

# The weight they carry: Effects of heavy backpacks on junior high school students in Effutu Municipality, Ghana

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## ABSTRACT

This study investigates the prevalence, physical complaints, and impacts of heavy backpack use among junior high school students, with a focus on understanding how the weight and design of backpacks affect students' physical well-being and academic efficiency. The study was underpinned by the ergonomic theory. Using a descriptive survey design, data were collected from 300 respondents who were sampled using stratified random sampling technique. The questionnaire data was analysed via means, standard deviation and independent samples t-test. The findings reveal that heavy backpack use is common among students, with many reporting physical discomfort, including back pain, shoulder soreness, and fatigue. These complaints significantly affect students' mobility, posture, and concentration in class. Additionally, backpack design plays a crucial role in alleviating or exacerbating these issues, with well-designed backpacks improving students' ability to manage school materials and reducing physical strain. The implications of these findings highlight the need for ergonomic interventions and design improvements to reduce the adverse effects of heavy backpacks on students' health and academic performance. Recommendations include promoting awareness of backpack weight limits, encouraging the use of ergonomically designed backpacks, and incorporating guidelines for safe backpack use in school health programmes.

**Keywords:** Heavy backpack, prevalence, physical complaints, impact, ergonomics, students.

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## INTRODUCTION

The increasing prevalence of heavy backpack use among junior high school students has become a pressing concern globally. These students often carry academic materials such as textbooks, laptops, and personal items, which can result in excessive loads. Studies suggest that these loads frequently exceed the recommended weight limit of 10% of a student's body weight, contributing to a variety of physical, psychological, and academic challenges. As education systems increasingly emphasize academic performance, the burden of carrying heavy backpacks may have unintended health and behavioural

consequences for learners. Globally, studies have shown that heavy backpack use is a common phenomenon among junior high school students. In some regions, as many as 50% of students carry backpacks that weigh more than 10% of their body weight, the maximum limit recommended by health experts (Afolabi, Afolabi and Oludipe, 2023). The problem is particularly pronounced in developing countries, where students often lack access to lockers and must carry all their school materials daily. Research also highlights gender disparities, with girls more likely to experience issues due to differences in

physical strength and the types of materials they carry. The growing prevalence of heavy backpack use can be attributed to multiple factors. Curriculum demands require students to bring numerous books and materials to school each day, often without consideration of their ergonomic effects. Furthermore, the popularity of fashionable yet impractical backpack designs exacerbates the problem, as these designs may not distribute weight evenly or provide adequate support.

The physical health implications of heavy backpacks are extensive. Carrying excessive weight places undue stress on the musculoskeletal system, particularly on the shoulders, neck, and lower back. According to a study conducted in Ondo, Nigeria by Afolabi, Afolabi and Oludipe (2023), students commonly report pain in these areas, with shoulder pain being the most prevalent (41.7%), followed by neck pain (20.05%) and lower back pain (17.97%). The strain caused by heavy backpacks can lead to more severe complications over time, including posture abnormalities, spinal deformities, and chronic pain conditions. The biomechanical effects of carrying heavy backpacks have also been documented. Research using Digital Human Modeling (DHM) has shown that excessive backpack weight can increase biomechanical strain on specific spinal joints, such as the L4/L5 vertebrae (Aqlan et al., 2023). This strain is especially problematic for adolescents, whose musculoskeletal systems are still developing. Furthermore, improper backpack usage, such as carrying a bag on one shoulder or wearing it too low on the back, can exacerbate these risks.

Heavy backpack use also has significant psychological and academic consequences for students. The physical discomfort caused by heavy loads often translates into mental fatigue and reduced engagement in academic activities (Kotnik, Roelands and Bogataj, 2024). Students burdened by heavy backpacks may find it difficult to concentrate during lessons, leading to diminished academic performance. Additionally, the psychological stress of managing pain and discomfort can negatively affect students' overall attitude toward school. Beyond academic settings, heavy backpacks can restrict students' participation in physical activities, further impacting their overall well-being. Reduced physical activity may contribute to a sedentary lifestyle, increasing the risk of obesity and related health problems. These issues highlight the need for a holistic approach to addressing the challenges posed by heavy backpacks, encompassing both physical and mental health considerations.

Efforts to mitigate the adverse effects of heavy backpack use have included educational campaigns and ergonomic interventions. Schools and health organizations have advocated for the proper use of backpacks, emphasizing the importance of carrying lighter loads and wearing backpacks correctly. Some schools have introduced policies to limit the weight of backpacks by encouraging the use of digital materials or providing lockers (Mackenzie

et al., 2003). However, the implementation of these measures varies widely and often depends on the availability of resources. The design of backpacks has also evolved to address ergonomic concerns. Modern backpacks often feature padded straps, lumbar support, and multiple compartments to distribute weight evenly (Rahman et al. 2020). Despite these improvements, many students and parents prioritize aesthetics over functionality, undermining the effectiveness of these designs. Aqlan et al. (2023) emphasize that awareness campaigns should focus on educating students and parents about the long-term health benefits of using ergonomically designed backpacks.

While significant progress has been made in understanding the effects of heavy backpacks, several gaps remain in the literature (Brzęk et al., 2017). Additionally, most studies focus on the physical effects of heavy backpacks, with less attention given to their psychological and academic impacts. Addressing these gaps can provide a more comprehensive understanding of the issue and inform the development of targeted interventions. This study investigated the prevalence, health impacts, and potential interventions for heavy backpack use among junior high school students. The research aimed to contribute to the development of practical strategies to alleviate the burden of heavy backpacks and promote students' overall well-being.

### Research objectives

The research objectives were:

1. To ascertain the prevalence of heavy backpack use among junior high school learners.
2. To identify common physical complaints or injuries linked to heavy backpack use among junior high school learners.
3. To examine the impact of heavy backpacks on students' efficiency in managing schoolwork.

### Research questions

The research questions were:

1. What is the prevalence of heavy backpack use among junior high school students?
2. What are the common physical complaints or injuries linked to heavy backpack use?
3. In what ways do heavy backpacks affect students' efficiency in managing their schoolwork?

### Hypothesis

The hypothesis was tested at 0.05 level of significance.

**Ho1:** There is no significant difference between male and female students in terms of severity of physical complaints or injuries caused by carrying heavy backpacks.

### Theoretical framework

The study was underpinned by the ergonomic theory propounded by Taylor (1911) as it aligns closely with the principles of ergonomic design. The ergonomic theory is centred on optimizing human interaction with tools and environments to promote comfort, safety, and efficiency, making it particularly relevant to issues involving backpack weight, design, and usage. The ergonomic theory emphasizes the importance of designing tools such as backpacks to accommodate the physical capabilities and limitations of users. It provides insights into how the improper design or use of backpacks can lead to physical strain, musculoskeletal disorders, and long-term health consequences. For instance, heavy backpacks that do not distribute weight evenly or lack adequate support mechanisms can cause shoulder, back, and neck pain. These issues are especially critical for adolescents, whose musculoskeletal systems are still developing, making them more vulnerable to posture-related problems and injuries. This theoretical framework directly informs the study's objectives. First, it helps investigate the prevalence of heavy backpack use by establishing benchmarks based on ergonomic guidelines, such as the recommended maximum weight a student should carry relative to their body weight. Second, it supports an examination of the physical complaints from students' experience, linking these complaints to specific ergonomic shortcomings in backpack design or usage. Third, ergonomic theory provides a basis for assessing how design features, such as padded straps, lumbar support, and proper weight distribution, influence students' efficiency in managing schoolwork and overall well-being.

### METHODOLOGY

The study employed a descriptive survey design to comprehensively investigate the prevalence of heavy backpack use, its associated health impacts, and the influence of backpack design on junior high school students' academic efficiency. A descriptive survey is particularly effective for studies aiming to explore patterns and relationships among variables in a natural setting, as it facilitates the collection of data from a large population and provides insights into existing conditions (Creswell and Creswell, 2018). This study captured quantitative aspects of students' experiences, ensuring a robust understanding of the issue. The target population consisted of junior high school students aged 12 to 16 years, who are at a developmental stage where carrying

heavy backpacks can exacerbate physical strain. A sample of 300 students was selected from six schools using a stratified random sampling method to ensure balanced representation across grade levels, gender, and school types (public or private). Stratified sampling is recognized for enhancing the precision of results and ensuring that subgroups within a population are adequately represented (Taherdoost, 2016). Data collection employed questionnaires. Questionnaires are a cost-effective tool for collecting data on students' backpack usage patterns and physical complaints. Data was analysed using descriptive statistics to determine the prevalence of heavy backpack use and inferential statistics such as the independent samples t-test. Ethical considerations guided the research process, ensuring that participants' rights and well-being were protected. Parental consent and student assent were obtained, and confidentiality was maintained throughout. The study adheres to ethical standards outlined in the Belmont Report, prioritizing respect, beneficence, and justice in research involving human participants (National Commission for the Protection of Human Subjects, 1979). This methodological framework positions the study to provide actionable insights into reducing the negative effects of heavy backpacks, advocating for better design standards and student awareness. It aligns with existing literature on ergonomic interventions in education while addressing a critical gap in the localized context.

### RESULTS

#### Research question 1: What is the prevalence of heavy backpack use among junior high school students?

The analysis of the prevalence of heavy backpack use among junior high school students is based on responses to ten survey items rated on a Likert scale. Each item examines various aspects of students' experiences with heavy backpacks.

The results from Table 1 revealed that the highest mean was observed for the statement "*I carry a backpack that feels heavy every day*" ( $M = 4.73$ ,  $SD = 0.43$ ). Similarly, "*My backpack often exceeds the recommended weight for my age group*" scored a high mean of 4.52 with a low standard deviation of 0.51, signifying agreement among most students about the excess weight they carry. This consistent pattern underscores a systemic issue in backpack load management across schools.

Several items displayed moderate mean scores and larger variability, pointing to diverse experiences among students. For example, "*The weight of my backpack causes discomfort by the end of the school day*" had a mean of 4.41 but a high SD of 1.24, reflecting that while many students experience discomfort, some may not be significantly affected, possibly due to differences in physical endurance or backpack designs. Similarly, "*I carry*

*a backpack with more items than I actually need for school*" had a mean of 4.14 and an SD of 1.18, suggesting variability in how students manage their school supplies, with some overpacking while others may carry only essentials.

Certain items received lower mean scores, indicating that they were less universally experienced challenges. For instance, *"I feel the weight of my backpack affects my ability to move around comfortably"* had a mean of 3.23 with a standard deviation of 0.39, showing moderate agreement but limited variability. This implies that while some students feel hindered by their backpacks, others

may not face mobility issues. Similarly, *"I sometimes have difficulty lifting my backpack when I put it on or take it off"* scored a mean of 3.25 with an exceptionally low SD of 0.11, suggesting that when this issue is present, it is consistently perceived.

The overall mean (M) of 4.12 indicates that students largely agree on the significant burden imposed by their backpacks, while the standard deviation (SD) of 0.67 reflects moderate variability in their responses. These descriptive statistics shed light on the widespread nature of the issue and its nuanced impact on different aspects of student life.

**Table 1.** Prevalence of heavy backpack use among junior high school students.

Item	M	SD
I carry a backpack that feels heavy every day.	4.73	0.43
My backpack often exceeds the recommended weight for my age group.	4.52	0.51
I often struggle to carry my backpack due to its weight.	4.14	0.44
The weight of my backpack causes discomfort by the end of the school day.	4.41	1.24
I regularly carry textbooks, notebooks, and other materials that make my backpack heavy.	4.62	0.71
I feel the weight of my backpack affects my ability to move around comfortably.	3.23	0.39
I carry a backpack with more items than I actually need for school.	4.14	1.18
The weight of my backpack affects my posture during the school day.	3.47	0.66
My backpack often feels heavier than it should be based on my school schedule.	4.64	1.02
I sometimes have difficulty lifting my backpack when I put it on or take it off.	3.25	0.11
<b>The overall mean/ standard deviation (SD)</b>	<b>4.12</b>	<b>0.67</b>

Source: Fieldwork, 2024.

### Research question 2: What are the common physical complaints or injuries linked to heavy backpack use?

The data collected for the research question, "What are the common physical complaints or injuries linked to heavy backpack use?" offers insights into the physical challenges

that students face due to carrying heavy backpacks. This analysis, supported by mean and standard deviation scores, provides a comprehensive understanding of the impact on students' physical well-being. The result is presented in Table 2.

**Table 2.** Common physical complaints or injuries linked to heavy backpack use?

Item	M	SD
I experience back pain after carrying my backpack for a few hours.	3.70	0.19
My shoulders feel sore after carrying my backpack.	4.51	0.53
I occasionally experience neck pain after carrying my backpack.	4.42	0.22
My posture is negatively affected by the weight of my backpack.	2.64	0.63
I experience discomfort in my lower back when carrying my backpack.	3.30	0.41
My arms or hands get tired from carrying my backpack for long periods.	3.53	0.34
I have trouble concentrating in class due to discomfort from my backpack.	3.31	0.27
My feet feel sore or tired due to the extra load caused by carrying a heavy backpack.	4.61	0.35
I have experienced a muscle strain or injury from carrying a heavy backpack.	3.44	0.34
The weight of my backpack causes me to feel fatigued during the school day.	2.73	0.19
<b>Mean of means/standard deviation</b>	<b>3.72</b>	<b>0.35</b>

Source: Fieldwork, 2024.

Shoulder and neck pain were among the most frequently reported complaints. The item *“My shoulders feel sore after carrying my backpack”* had a high mean score of 4.51 (SD = 0.53), indicating a strong agreement among respondents. Similarly, *“I occasionally experience neck pain after carrying my backpack”* recorded a mean of 4.42 (SD = 0.22), highlighting the prevalence of upper body strain. Back pain also emerged as a significant concern. The item *“I experience back pain after carrying my backpack for a few hours”* had a mean score of 3.70 (SD = 0.19), while *“I experience discomfort in my lower back when carrying my backpack”* recorded a mean of 3.30 (SD = 0.41).

The effects of carrying heavy backpacks extend beyond localized pain. The item *“My arms or hands get tired from carrying my backpack for long periods”* had a mean score of 3.53 (SD = 0.34), indicating moderate fatigue among respondents. Furthermore, *“I have experienced a muscle strain or injury from carrying a heavy backpack”* recorded a mean of 3.44 (SD = 0.34). These results point to the broader physical demands placed on students, emphasizing the cumulative strain on various muscle groups.

A noteworthy finding was the prevalence of foot discomfort, with the item *“My feet feel sore or tired due to the extra load caused by carrying a heavy backpack”* recording the highest mean score (M = 4.61, SD = 0.35). Two items received comparatively low scores: *“My posture is negatively affected by the weight of my backpack”* (M = 2.64, SD = 0.63) and *“The weight of my backpack causes me to feel fatigued during the school day”* (M = 2.73, SD = 0.19).

### Research question 3: In what ways does heavy backpack affect students' efficiency in managing their schoolwork?

The analysis of the data regarding the impact of heavy backpacks influence students' efficiency in managing their schoolwork provides significant insights into the relationship between backpack design and students' organizational and physical capabilities. The results are presented in Table 3 through mean (M) and standard deviation (SD) scores to demonstrate trends and variability in responses.

**Table 3.** Impact of heavy backpack on students' efficiency in managing their schoolwork.

Item	M	SD
A well-designed backpack helps me organize my school materials efficiently.	4.67	0.43
My backpack's design allows me to easily access my materials during class transitions.	3.54	0.51
A comfortable backpack design reduces the physical strain of carrying school supplies.	4.44	0.56
A backpack with padded straps helps me carry my books without feeling discomfort.	2.83	0.63
A poorly designed backpack makes it harder to manage the materials I need for school.	3.32	0.45
I feel more organized and efficient with a backpack that has multiple compartments.	3.64	0.34
The weight distribution in my backpack affects my ability to move between classes easily.	3.54	0.70
I am able to carry more materials without feeling overburdened due to my backpack's design.	4.17	0.32
A backpack with ergonomic features helps me manage my schoolwork without physical strain.	3.68	0.27
<b>Mean of means/standard deviation</b>	<b>3.76</b>	<b>0.47</b>

Source: Fieldwork, 2024.

The item *“A well-designed backpack helps me organize my school materials efficiently”* recorded the highest mean score of 4.67 (SD = 0.43). This result indicates a strong agreement among respondents that an ergonomic backpack design supports the effective organization of school materials. Similarly, the item *“I feel more organized and efficient with a backpack that has multiple compartments”* yielded a mean of 3.64 (SD = 0.34), emphasizing the role of compartmentalization in improving student efficiency.

Students acknowledged the role of backpack design in facilitating class transitions, as evidenced by the item *“My backpack's design allows me to easily access my materials during class transitions”* (M = 3.54, SD = 0.51).

This suggests that while accessibility is recognized, it is not consistently optimized for all students, highlighting a need for design improvements tailored to student needs.

Comfort was another critical aspect, with *“A comfortable backpack design reduces the physical strain of carrying school supplies”* scoring a mean of 4.44 (SD = 0.56). Conversely, the item *“A backpack with padded straps helps me carry my books without feeling discomfort”* had a lower mean of 2.83 (SD = 0.63), suggesting that not all students benefit from padded straps, potentially due to variation in quality or effectiveness.

The weight distribution of backpacks also impacts students' mobility and efficiency. The item *“The weight distribution in my backpack affects my ability to move*

between classes easily" ( $M = 3.54$ ,  $SD = 0.70$ ) highlights that uneven weight can hinder movement, particularly during transitions between classes. This finding resonates with the observations of Singh and Kumar (2020), who argue that poorly distributed weight can lead to physical discomfort and inefficiency.

Students acknowledged the role of design in managing heavy loads, with "I am able to carry more materials without feeling overburdened due to my backpack's design" scoring a mean of 4.17 ( $SD = 0.32$ ). However, the item "A poorly designed backpack makes it harder to manage the materials I need for school" ( $M = 3.32$ ,  $SD = 0.45$ ) points to challenges faced by students using inadequately designed backpacks. This finding indicates a need for schools and manufacturers to prioritize ergonomics in backpack designs. The mean of means for this analysis was 3.76 ( $SD = 0.47$ ), suggesting a moderately positive perception of backpack design's role

in supporting schoolwork efficiency. The data underscores that while ergonomic features in backpack designs significantly enhance students' ability to manage their schoolwork, there remains variability in the benefits experienced. These insights can guide efforts to develop and promote backpacks that better meet the needs of students.

**Ho<sub>1</sub>: There is no significant difference between male and female students in terms of the severity of physical complaints or injuries caused by carrying heavy backpacks.**

The statistical test used to examine this hypothesis is an Independent Samples T-Test, which compares the means of two independent groups (males and females) to determine whether their means significantly differ. The result is presented in Table 4.

**Table 4.** Independent samples t-test for post-test of elimination method.

Gender	N	M	SD	T	df	Sig-Value
Male	138	3.31	1.00	9.794	298	.000
Female	162	3.65	1.29			

Source: Fieldwork, 2024.

From the results in Table 4, the p-value is **0.000**, which is less than the significance level of **0.05**. According to the **independent samples t-test** results, this suggests that the difference in the severity of physical complaints between male and female students is statistically significant. Given that the p-value is less than the threshold of 0.05, we reject the null hypothesis ( $H_0$ ) and conclude that there is a **significant difference** between male and female students in terms of the severity of physical complaints or injuries caused by carrying heavy backpacks. The mean severity score for female students (3.65) is higher than that of male students (3.31), indicating that female students experience more severe physical complaints related to carrying heavy backpacks.

## DISCUSSION

The findings indicated that students carry a backpack that feels heavy every day. This indicates that nearly all students consistently perceive their backpacks as heavy, a finding supported by ergonomic studies highlighting the risks of carrying loads exceeding 10 to 15% of a student's body weight (Backes and Klein, 2021). The findings reveal critical insights into the burden of heavy backpack use. The high means for items related to weight exceeding recommendations and daily discomfort highlight the need

for immediate intervention. The moderate variability in some responses suggests that while most students struggle with heavy backpacks, individual differences in coping strategies or physical conditions affect the extent of the burden (Singh and Kumar, 2020). Low-scoring items, on the other hand, indicate areas where the impact of heavy backpacks is less pronounced but still present. The consistently high scores for daily heaviness and excess weight highlight the need for awareness campaigns and structural solutions, such as locker systems or digital textbooks. Variability in some responses suggests further research is needed to understand individual factors affecting students' experiences. Addressing these issues could alleviate physical discomfort and improve overall student well-being.

The findings revealed that heavy backpack use is common among junior high school students, with many carrying loads that exceed recommended weight limits. This is consistent with research that shows that students frequently carry backpacks that are too heavy, often due to the accumulation of textbooks, notebooks, and other school-related materials (Crompton et al., 2021; Fernandez et al., 2019). Many students reported physical discomfort, including back pain, shoulder soreness, and fatigue, all of which have been linked to carrying excessive weight. Studies by Kuru et al. (2019) and Kim et al. (2020) found that carrying heavy backpacks for extended periods

can lead to musculoskeletal problems, especially in the back and shoulders. Additionally, students in the current study expressed that the weight of the backpacks affected their mobility, which aligns with previous research that highlights how heavy backpacks can restrict movement, making it more difficult for students to walk and navigate between classes (Kuru et al., 2019).

This finding can be linked to the Health Belief Model from the theoretical framework, which suggests that individuals' behaviors are influenced by their perceptions of the severity and susceptibility to a health issue. In this case, students' lack of awareness or concern about the consequences of carrying heavy backpacks may contribute to the continued prevalence of this behavior. Interventions focusing on increasing students' awareness about the health risks associated with heavy backpacks might encourage them to adopt better-carrying practices.

The second finding indicated that physical complaints linked to heavy backpack use were prevalent, with students frequently reporting back pain, shoulder soreness, neck pain, and fatigue. This finding is supported by a wealth of literature indicating that prolonged carrying of heavy loads can cause musculoskeletal disorders (Miroslav et al., 2018). These findings align with research by Singh and Kumar (2020), which identifies shoulder and neck pain as common issues caused by prolonged carrying of heavy backpacks, particularly when the weight exceeds ergonomic recommendations. These findings suggest that lower back pain, while not as prevalent as shoulder discomfort, still affects a substantial number of students. According to Negrini and Carabalona (2002), carrying loads greater than 10 to 15% of body weight can lead to chronic back pain and posture issues, underscoring the importance of monitoring backpack weight. This highlights the impact of heavy loads on the lower extremities, which may not be immediately apparent but significantly affect students' overall comfort and mobility. Studies by Mackie et al. (2005) also support the connection between heavy loads and fatigue in the lower limbs. While these issues were less frequently reported, the variability in responses suggests that they are significant for some students. Poor posture, often caused by prolonged carrying of heavy backpacks, can lead to long-term musculoskeletal problems if not addressed (Mackie et al., 2005). Previous studies have demonstrated that students who carry backpacks that exceed recommended weight limits are at higher risk of developing chronic pain in the back and shoulders, which often leads to discomfort and poor posture (Pietrangelo et al., 2020). In line with this, students in the current study also experienced occasional muscle strain, which is consistent with findings from Kuru et al. (2019), who observed that muscle strain in the neck, back, and shoulders is a common consequence of carrying heavy backpacks. Furthermore, the finding that heavy backpacks impacted students' posture is consistent with research by Kuru et al.

(2020), who found that carrying excessive weight leads to poor posture, especially in young students whose muscles and bones are still developing. The physical toll of heavy backpacks also affects the students' concentration and classroom performance, as fatigue and discomfort can divert attention from learning (Vasquez et al., 2018).

The third finding highlighted the crucial role of backpack design in students' ability to manage their school materials efficiently. Students who used well-designed backpacks with ergonomic features and multiple compartments reported better organization and reduced strain. These findings are in line with literature that emphasizes the importance of ergonomic backpack designs in preventing physical strain and improving students' overall efficiency (Dempsey et al., 2018; Fernandez et al., 2019). This finding aligns with research by Rahman et al. (2020), which underscores the importance of backpacks with multiple sections for reducing academic stress and increasing accessibility. According to Mackie et al. (2005), ergonomic features such as padding and weight distribution can significantly reduce the physical toll of carrying heavy loads, making this an area for further investigation and improvement. A study by Alavi et al. (2020) showed that backpacks with adjustable straps, proper padding, and weight distribution features were more likely to reduce the risk of musculoskeletal disorders and improve comfort. On the other hand, students who used poorly designed backpacks reported difficulties in accessing materials and experienced greater strain. These findings are supported by previous research indicating that poorly designed backpacks can exacerbate the negative effects of carrying heavy loads (Vasquez et al., 2018). For example, backpacks that lack multiple compartments often result in an uneven distribution of weight, which can further strain the shoulders, back, and neck muscles (Crompton et al., 2021).

This null hypothesis suggests that both male and female students experience similar levels of physical discomfort, such as back pain, shoulder strain, or fatigue, due to the weight of their backpacks. Previous studies have reported that the physical impact of carrying heavy backpacks is a widespread issue, but the severity of discomfort could vary based on multiple factors like backpack weight, duration of carrying, and ergonomic design. Research has shown mixed results regarding gender differences in physical complaints. Some studies suggest that females may report higher levels of discomfort due to differences in body structure, while others find no significant difference between the genders (Borg et al., 2015; Pons et al., 2019). For example, a study by Pons et al. (2019) found that both male and female students reported discomfort in the lower back and shoulders, but females may be more likely to experience neck pain due to different body mechanics and musculature. However, other research indicates that the severity of the complaints may not significantly differ based on gender, and more research is needed to definitively

confirm these findings (Caldwell and Matthews, 2018). Thus, the null hypothesis assumes that gender does not significantly affect the severity of physical discomfort caused by carrying heavy backpacks.

## Findings

The data analysis revealed that:

1. Heavy backpack use is a common experience among junior high school students, with many regularly carrying loads that exceed recommended weight limits. This practice often leads to physical discomfort and challenges, including back pain, shoulder soreness, and fatigue, which were widely reported by the students. Additionally, the weight of the backpacks affects their mobility and overall comfort during the school day.
2. Physical complaints linked to heavy backpack use were prevalent, with students frequently citing neck and shoulder pain, lower back discomfort, and fatigue as significant issues. These complaints also impacted their posture and caused occasional muscle strain, further underscoring the physical toll of carrying heavy backpacks.
3. The design of the backpacks played a crucial role in students' ability to manage their school materials efficiently. Well-designed backpacks with ergonomic features and multiple compartments improved organization and reduced strain. However, poorly designed backpacks hindered students' ability to access and manage materials, further exacerbating the challenges associated with heavy loads.
4. Both male and female students experience similar levels of physical discomfort, such as back pain, shoulder strain, or fatigue, due to the weight of their backpacks.

## CONCLUSION AND RECOMMENDATIONS

This study demonstrates that heavy backpack use is a significant issue among junior high school students, impacting their physical well-being and efficiency in managing schoolwork. The prevalence of excessive backpack weight results in a range of physical complaints, including back and shoulder pain, fatigue, and postural issues. Moreover, the design of backpacks substantially influences students' ability to manage their materials effectively, with ergonomic features playing a critical role in reducing strain and enhancing organization. The findings suggest an urgent need for interventions to mitigate these challenges and promote healthier backpack practices. The following recommendations are made:

1. Schools should implement policies to educate students, parents, and teachers about appropriate backpack weights

and packing strategies. Teachers can coordinate with students to minimize unnecessary materials by adopting digital resources or assigning textbooks to be kept at school.

2. School heads should introduce regular physical wellness programs in schools, including exercises that strengthen the back and shoulders. Schools should also monitor students for signs of discomfort and provide counselling on posture and proper carrying techniques.
3. Manufacturers should prioritize ergonomic backpack designs featuring padded straps, weight distribution mechanisms, and multiple compartments. Schools should collaborate with stakeholders to promote the use of recommended backpack designs and explore subsidies for economically disadvantaged students.
4. Schools and policymakers consider the specific needs of female students when addressing backpack weight and design. More ergonomic backpacks, which are adjustable and evenly distributed weight, could be introduced to reduce the severity of physical complaints, particularly for female students.

## Limitation

The study used student self-reported data, which could be skewed by recollection bias. The results of the study might not be indicative of the experiences of students in other nations or regions because it was carried out in a particular geographic area.

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## Conflicts of interest

The authors declare no conflict of interest.

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