analyzes the correlation between the type of bag utilized and the incidence of pain associated with carrying a backpack. Of persons who frequently utilize a backpack, 67.7% reported having discomfort from carrying it, whereas 32.3% did not. Conversely, among individuals utilizing alternative bag types, 100% indicated the absence of pain. In total, 67.5% of respondents reported experiencing pain, whereas 32.5% did not. The results indicate that backpacks are more closely linked to pain, as a greater proportion of backpack users experienced musculoskeletal discomfort than those utilizing alternative bag types. This emphasizes the necessity for additional research into the elements contributing to backpack-related pain, including design, weight distribution, and usage habits.

4.18 Relationship Between Bag Weight Percentage and Pain Prevalence Due to Backpack Carrying

Table 7: Relationship Between Bag Weight Percentage and Pain Prevalence Due to Backpack Carrying

Pain caused due to carrying backpack	Range of bag weight percentage			Total	Pearson Chi-square	p value	df
	Response	3-7	7-11				
Yes	38	127	24	189	33.412	0.000	2
No	47	43	1	91			
Total	85	170	25	280			

The table illustrates the relationship between pain caused by carrying a backpack and the relative weight of the bag as a percentage of body weight among 280 students. Out of the total respondents, 189 (67.5%) reported experiencing pain, while 91 (32.5%) did not. Among those reporting pain, the majority (127 students) carried backpacks within the 7–11% body weight range, followed by 38 students in the 3–7% range and 24 students in the 11–15% range. In contrast, students who did not report pain were more frequently found in the lighter load category (47 in the 3–7% range), while only 1 student carrying 11–15% of their body weight reported no pain. The Pearson chi-square test value of 33.412 with a p-value of 0.000 indicates a statistically significant association between backpack weight and the occurrence of pain. These findings suggest that heavier backpacks are strongly associated with a higher prevalence of musculoskeletal pain among students.

This study examined the influence of school bag weight on musculoskeletal symptoms in secondary school students, indicating a notable prevalence of musculoskeletal problems linked to heavy and extended bag usage. The findings align with an expanding corpus of literature, emphasizing apprehensions regarding school bag ergonomics and their health implications for adolescents.

The demographic attributes of participants indicated an almost similar groups, predominantly aged 15, with a mean body weight of approximately 51.94 kg and an average bag weight of 4.31 kg. A significant number of students carried bags that over the 10–15% barrier of body weight suggested by health authorities, a level commonly referenced in scholarly literature (Sheikhoseini, Sayyadi and Piri, 2022). Exceeding this barrier is commonly acknowledged to elevate the risk of back pain and postural complications. Negrini and Carabalona (2002) proposed a healthy limit of 10% of body weight, highlighting that exceeding this weight negatively impacts posture and comfort.

Musculoskeletal issues were prevalent in this sample, with shoulder pain as the most commonly reported symptom (60.7%), followed by neck pain (35.7%) and upper and lower back pain (18.9% and 18.2%, respectively). The findings correspond with those of a cross-sectional study by Dianat et al. (2013), which identified comparable high prevalences of shoulder and neck pain among Iranian schoolchildren overburdened by large backpacks. The biomechanical load from heavy bags leads to compensatory postures that exert pressure on the spine and shoulder girdle, as demonstrated in this study.

The relationship between pain and backpack weight was statistically significant ($p < 0.001$), as demonstrated by Pearson's Chi-square analysis. Students with heavy bags had a markedly greater incidence of pain (78.2%) compared to those with medium (63.9%) or light (32.1%) bags. This pattern supports the findings of Alsiddiky et al. (2019), who identified a distinct dose-response correlation between increasing backpack weight and the occurrence of back pain. Research on Indian adolescents indicated that the weight of school bags considerably affected musculoskeletal discomfort, particularly when exceeding 15% of body mass (Ejesm, 2022c).

Notably, despite the fact that most students utilized a bilateral shoulder strategy for carrying their bags—an approach considered ergonomically optimal—more than half (52.9%) still experienced discomfort. This indicates that the approach alone is inadequate for symptom prevention if other factors, such as excessive bag weight or prolonged carrying, persist. Students who carried their bags over one shoulder (right or left) reported higher pain percentages (29.6% and 15.3%, respectively), corroborating the findings of Dianat et al. (2013), which identified asymmetrical bag usage as a significant contributor to musculoskeletal pain resulting from uneven spinal loading.

Alternative carrying methods, including front-loading with both shoulders or hand-carrying the bag, yielded minimal reported discomfort. For instance, 98.4% of students employing front-carry techniques did not experience pain. Sheikhhoseini, Sayyadi and Piri (2022) similarly emphasized this outcome, proposing alternate ergonomic methods—such as trolleys and back packs—as safer alternatives when burdens are unavoidable. Although these options are infrequently utilized, their advantages necessitate increased focus in student ergonomic instruction and modifications in school policy.

The duration of carrying also had a considerable impact. More than 40% of students indicated that they carry their bags for 25 minutes or longer while traveling to school. The extended length, along with excessive load, substantially leads to the emergence of musculoskeletal issues. These results correspond with the findings of Syazwan et al. (2011), who noted that the duration of load carriage exacerbates weariness and discomfort, especially during prolonged daily school trips. It emphasizes that, despite compliance to weight limits, prolonged carrying can still exert significant stress on the growing musculoskeletal system.

Postural modifications during bag utilization indicated that a considerable proportion of students experienced alterations in their posture. Approximately 48.2% did not exhibit abnormal postures; nevertheless, 28.6% reported stooping, 14.6% leaned laterally, and 8.6% leaned anteriorly. The data suggest a prevalent problem of postural deviation, possibly affected by inappropriate bag weight, design, and user practices. Negrini et al. (2002) concurred, documenting analogous aberrations in Italian adolescents and arguing that prolonged exposure to incorrect backpack usage can result in scoliosis-like postural adjustments.

The significant proportion of students who acknowledged the need of sustaining appropriate posture (68.2%) indicates an understanding of proper ergonomics. Among individuals who failed to maintain posture, 82% reported having pain. This strongly indicates that knowledge may not convert into conduct or that the physical weight of baggage surpasses the advantages of maintaining appropriate posture. This discovery corroborates the research conducted by Dianat et al. (2013), which emphasized the disparity between awareness and implementation of ergonomic standards among students.

The total incidence of musculoskeletal problems, particularly shoulder and neck pain, is of significant concern due to potential long-term developmental implications. A cross-sectional survey conducted by Alsiddiky et al. (2019) highlighted that early back and neck discomfort in adolescents may continue throughout adulthood, underscoring the necessity for early therapies. The occurrence of symptoms like tingling and wrist/hand pain, however infrequent, suggests potential nerve compression or repetitive strain injuries, necessitating additional assessment.

The correlations shown among carrying method, duration, and posture provide a multifaceted comprehension of the causation of musculoskeletal pain. Students exhibiting poor posture or asymmetrically carrying large bags were more prone to report pain, indicating that remedies should be holistic. Standalone proposals, such as advocating for two-strap carrying, may prove inadequate unless accompanied by weight limitations, awareness initiatives, and possible alterations to school schedules or infrastructure to reduce the load.

A significant aspect of this study is its comprehensive approach, assessing not only weight and carrying methods but also related behaviors and student views. This study contextualizes student experience within their environment and everyday habits, in contrast to many prior studies that depend exclusively on weight ratios. It provides new insights into students' comprehension and approach to ergonomics and the alignment or misalignment of those perceptions with observable outcomes.

5.1 Limitations

This study faced several methodological limitations that may affect the generalizability and validity of its findings. Firstly, the use of a non-probability convenience sampling method restricted the representation of the broader student population, potentially introducing selection bias. Additionally, the musculoskeletal symptoms were assessed solely through self-reported questionnaires, which are subject to recall bias and may lead to inaccurate or underestimated reporting. The absence of clinical evaluation or diagnostic confirmation further limits the reliability of symptom identification, as no physical examinations or medical assessments were conducted to validate the reported discomfort. Geographically, the research was confined to two schools in the Savar region, which may not capture the diversity of environmental and institutional factors influencing students in other parts of Bangladesh. Moreover, important potential confounding factors—such as nutritional status, psychosocial stress, physical activity levels, and previous musculoskeletal injuries—were not accounted for in the analysis, which could have influenced the observed associations between school bag weight and reported symptoms.

This study comprehensively evaluated the influence of school bag weight on musculoskeletal symptoms in secondary-level students, offering definitive proof of the physical strain that excessively heavy school bags can impose on adolescents. The results indicated that a considerable proportion of students transport backpacks that surpass the advised limit of 10% of their body weight, and this excess weight was significantly correlated with the incidence of shoulder, neck, and back pain. Despite many students recognising the significance of proper posture, the prevalent occurrence of postural abnormalities and related discomfort indicates an imbalance between awareness and implementation.

Statistical investigation indicated that hefty backpacks, prolonged carrying periods, and asymmetrical carrying techniques (such as utilising one shoulder) markedly elevate the risk of musculoskeletal discomfort. Unexpectedly, students employing the proper two-shoulder technique somehow experienced discomfort, suggesting that optimal load distribution is inadequate without proper weight management and awareness of posture and duration of carrying. The research demonstrated the efficacy of alternative approaches, including front-carrying and handheld bags, which correlated with diminished reports of discomfort.

These results not only confirm findings from global literature but also provide new insights, especially with students' views of posture, their walking behaviour with bags, and the statistical significance of connections between carrying ways and pain. This work effectively connects ergonomic theory with practical application, offering a comprehensive foundation for policy reform and additional research.

6.1 Recommendations

6.1.1 Further Research

- **Longitudinal Research:** Future research should utilise longitudinal designs to investigate the impact of sustained exposure to heavy school bags on musculoskeletal development and posture over time. This would enable causal inferences that cross-sectional studies cannot provide.
- **Gender-Specific Analysis:** Due to the absence of gender stratification in this study, subsequent research should investigate gender disparities in bag-related musculoskeletal complaints to determine whether girls or boys are preferentially impacted.
- **Ergonomic Design Studies:** Research should examine the impact of several backpack attributes—such as strap width, support, weight distribution mechanisms, and many compartments—on comfort and the risk of injury.
- **Psychosocial Factors:** As psychological stress may influence the experience of pain together with physical stresses, subsequent research should evaluate students' mental health and academic stress as potential influences of musculoskeletal pain.
- **Experimental Interventions:** Randomised controlled trials must be executed to evaluate the efficacy of posture training programs, school bag redesigns, and comprehensive weight reduction initiatives in schools.

6.1.2 Practical Implications

- **Policy Enforcement on Bag Weight:** Educational institutions need to implement and maintain strict rules capping school bag weight at 7–10% of a student's body mass. Systematic inspections must be conducted to ensure adherence.
- **Locker Implementation:** Offering lockers or storage facilities can substantially reduce the everyday burden on students, particularly in institutions with extended academic schedules or several textbooks.
- **Posture and Ergonomics Education:** Educational institutions should integrate modules on correct posture, effective bag packing methods, and safe lifting and carrying procedures into their health or physical education curriculum.

- **Parental and Teacher Involvement:** Training sessions and awareness campaigns should focus on parents and educators to enable them to identify early indicators of musculoskeletal distress and educate children in optimal behaviours.
- **Standardization of Backpack Design:** Educational institutions and policymakers need to promote the utilization of ergonomically designed backpacks including padded straps, equitable weight distribution, and adjustable fittings that accommodate individual body dimensions.

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Appendix- A

CONSENT FORM

Assalamu-alaikum,

My name is **Rakibul Islam**, student of B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI), CRP. I am conducting a study for partial fulfilment of my Bachelor of Science in Physiotherapy, titled, **The Impact of School Bag's Weight on Musculoskeletal Symptoms in Secondary Level Students**.

Through this research, I'll look into whether carrying a school bag contributes to musculoskeletal problems among secondary school pupils. For this purpose, I would need to collect data from the students of the secondary level. Considering the area of research, you have met the inclusion criteria, and I would like to invite this study. If you participate in this study, I will ask you some questions related to your school bag and musculoskeletal health. Your participation will be voluntary. You may have the right to withdraw consent and discontinue participation at any time. If you have any queries about the study, you may contact, researcher **Rakibul Islam** or my supervisor, **Dr. Shazal Kumar Das, PhD**, Assistant Professor, BHPI, CRP, Savar, Dhaka-1343.

Do you have any questions before I start?

So may I have your consent to proceed with the interview?

Yes.....

I am..... have read and understood the contents of the form. I agree to participate in the research without any force.

Signature of the participant..... Date.....

Signature of the Interviewer..... Date.....

Appendix- B

সম্মতিপত্র

আসসালামু আলাইকুম,

আমার নাম **রাকিবুল ইসলাম**, বাংলাদেশ হেলথ প্রফেশনস ইনস্টিটিউট (বিএইচপিআই), সিআরপি-তে বিএসসি ইন ফিজিওথেরাপি বিভাগের একজন ছাত্র। আমি ফিজিওথেরাপিতে আমার ব্যাচেলর অফ সায়েন্সের আংশিক পরিপূর্ণতার জন্য একটি অধ্যয়ন পরিচালনা করছি, শিরোনাম,

“মাধ্যমিক স্তরের শিক্ষার্থীদের মাস্কুলোস্কেলিটাল লক্ষণগুলির উপর স্কুল ব্যাগের ওজনের প্রভাব”।

এই গবেষণার মাধ্যমে, আমি দেখব যে, স্কুল ব্যাগ বহন করা মাধ্যমিক বিদ্যালয়ের শিক্ষার্থীদের মধ্যে পেশীবহুল সমস্যায় অবদান রাখে কিনা। এই উদ্দেশ্যে, আমাকে মাধ্যমিক স্তরের শিক্ষার্থীদের কাছ থেকে তথ্য সংগ্রহ করতে হবে। গবেষণার ক্ষেত্র বিবেচনা করে, আপনি অন্তর্ভুক্তির মানদণ্ড পূরণ করেছেন এবং আমি এই অধ্যয়নের জন্য আপনাকে আমন্ত্রণ জানাতে চাই। আপনি যদি এই গবেষণায় অংশগ্রহণ করেন, আমি আপনাকে আপনার স্কুল ব্যাগ এবং পেশীর স্বাস্থ্য সম্পর্কিত কিছু প্রশ্ন জিজ্ঞাসা করব। আপনার অংশগ্রহণ স্বেচ্ছায় হবে। আপনার সম্মতি প্রত্যাহার করার এবং যেকোনো সময় অংশগ্রহণ বন্ধ করার অধিকার থাকতে পারে। অধ্যয়ন সম্পর্কে আপনার কোন প্রশ্ন থাকলে, আপনি যোগাযোগ করতে পারেন, গবেষক **রাকিবুল ইসলাম** বা আমার সুপারভাইজার, **ড. সজল কুমার দাস**, **পিএইচডি**, সহকারী অধ্যাপক, বিএইচপিআই, সিআরপি, সাভার, ঢাকা-১৩৪৩।

আমি শুরু করার আগে আপনার কোন প্রশ্ন আছে?

তাই ইন্টারভিউ নিয়ে এগিয়ে যাওয়ার জন্য আমি কি আপনার সম্মতি পেতে পারি?

হ্যাঁ.....

আমি ফর্মের বিষয়বস্তু পড়েছি এবং বুঝেছি। আমি স্বেচ্ছায় গবেষণায় অংশগ্রহণ করতে রাজি।

অংশগ্রহণকারীর স্বাক্ষর..... তারিখ.....

সাক্ষাৎকারগ্রহীতার স্বাক্ষর..... তারিখ.....

Appendix- C

Questionnaire

Part: -1 Personal Information

Write down your response:

1.1	Participant's code	
1.2	School's name	
1.4	Contact number	
1.5	Living area	1= Rural 2= Semi-urban 3= Urban
1.6	Address	

Part: -2 Socio-demographic Information

Write down your response according to the instructions:

2.1	Age (write down your response)	In Years
2.2	Gender (please✓ your correct response)	1= Male 2= Female
2.3	Weight (write down your response)	In Kg

Part: -3 School Bag's Characteristics

Please ✓ your correct response:

3.1 What type of bag is often used to carry books and classroom supplies to and from school?

1= Backpack

2= Duffle Bag

3= Tote bags

4= Satchels

5= Others

3.2 What are the characteristics of your backpack, and how long have you used them?

	1	2	3	4
Backpack Characteristics:	Don't have it	Never	Sometimes	Always
1. Waist belt				
2. Chest strap				
3. Wheels				
4. Padded shoulder straps				

Part: -4 School Bag's Weight

4.1	School bag weight (write down your response)	
4.2	The weight of the bag on a normal school day-	1= Heavy 2= Medium 3= Light

Part: -5 School Bag Carry Time

Please ✓ your correct response:

5.1	How long have you typically carried a backpack or bag while traveling to school each day? (Include time sitting in the vehicle).	1= Less than 5 minutes 2= 6–10 minutes 3=11–15 minutes 4=15–24 minutes 5= 25 minutes or more
5.2	Do you have to climb up and down stairs?	1= Yes 2= No

Part: - 6 Method of School Bag Carriage:

6.1	What is the method for carrying a school bag?	1= Over both shoulders 2= In front using both hands 3= Over the right shoulder 4= Over the left shoulder 5= In the right hand 6= In the left hand 7= Rolled
6.2	If your response for the previous question is within 1-7 then specify your reason for doing that.	

Part: - 7 Posture:

Please✓ your correct response:

7.1	Do you think you maintain good posture while walking with your backpack/bag?	1= Yes 2= No
7.2	If question 7.1 is yes then answer this question about how long you maintain that good posture.	1= All of the time 2= Most of the time 3= Some of the time 4= Very little 5= Always bent over when wearing a backpack/bag

7.3	When walking with your backpack/bag, do you feel any of the given position?	1= Stooping 2= Leaning forward 3= Leaning sideways 4= None of the above
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Part: -8 Pain and related symptoms

Please✓ your correct response:

8.1	Do you currently experience any pain that you believe is caused by carrying your backpack or bag?	1= Yes 2=No
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8.2	As a result of your backpack/bag, have you noticed any of the given problems -	1= Muscle soreness 2= Shoulder pain 3= Neck pain 4= Arm pain 5= Elbow pain 6= Wrist/Hand pain 7 = Upper back pain 8= Lower back pain 9= Hip/Thigh pain 10= Knee pain 11= Ankle/Feet pain 12= Tingling in arms/legs 13= Others
8.3	Do you take any kind of medication for the problems you have chosen in the previous question?	1= Yes 2= No
8.4	If the answer to the previous question is yes then write down the name of the medication that you use to relieve that problem.	

8.5	If you respond to all the above 4 questions then have you consult with a Doctor or Physiotherapist.	1= Doctor 2= Physiotherapist 3= None
8.6	If the answer to your previous question is yes, what did he/she prescribe	

Appendix- D

প্রশ্নপত্র

অংশ:-১ ব্যক্তিগত তথ্য

আপনার প্রতিক্রিয়া লিখুন:

১.১	অংশগ্রহণকারীর কোড	
১.২	স্কুলের নাম	
১.৩	মোবাইল নম্বর	
১.৪	বাসস্থানের এলাকা	১= গ্রাম ২= উপজেলা শহর ৩= শহর
১.৫	ঠিকানা	

অংশ:-২ সামাজিক-জনসংখ্যা সংক্রান্ত তথ্য

নির্দেশাবলী অনুযায়ী আপনার প্রতিক্রিয়া লিখুন:

২.১	বয়স (আপনার প্রতিক্রিয়া লিখুন)	বছর
২.২	লিঙ্গ	১= ছেলে ২= মেয়ে

২.৩	ওজন (আপনার প্রতিক্রিয়া লিখুন)	কেজি
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পর্ব:-৩ স্কুল ব্যাগের বৈশিষ্ট্য

অনুগ্রহ করে সঠিক উত্তরের পাশে $\sqrt{\quad}$ দিন:

৩.১ স্কুলে বই এবং শ্রেণীকক্ষের প্রয়োজনীয় জিনিসপত্র বহন করার জন্য প্রায়শই কোন ধরনের ব্যাগ ব্যবহার করা হয়?

১=ব্যাকপ্যাক

২=ডাফেলব্যাগ

৩=টোটব্যাগ

৪=সাচেল

৫= অন্যান্য

৩.২ আপনি যে ব্যাকপ্যাক ব্যবহার করেন তার বৈশিষ্ট্যসমূহ কী কী?

	১	২	৩	৪
ব্যাকপ্যাকের বৈশিষ্ট্য:	নেই	কখনো না	মাঝেমধ্যে	সবসময়
কোমর বেল্ট				
চেস্ট স্ট্রাপ				
চাকা				
প্যাডেড শোল্ডার স্ট্রাপ				

পর্ব:-৪ স্কুল ব্যাগের ওজন

৪.২	স্কুল ব্যাগের ওজন (আপনার প্রতিক্রিয়া লিখুন)	
৪.২	স্কুলের সাধারণ দিনে ব্যাগের ওজন কেমন মনে হয়?	১= ভারী ২= মাঝারি ৩= অল্প

পর্ব:-৫ স্কুল ব্যাগ বহনের সময়

অনুগ্রহ করে সঠিক উত্তরের পাশে $\sqrt{\text{দিন}}$:

৫.১	স্কুলে যাওয়ার পথে আপনি কতক্ষণ ব্যাকপ্যাক বা ব্যাগ বহন করেন? (যানবাহনে চলাচলসহ)	১= ৫ মিনিটের কম ২ = ৬-১০ মিনিট ৩= ১১-১৫ মিনিট ৪= ১৫-২৪ মিনিট ৫ = ২৫ মিনিট বা তার বেশি
৫.৩	আপনাকে কি সিঁড়ি বেয়ে উপরে উঠতে হয়?	১= হ্যাঁ ২ = না

পর্ব:-৬ স্কুল ব্যাগ বহনের পদ্ধতি:

৬.১	আপনি স্কুল ব্যাগ কিভাবে বহন করে থাকেন?	১= উভয় কাঁধের উপরে ২= উভয় কাঁধ ব্যবহার করে সামনের দিকে ৩= ডান কাঁধের উপরে ৪= বাম কাঁধের উপরে ৫= ডান হাতে ৬= বাম হাতে ৭= ঘূর্ণিত
৬.২	যদি উপরের প্রশ্নের উত্তর ১-৭ এর মধ্যে হয়, তাহলে এর কারণ উল্লেখ করুন।	

অংশ:- ৭ চালচলন ভঙ্গি:

অনুগ্রহ করে সঠিক উত্তরের পাশে √ দিন:

৭.১	আপনি কি মনে করেন যে, ব্যাকপ্যাক বা ব্যাগ বহন করার সময় আপনি সঠিক অঙ্গবিন্যাস বজায় রাখেন?	১= হ্যাঁ ২= না
৭.২	যদি প্রশ্ন ৭.১ এর উত্তর হ্যাঁ হয়, তাহলে উল্লেখ করুন আপনি কতক্ষণ সেই সঠিক অঙ্গবিন্যাস বজায় রাখেন:	১ = সব সময় ২ = বেশিরভাগ সময় ৩ = কিছু সময় ৪ = খুব কম ৫ = সর্বদা ঝুঁকে থাকেন

৭.৩	ব্যাকপ্যাক বা ব্যাগ বহনের সময় আপনি নিচের অবস্থানগুলোর কোনটি অনুভব করেন?	১ = সামনে ঝুঁকে থাকা ২ = সামনের দিকে হেলে থাকা ৩ = পাশের দিকে হেলে থাকা ৪ = এর কোনোটিই নয়
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অংশ:-৮ ব্যাথা এবং সংশ্লিষ্ট উপসর্গ

৮.১	আপনি কি বর্তমানে কোনো ব্যাথা অনুভব করছেন যা আপনি মনে করেন ব্যাকপ্যাক বা ব্যাগ বহনের কারণে হয়েছে?	১= হ্যাঁ ২=না
৮.২	ব্যাকপ্যাক বা ব্যাগ বহনের ফলে আপনি কি নিচের সমস্যাগুলোর কোনোটি লক্ষ্য করেছেন:	১= মাংশপেশী ব্যাথা ২ = কাঁধে ব্যাথা ৩= ঘাড় ব্যাথা ৪= বাহুতে ব্যাথা ৫= কনুই ব্যাথা ৬= কঙ্গি/হাতে ব্যাথা ৭= পিঠের উপরের দিকে ব্যাথা

		<p>৮= পিঠের নিচের দিকে ব্যাথা</p> <p>৯= হিপ/উরুতে ব্যাথা</p> <p>১০= হাঁটু ব্যাথা</p> <p>১১= গোড়ালি/পায়ে ব্যাথা</p> <p>১২= বাহু/পায়ে শিহরণ</p> <p>১৩= অন্যান্য</p>
৮.৩	আপনি কি আগের প্রশ্নে উল্লেখিত সমস্যাগুলোর জন্য কোনো ওষুধ গ্রহণ করেন?	<p>১= হ্যাঁ</p> <p>২=না</p>
৮.৪	যদি আগের প্রশ্নের উত্তর হ্যাঁ হয়, তাহলে উল্লেখ করুন আপনি কি ওষুধ ব্যবহার করেন এবং তার নাম লিখুন -	
৮.৫	আপনি যদি উপরের ৪টি প্রশ্নের উত্তর দিয়ে থাকেন, তবে আপনি কি কোনো ডাক্তার বা ফিজিওথেরাপিস্টের সঙ্গে পরামর্শ করেছেন?	<p>১ = ডাক্তার</p> <p>২ = ফিজিওথেরাপিস্ট</p> <p>৩ = কেউ নয়</p>
৮.৬	যদি আগের প্রশ্নের উত্তর হ্যাঁ হয়, তাহলে উল্লেখ করুন তিনি কী প্রেসক্রাইব করেছেন -	

Appendix- E

IRB Approval letter



বাংলাদেশ হেলথ প্রফেশনস ইনস্টিটিউট (বিএইচপিআই)
Bangladesh Health Professions Institute (BHPI)
(The Academic Institute of CRP)

Ref: CRP-BHPI/IRB/12/2024/1026

Date: 15/12/2024

To
Rakibul Islam
4th Year B.Sc. in Physiotherapy
Session: 2019-2020, Student ID: 112190512
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Subject: Approval of the thesis proposal “The Impact of School Bag’s Weight on Musculoskeletal Symptoms in Secondary Level Students” by ethics committee.

Dear Rakibul,
Congratulations.

The Institutional Review Board (IRB) of BHPI has reviewed and discussed your application to conduct the above-mentioned thesis, with yourself, as the principal investigator and Dr. Shazal Kumar Das, PhD, Assistant Professor, Department of Physiotherapy, BHPI as thesis supervisor. The following documents have been reviewed and approved:

Sl. No.	Name of the Documents
1	Thesis Proposal
2	Questionnaire (English & Bengali version)
3	Information sheet & consent form.

The purpose of the study is to explore the use of school bags and approximate weight for children and the occurrence of musculoskeletal symptoms among secondary-level students. The study involves the use of a semi-structured questionnaire that may take 10 to 15 minutes to answer in the questionnaire. Any instruction or precaution for the collection of specimens and there is no likelihood of any harm to the participants and participation in the study may benefit the participants. The members of the Ethics Committee have approved the study to be conducted in the presented form at the meeting held at 9 AM on 15th July 2024 at BHPI (44th IRB Meeting).

The institutional Ethics committee expects to be informed about the progress of the study, any changes occurring in the course of the study, any revision in the protocol and student information or informed consent and ask to be provided with a copy of the final report. This Ethics committee is working in accordance with the Nuremberg Code 1947, the World Medical Association Declaration of Helsinki, 1964 - 2013 and other applicable regulations.

Best regards,

Muhammad Millat Hossain
Associate Professor & Course Co-ordinator, MRS
Member Secretary, Institutional Review Board (IRB)
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Appendix- F

IRB Application form

Date: 29th September 2024

The Chairman
Institutional Review Board (IRB)
Bangladesh Health Professions Institute (BHPI)
CRP-Savar, Dhaka-1343, Bangladesh

Subject: **Application for review and ethical approval.**

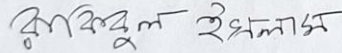
Sir,

With due respect, I would like to state that I am a student of 4th professional, B. Sc in Physiotherapy at Bangladesh Health Professions Institute. I want to conduct a dissertation titled, **"The Impact of School Bag's Weight on Musculoskeletal Symptoms in Secondary Level Students"** with myself, as the principal investigator and Dr. Shazal Kumar Das, PhD, Assistant Professor & Head, Department of Physiotherapy, BHPI, CRP, Savar, Dhaka-1343, as my supervisor. The purpose of this study is to explore the use of school bags and approximate weight for children and the occurrence of musculoskeletal symptoms among secondary-level students.

Semi structural questionnaire will be used in the study that will take about 10 to 15 minutes and measurements of body weight and school bag's weight. Data collectors will receive informed consent from all participants. Any data collected will be kept confidential.

Therefore, I look forward to having your approval for the thesis proposal and to start data collection. I also assure you that I will meet all the requirements for my study.

Sincerely yours,



.....
Rakibul Islam
4th Year B.Sc. in Physiotherapy
Session: 19-20 Student ID: 112190512

Recommendation from the thesis supervisor:



.....
Dr. Shazal Kumar Das, PhD
Assistant Professor & Head, Department of Physiotherapy
BHPI, CRP, Savar, Dhaka-1343, Bangladesh

Appendix- G

Permission letter

BPATC School & College

Date: 21st December 2025

The Principal
BPATC School & College
Savar, Dhaka

A. H. M.
20/21/02/25

Subject: Prayer for seeking permission to collect data for conducting a research project.

Sir,

With due respect and humble submission to state that I am Rakibul Islam, a student in the 4th year of my B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI). The Ethical committee has approved my research project entitled: "**The Impact of School Bag's Weight on Musculoskeletal Symptoms in Secondary Level Students**" under the supervision of **Dr. Shazal Kumar Das, PhD**, Assistant Professor, and Co-supervisor **Dr. Emran Hossain**, Lecturer, Department of Physiotherapy, BHPI. I am writing to you to seek permission to collect data from your school. The data collection will involve students from classes eight to ten. I assure you that the study will adhere to strict ethical guidelines, ensuring confidentiality and privacy for all participants. The data collection process is expected to take place during free time and will be scheduled to minimise disruption to the school's regular activities.

I would be grateful if you could permit me to conduct this study at your esteemed institution. Please let me know if there are any forms to fill out if additional documentation is needed, or if there are any specific guidelines that I should follow.

Thank you very much for considering my request. I look forward to your positive response.

Yours sincerely,

Rakibul Islam

4th Year B.Sc. in Physiotherapy

Student ID: 112190512

Bangladesh Health Professions Institute (BHPI), An academic Institution of CRP

Chapain, Savar, Dhaka-1343.

If you have any queries please contact the following numbers,

Dr. Shazal Kumar Das, PhD- 01717877546

Dr. Emran Hossain- 01515202923

Rakibul Islam- 01833576467

Forwarded and Recommended
for your kind approval.

Sedh
22.1.2025

Dr. Shazal Kumar Das, PhD
Assistant Professor and Head
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka-1343.

Approved
20/21/02/25
স্বাক্ষরিত
২০/২১/০২/২৫
স্বাক্ষরিত
২০/২১/০২/২৫
স্বাক্ষরিত
২০/২১/০২/২৫
স্বাক্ষরিত
২০/২১/০২/২৫

Permission letter

ACED School

Date: 21st December 2025

The Principal

ACED School

Bank Colony, Savar, Dhaka

Subject: Prayer for seeking permission to collect data for conducting a research project.

Sir,

With due respect and humble submission to state that I am Rakibul Islam, a student in the 4th year of my B.Sc. in Physiotherapy at Bangladesh Health Professions Institute (BHPI). The Ethical committee has approved my research project entitled: "**The Impact of School Bag's Weight on Musculoskeletal Symptoms in Secondary Level Students**" under the supervision of **Dr. Shazal Kumar Das, PhD**, Assistant Professor, and Co-supervisor **Dr. Emran Hossain**, Lecturer, Department of Physiotherapy, BHPI. I am writing to you to seek permission to collect data from your school. The data collection will involve students from classes eight to ten. I assure you that the study will adhere to strict ethical guidelines, ensuring confidentiality and privacy for all participants. The data collection process is expected to take place during free time and will be scheduled to minimise disruption to the school's regular activities.

I would be grateful if you could permit me to conduct this study at your esteemed institution. Please let me know if there are any forms to fill out if additional documentation is needed, or if there are any specific guidelines that I should follow.

Thank you very much for considering my request. I look forward to your positive response.

Yours sincerely,

Rakibul Islam

4th Year B.Sc. in Physiotherapy

Student ID: 112190512

Bangladesh Health Professions Institute (BHPI), An academic Institution of CRP
Chapain, Savar, Dhaka-1343.

If you have any queries please contact the following numbers,

Dr. Shazal Kumar Das, PhD- 01717877546

Dr. Emran Hossain- 01515202923

Rakibul Islam- 01833576467

Approved
22/12/25
Md. Azadul Haque
Principal
ACED School, Savar, Dhaka.

Forwarded and Recommended
for your kind approval.

Stedh
22-01-2025
Dr. Shazal Kumar Das, PhD
Assistant Professor and Head
Department of Physiotherapy
BHPI, CRP, Savar, Dhaka-1343