



## Original Article

## Ergonomic Risk Assessment among Private and Govt Middle School Children of Hayatabad, Peshawar: A Cross Sectional Survey

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## ABSTRACT

Ergonomics is the study of fitting products for users and tasks to fit for humans. Compared to designing for children, designing for adults is simpler, but school-aged children are more susceptible to musculoskeletal problems and ergonomic risks. In Pakistani context, notably, nothing is known about ergonomic examinations in school-going youngsters. **Objective:** To determine and assess the ergonomic risks among private and government middle school children of Hayatabad, Peshawar. **Methods:** A cross sectional study was conducted in which 202 students participated. All the children studying in class 6<sup>th</sup> to 8<sup>th</sup> were recruited from different private and government middle schools of Hayatabad Peshawar. Ergonomic risk among all participants was assessed via standardized questionnaire called Rapid Upper Limb Assessment. Probability multistage sampling technique was utilized while data was analysed through SPSS version 25. Frequencies distribution, mean and standard deviation was calculated for descriptive variables, while chi square test was used to find out significant association between RULA scale and MSK pain. **Results:** A total of 202 students participated, ranging from 10-14 years with mean age of 12.4±1.4. Out of 202 participants only 78 participants reported MSK pain/discomforts. The most common reported painful region was the back 22 %. Most were within mild risk which was 50% followed by severe which was 13% of the total population. **Conclusions:** The most discomforting MSK region was the BACK followed by NECK. Pairing those with the RULA scale assessment scores, it was concluded that students were at risk of further MSK disorders if not acted upon.

## INTRODUCTION

Ergonomics is a science that aims to provide comfort to humans at workstations taking into account the human factors [1,2]. It is the scientific process of planning and designing products and places as well as procedures to align with the physical, mental, cultural and emotional capabilities as well as limitation of the target audience [3]. People generally think of ergonomics in terms of physical tasks like body position changes during an activity or change in physical arrangements such as correct positioning of tables and chairs or work place. Ergonomics

when viewed from the lens of equal opportunity makes it clear that it is unequivocally important and applicable to designing anything for anyone of any age. Professionals such as manufacturers of furniture, cars etc. especially in the case of children may not be aware of how to adequately design stuff because there are not a one size fits all formula i.e. each child develops in a different way. Similarly, typical workstations installed in schools are described as unsuitable for children [4]. Workstations in schools may contribute to musculoskeletal discomfort in school going

children which is a serious community health problem. During classroom lessons, children often sit with stooped posture, having their trunk, back, and neck flexed or rotated for long periods, with musculoskeletal symptoms arising from the classroom environment. According to the Hazard Identification Risk Assessment and Risk Control study, universal factors may influence the incidence of musculoskeletal pain in school children categorized into three main groups; a heavy schoolbag (>10% of body weight), not body friendly furniture design and incorrect sitting posture on the part of the student [5,6]. MSK complaints, such as low back pain, among school students are believed to be due to multiple causes [7,8]. School environment being one of the causes, because students almost spend thirty percent of their time in school in the sitting posture. Balaguett. Yeats and Troussier et al reported an increase in nonspecific low back pain when sitting on poorly designed furniture [5]. Studies have concluded that inconsistency between school furniture and body dimensions can cause msk disorders [2,9] and may influence learning activities including writing, reading and typing [10]. Lifetime prevalence of MSD in children and adolescents varies from 7% to 63% [7]. A study reported that the majority of school children (62%) had poor sitting posture while writing and reading. MSK regions affected due to poor posture were neck 61.3%, Shoulder 57%, abdominal region 49.2%, posterior region 54.5% and arm 72.3% [1,11]. Much international attention among the health related literature has been focused on interventional strategies to reduce the ergonomic risks related to school children which includes use of ergonomic furniture, posture correction, reduction of school bag weight i.e. < 15% of the body weight, health promotion packages and exercises to reduce muscle fatigue along with lack of exercise and lack of ergonomics awareness in the developed and developing countries is also a risk factor [5,12,13]. Evidence has reported 30-60% of school children self-reporting discomfort associated with wrong computer postures [14]. Linton et al., reported that to reduce musculoskeletal symptoms in school children, ergonomically designed chairs with curved seat must be used because these increase the angle between torso and thigh as well as enhance Lumbar curve [15,16]. Studies have concluded that inconsistency between school furniture and body dimensions can cause msk disorders [2,9], and may influence learning activities including writing, reading and typing [10]. Literatures were available nationally and internationally regarding ergonomics risk assessments among various employees. But, there was no such study among school children particularly, the middle school children. There is a lot of difference not only in educational system in Pakistan but even in infrastructure of each

school. Therefore, the aim of this study was to determine and assess the Ergonomic risk among middle school children of Hayatabad, Peshawar.

## METHODS

This study was descriptive cross-sectional study, conducted in Private and Government Middle schools of Hayatabad, Peshawar. Sampling was done via Probability multistage sampling technique and sample size of the study was 202 that was calculated by help of online sample size calculator (OpenEpi). The study was completed within six months after approval of proposal by ASRB, i.e. February 2021 to August 2021. All the children both male and female registered with the private and government middle schools in class 6th to 8th aged between 10 - 14 years and those attending their school regularly (< 60% attendance) were included in our study while children having any MSK discomfort before admission/promotion in the school determined via their medical records provided by their parents or guardians, children with any known systemic diseases. (Arthralgia, Arthritis, Myalgia etc) or those who have had any recent trauma such as Road Traffic Accident, History of falls etc. (trauma in the past 6 months) were excluded from our study. After the approval proposed study from graduate committee and Advance Study and Research Board (KMU) permission was taken from the concerned middle school principals through official permission letters for data collection. All the willing students were briefed about the purpose and procedure of this study and then an informed consent had been taken from them and their parents. The consented students had been screened through inclusion and exclusion criteria. Data were collected via questionnaire including demographic data and Rapid Upper Limb Assessment (RULA) Questionnaire that was used to assess ergonomic risk for musculoskeletal discomfort among school children with excellent validity and reliability [17]. RULA scale was mainly comprised of 4 categories (Negligible, Mild, moderate and severe) based on its scoring Children with score 1-2 were place in no risk category, similarly 3-4 were placed in category of low risk, while 5-6 in category of medium risk while on the other hand 6 plus were place in category of very high risk of MSK related issues. The data were analysed using SPSS (Statistical Package for Social sciences) version 20.0. On the basis of assessment, percentages and frequencies of five categories of (RULA) Rapid upper limb assessment scale i.e. negligible risk, low risk, medium risk and very high risk were developed and presented in the form of tables and graphs, a chi square test was used to find out significant association between RULA scale and MSK pain. Participants were informed verbally about the aims and objectives of my study.

Consent forms were given to the participants and explained to them by the interviewer. The subjects were given the right to quit from the research at any time due to any reason. It was assured to the participants that their name or address would be kept confidential. The participants were also informed that this research study result wouldn't harm them. It would not be disclosed and their information would only be shared with research supervisor

## RESULTS

A cross-sectional study was conducted to determine and assess the ergonomic risk among private and government middle school children of Hayatabad, Peshawar. We recruited total 202 students with a mean age of 12.4 (1.4). Out of total 77 (37.6%) of students having a maximum age were range in 12-13 yr. Out of 202 students, male ratio was greater than female, i.e. 103(51%) and 99(49%) respectively. The maximum number of students having normal BMI were (68.3%) followed by underweight category were (15.3 %.) The 124 students reported no MSK pain/discomfort and 78 students reported MSK pain/discomfort within different regions of the body. The most reported painful region was back (n=46) followed by neck (n=20) and arm (n=13). Based on RULA scale, the maximum number of students were suffering from mild pain(n=101)as shown in table 1.

Variables	Frequency (%)
<b>Age (yr)</b>	
10-11	61(29.8%)
12-13	77(37.6%)
14	64(31.2%)
<b>Gender</b>	
Males	103(51.0%)
Females	99(49.0%)
<b>BMI</b>	
Under-weight	31(15.3%)
Normal	138(68.3%)
Over-weight	33(16.3%)
<b>Class/Grades distribution</b>	
6.00	57(28.2%)
7.00	79(39.1%)
8.00	66(32.7%)
<b>MSK pain</b>	
Yes	78
No	124(61.3%)
<b>Region of Pain</b>	
Neck	20(9.9%)
Back	46(22.8%)
Arm	13(6.4%)
<b>RULA scale</b>	
Negligible	59(29.2%)
Mild	101(50.0%)
Moderate	14(6.9%)
Sever	28(13.9%)

**Table 1:** Shows basic demographic characteristics of participants

The association were checked between MSK pain and RULA scale, there was significant association between MSK pain and RULA scale ( $P < 0.05$ ) as shown in table 2.

RULA scale	MSK pain		Total	P-Value
	No	Yes		
Negligible	56	3	59	0.000
Mild	63	38	101	
Moderate	5	9	14	
Sever	0	28	28	
Total	124	78	202	

**Table 2:** Shows RULA categories and association with MSK pain

## DISCUSSION

In this study we have explored for various factors for MSK pain school going children ranging from 10- 15 years and its relationship with RULA score and classes. Total 202 participants from different school took part in this study, out of 202, participants of age group 10-11 years were 61, while with age of 12-13 years were 77, and with 14 years were 64, having mean of  $12.4 \pm 1.4$ . Out of total 202 children 124 (61.3%) had MSK pain. In comparison an investigation done in the Boston university, looking for backpacks and posture assessment took age classification from 9 to 14, having mean of  $12.7 \text{ years} \pm 0.52 \text{ years}$  that is some-what related to this study [18]. Another cross-sectional study performed in the New Zealand took the age group from 11-14 years showing mean age of  $12.02 \pm 0.59$  [19]. An examination was done, to teach youngsters and guardians about the utilization of right ergonomics and right span can limit the discomforts [18]. Studies uncovered the importance that MSK related issues and pain are prevalent in both youngsters, as well in children [20]. Out of all participants 124 showed having no pain, and 78 members revealed pain in various locales of the body that is neck=9.9%, back=22.8%, and arms=6.4%. The most announced area of pain was back=22.8%. Same type of study was done in university of putra, Malaysia showing devastating consequences of MSK related injuries with high rates of prevalence in neck and shoulder 38% and 16% regions respectively [1]. This high prevalence of pain may be due to different age group being taken in this Malaysian study, so there is the possibility that students from primary grade may not be able to hold backpacks correctly [1]. Another study took children of 11-17 years which revealed that most painful area is back with 20% of prevalence rate, matching with the results of our studies. Another cross-sectional was conducted in the Palmerston North area of New Zealand in which their investigation also showed predominance of back pain 34% and neck 27% respectively [19]. Another study has revealed that sitting on a normal stenographic chair having no back support increases the

flexion and compressive forces on the lumbar spine, thereby increasing the low back pain in children, which also support our study in terms high rates of low back pain [10]. Similarly, in our study we have explored the risk of MSK related pain with ergonomics by utilizing RULA scale, among 202 children most 101 were classified in mild category of RULA. Similarly, in other two of the international studies with school going children who had risk of MSK related pain, only 38 children lied in category MSK risk with other showing no pain and in another study with only 28 participants in mild category which also support the idea of least student showing Risk of MSK pain in association with RULA[4].

## CONCLUSIONS

The most discomforting MSK region was the BACK followed by NECK. Pairing those with the RULA scale assessment scores, it was concluded that students were at risk of further MSK disorders if not educated or measures were not taken to eradicate or even address this issue.

## Conflicts of Interest

The authors declare no conflict of interest.

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