

The Relationship between Features of Desks and Chairs and Prevalence of Skeletal Disorders in Primary School Students in Abadan, South West of Iran

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Abstract

Background

Sitting on inappropriate benches, as well as the poor posture (body position) during the years of growth, can lead to spinal disorders, fatigue and discomfort in students. This study aimed to investigate the relationship between features of desks and chairs and prevalence of some musculoskeletal disorders in primary school students in Abadan.

Materials and Methods

This cross-sectional study was conducted in 2015 in the city of Abadan- South West of Iran; for which, 383 primary school students were selected and studied through cluster sampling method. Data were collected by the checkered board and researcher-made questionnaire. Features and dimensions of desks and chairs of students were recorded and evaluated based on their condition (being standard or not). Statistical analysis was conducted using SPSS, version 22; and then, descriptive statistics and Chi-square test were conducted.

Results

Study results showed that about 56.1% of the desks and chairs in under study schools were non-standard. It found that drooping shoulder (85.4%) and scoliosis (81.7%) were the more prevalent disorders and back straight (1.6%) was the least frequent disorder. There was a significant relationship between the variable of non-standard desks and chairs and prevalence of drooping shoulders ($P=0.001$), scoliosis ($P=0.04$), kyphosis ($P=0.007$) and lordosis ($P=0.002$) disorders in students.

Conclusion

The non-standard-sized desks and chairs increase the prevalence of skeletal disorders in schoolchildren. Therefore, it is essential to pay attention to design and build standard classroom desks and chairs, which are best, adjust to students' physics.

Key Words: Drooping shoulders, Kyphosis, Lordosis, Skeletal disorders, Student.

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1- INTRODUCTION

Today, the education of children who are the future of this country is of particular importance which requires effective trainings in a safe environment without stress in classrooms. One of devices which plays an important role – as a component of the learning environment – in the learning process of students, is the learning furniture; that is the students' desks and chairs which are used by the students during the training hours (1). The chairs proportional to the body size of schoolchildren (anthropometric), cause correct sitting habit at a later age; while raising the quality of education. This can help prevent musculoskeletal problems that may be occurred because of the poor posture (due to the use of chairs disproportionate with the body posture) (2). Several studies have reported the high prevalence of skeletal disorders in high school children (3, 4) caused by various factors such as the weight of backpacks, obesity, physical activity, family history, etc. (5, 6). However, in recent years, non-standard features and sizes of desks and chairs have been considered as one of the causes of musculoskeletal disorders. Prolong sitting in one place damages the spine (vertebral column or backbone), because of reduced nutrition of discs, restricted blood circulation and increased muscle fatigue of the spine. Students also suffer from many pressures on the muscles, ligaments; and specifically intervertebral discs (7).

Children make up almost 25% of the population of developing countries; 99 percent of them, study in the schools (8). Students spend quite a lot of time in the schools; where they sit on benches most of the time (9). Ergonomic chairs and proper body position (posture) while doing activities are very important factors that should be considered for the children. However, less attention has been paid to this issue in the classrooms where the

youngest people of our society spend most of their time (10). Numerous studies have pointed out the unsuitability of desks and chairs used by the schoolchildren in the schools. For example, in his study, Dianat et al. have reported the seat height, its width, and the height of desks in the schools as inappropriate for students (11). In addition, Varmarzyar, Habibi et al. and Haidari moghaddam et al. stated that most of the features of the desks and chairs in the schools do not fit the anthropometric characteristics of students (12-14). Sitting on inappropriate coaches and poor posture can lead to deformities of spine, back pain, neck pain, fatigue, and discomfort at these ages (15). Proper design of desks and benches reduces the incidence of above damages (16). Poor design of chair also affects the performance of individuals. Badly designed chairs cause backache and even damages to the waist, shoulder and neck pain, muscle pain and impaired circulation in the legs (17).

The use of unsuitable desks and chairs for a long time not only causes impaired physical growth of students, but also prevents them from learning due to lack of sufficient focus caused by created discomforts (18). The study conducted by Gouvali and Boudolos show that there is little consistency between anthropometric characteristics of students and the size of their desks and chairs; and limited provision of a single-sized desks for a group of students in one educational level cannot cover anthropometric changes even among similar students (20). In his study, Sepehri et al. showed that improper desks and chairs increase lordosis, scoliosis, and drooping shoulders in students (21).

Chubineh et al. addressed several factors such as inappropriate desk height, lack of adequate space for the legs under the desks, lack of adjustability of the slope of the seat and seatback, high depth of chairs and their inappropriateness are among the factors the cause musculoskeletal injuries

(22). Musa et al. also states that musculoskeletal disorders, especially in the neck, shoulder, wrist and waist has a direct relationship with non-standard desks and benches (23). Identifying the causes of musculoskeletal disorders can reduce both the prevalence and complications of these disorders; and ultimately improve the health of today's students and tomorrow's adults, because students pass a lot of time at school where most of the times sit on the benches (24). An important factor in the development of musculoskeletal disorders in adulthood, especially in the waist area, is the disproportion between the individual anthropometric characteristics of students and desks and chairs at school (19). Students learn their sitting habits in school (25) which could have a significant role in their today's and future's health. In this regard, Robertson et al. and Van Niekerk et al. showed that teaching how to make good use of chairs and the correct adjustment of the seat could reduce the risk of musculoskeletal disorders (26, 27).

Therefore, avoiding the undesirable impacts of non-standard desks and chairs on the musculoskeletal system of schoolchildren preserves the structural integrity of the body in adulthood. Since most studies have examined the proportion of anthropometric measurements of students with features of desks and chairs, and in other studies, only the relationship between desks and benches of schools with musculoskeletal pains have been addressed, the researchers of this study aimed to investigate the relationship between features of school desks and chairs and the prevalence of some musculoskeletal disorders (drooping shoulders, scoliosis, kyphosis, lordosis, back straight and head forward) in primary school students in Abadan.

2- MATERIALS AND METHODS

2-1. Study design and sample size

The present study is a cross-sectional research in which researchers examined the relationship between features of desks and benches and the prevalence of lordosis, kyphosis, scoliosis, flat back, drooping shoulders and forward head. It was conducted on 383 elementary school students in Abadan, South West of Iran, in 2015. The study population included all elementary school students in Abadan city. According to the study by Behrouzi et al. on the prevalence of scoliosis in 9-16 year-old students studying in Arak's schools (28), sample size was calculated as 300 using the following formula. The sample size was increased to 383 to increase the accuracy of the study [$d=0.03$; confidence interval (CI): 0.95%; $P=0.01$; $\alpha=5\%$].

$$n = \frac{Z_{1-\frac{\alpha}{2}} \cdot P(1-P)}{d^2}$$

Cluster sampling was used to select the samples. First, Abadan city was divided into 3 districts (floors) using the regional municipal areas. In each district, three elementary school for boys (3 clusters) and three elementary school for girls (3 clusters) were randomly selected (a total of 18 schools). At each school, 20 students were then randomly selected from different grades. Inclusion criteria included: the absence of neurological or rheumatic disease or muscle and joint disease, and no history of fracture or dislocation in the past year.

2-2. Measuring tools

In this study, following tools were used to collect the data:

- 1) Checkered board which is used to measure and detect drooping shoulders, kyphosis, scoliosis and lordosis.
- 2) Factors such as age, gender, type of school (public-private), depth, width, backrest angle, backrest width, rear seat height, height of desks and chairs were recorded. Devices such as tape measure,

ruler, skimmer with an accuracy of one degree, caliper (MITUTOYO Company) with movable jaw were also used to measure and record the angles and dimensions of desks and chairs.

The standard of seat depth is 43-38 cm, seat width is 45 cm, angle of the seat cushion is 90-105, seat width is 30 cm, and seat height is 50 cm. The height of an appropriate desk must be sized, so that the student's elbows are put on the desk from the shoulder to the elbow at an angle of 90°. The height of benches should be sized so that the knees angles are 90 degrees (29). Provided standard measurements were compared with measured items by the researcher in order to determine whether or not the desks and chairs are in standard sizes.

2.3. Method

Spine examination to assess disorders including dropped shoulders, scoliosis, kyphosis and lordosis was conducted by a masters in physiotherapy (research assistant), while the students wore shorts with bare upper body. Then, the relationship between non-standard sizes of desks and chairs and the prevalence of musculoskeletal disorders (drooping shoulders, scoliosis, kyphosis, lordosis, back straight and head forward), previously diagnosed by the researcher's assistant (with master degree in Physiotherapy) was determined.

2-4. Data Analysis

The Chi-square test was used to evaluate the relationship between non-standard backpack weight and prevalence of disorders such as dropped shoulders, scoliosis, kyphosis and lordosis. Data collection was conducted using interviews and questionnaires, observation and examination. Questionnaires were completed by the researcher in the presence of parents. SPSS- 22 was used for statistical analysis and data entry, and descriptive statistics and the Chi-square

test were used to assess the association between variables ($P < 0.05$).

2-5. Ethical considerations

This study was approved by the ethics committee of Ahvaz University of Medical Sciences (ID Number: 93172). The aim of this research and confidentiality of personal information were first explained to the authorities, parents and students. Before the study, verbal consents were obtained from students, and written consents were obtained from parents.

3. RESULTS

Of the total students, 318 (83.03%) were from public schools and 65 (16.97%) from private schools. Of them, 195 (50.91%) were female and 188 (49.09%) were male students. The mean ages of female and male students were 9.61 ± 1.9 and 9.87 ± 1.82 years, respectively.

In total, 56.1% of desks and chairs in the studied schools were not standard; so that 60.1% of the width, 58.5% of the backrest angle, 57.5% of the depth, 55.6% of the rear width, 50.2% of the height of desks, 47.4% of the rear cushion height, and 45.8% of the height of the benches in the studied schools were inappropriate. More information regarding the comparison of inappropriateness of desks and chairs' features in private and public schools is manifested in the **Figure.1**.

Table.1 indicates the prevalence of musculoskeletal disorders among schoolchildren based on the features of their desks and chairs (being standard or not). It also examines the relationship between the features of desks and chairs (being standard or not) with the prevalence of drooping shoulders, kyphosis, scoliosis and lordosis. Chi-square test was used to examine the relationship between the standard desks and chairs and skeletal disorders. It was found that there is a significant relationship between the variable of non-standard desks and chairs

and drooping shoulders, scoliosis, kyphosis and lordosis disorders. In other words, the prevalence of drooping shoulders ($P=0.001$), scoliosis ($P= 0.04$), kyphosis ($P=0.007$) and lordosis ($P=0.002$) disorders were significantly higher in those

students who use non-standard desks and chairs. However, there was no significant relationship between the non-standard size of desks and chairs and prevalence of forward head ($P = 0.79$) and back straight ($P= 0.72$).

Table-1: The prevalence of musculoskeletal disorders based on the condition of desks and chairs (being standard or not) and the examination of the relationship between the condition of desks and chairs (being standard or not) and the prevalence of musculoskeletal disorders

Desk and chair Type of disorder	Standard (%)	Non-standard (%)	P-value
Forward head	28.6	25.6	0.79
Drooping shoulder	78	91.2	0.001
Scoliosis	76.8	85.6	0.04
Kyphosis	7.8	18.1	0.007
Back straight	1.2	1.9	0.73
Lordosis	16	31.6	0.002

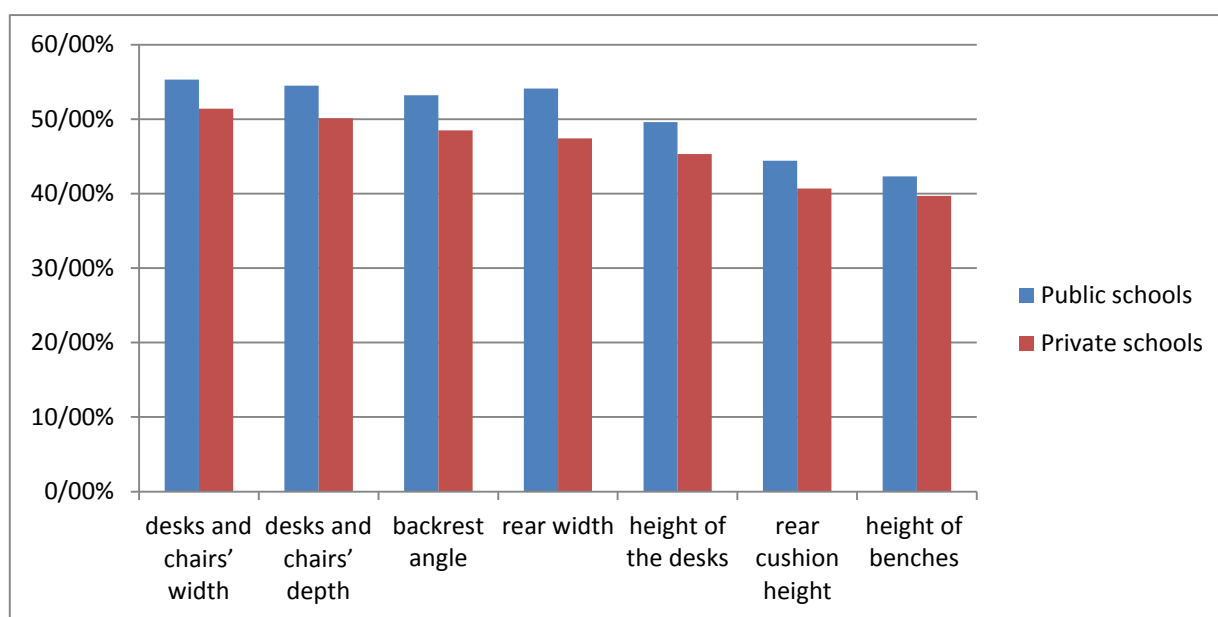


Fig.1: Comparing the percentage of inappropriateness of features of desks and chairs in private and public schools

4- DISCUSSION

The results of this study showed that the prevalence of drooping shoulders, kyphosis, lordosis and scoliosis is was significantly higher in students who used non-standard desks and chairs. The results

of various studies are consistent with the results of this study. In his study, Sepehri et al. indicated that there is a significant relationship between the incidence of lordosis, scoliosis, drooping shoulder and features of desks and chairs (21).

Chubineh et al. concluded that inappropriate desk height, lack of adequate space for the legs under the desk, lack of adjustability of the slope of the seat and seatback, high seat depth and its inappropriateness are among the factors that cause musculoskeletal injuries (22). Musa et al. also said that the use of non-standard desks and chairs for schoolchildren cause musculoskeletal disorders, especially in the neck, shoulder, wrist and waist (23). Grimer and Milanese state that disproportion between the individual anthropometric characteristics of students and desks and chairs at school is considered as a strong factor in the development of musculoskeletal disorders in adulthood, especially in the waist area (19). In this study, 56.1% of desks and chairs in the studied schools were non-standard. In addition, 60.1% of the width, 58.5% of the backrest angle, 57.5% of the depth, 55.6% of the rear width, 50.2% of the height of desks, 47.4% of the rear cushion height, 45.8% of the height of the benches in the studied schools were inappropriate.

Dianat et al. reported that 60.9% of seat height, 54.7% of its width and 51.7% of the height of desks in the schools were inappropriate for the students (11). Heidarimoghadam et al. reported that 89.5% of the seat height, 76.5% of the seat depth, 57.5% of the seat width, and 62.5% of the backrest height, 55.4% of the height of desks, 45.2% of below desk height were inappropriate for students (14). In the study conducted by Gouvali and Boudolos, the seat height was higher than acceptable range (71.5%), and the depth of the chairs was just appropriate for 38.7% of students (20), which is consistent with the results of this study. Dimensions of the desks and chairs in private schools were in better conditions compared with the public schools, but statistically not significant. This is probably due to the existence of

more facilities in the private (non-profit) schools.

4-1. Limitations of the study

The important limitation in this study was time coordination with parents to be present at the time of study on their children.

5. CONCLUSION

The prevalence of drooping shoulders, kyphosis, lordosis and scoliosis was significantly higher in students who use non-standard desks and chairs. In other words, there was a significant relationship between the non-standard size of backpack and prevalence of some musculoskeletal disorders. This could be a warning; so that if they are not prevented, they may cause more complications for the schoolchildren in the later stages of their growth. Therefore, it is crucial to avoid the occurrence of these problems through the special care and attention.

The results of this study indicate non-compliance with the ergonomics in the construction of chairs or chairs used in the classrooms. Therefore, it is essential for the craftsmen to design and build the classroom chairs with height adjustable seat and handle using national anthropometric data and observe the ergonomics in order to meet the physical expectations of students. In addition, the provision of left-hand chairs (seats) for the left-hand students, the activation of "Health, Safety and Environment (HSE)" in the schools; and the use of the opinions of ergonomics experts during the phases of ordering and purchasing ergonomic classroom desks and chairs can also be effective in reducing the prevalence of musculoskeletal disorders.

Finally, although the ergonomic features of the seats have a substantial impact on the incidence of these disorders; however, since the proper way of sitting is effective in this case, teaching ergonomics and

correct method of sitting to the students is recommended.

6- CONFLICT OF INTEREST: None.

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