Frequency of Scoliosis among School Going Students Carrying Heavy Bags: A Cross-Sectional Study in Lahore Pakistan

ABSTRACT

Objective: Scoliosis is structural change that occurs in a diversity of conditions. Development of the scoliosis during time periods of rapid child growth may consequence in severe abnormality. This survey had the purpose to find out the scoliosis frequency among school going students with age 11-16 years and determine possible associations among scoliosis and bodyweight and the bagpacks weight. **Method:** A Cross-Sectional study was conducted on 374 students with age of 11-16 years old boys and girls were having no abnormality or any MSK deformity was involved in the survey..All students were monitored by Adam's forward bend test and physical inspection test and for this purpose SRS-22r patient questionnaire was used. All data collected via a questionnaire which coded it into SPSS version 26. Data was constituted in configuration of bar charts, graphs and tables. **Results:** This inquiry contains 374 participants, and means weight of students 43.83±11.98, and mean weight of bags 5.21±1.99. The frequency of scoliosis among respondents was 48.66%, 103(27.54%) students were suffering from right Scoliotic hump, and 79(21.12%) have left Scoliotic hump. The frequency of shoulder & scapular asymmetry 73%, uneven hips 19.7%, head deviation 50.8%, body overweight 1.9%, carrying immoderate heavy school bag packs material 4%.. **Conclusion:** The scoliosis frequency among the sample of school going students was high. The statistical analysis showed that scoliosis was positively correlated with weight of students with statistically significant (p=0.000). No association was found among frequency of scoliosis and bags weigh.

Keywords: *Scoliosis, Frequency, School going students, carrying heavy bags*

Introduction

Word “scoliosis” comes from Greek term” skolios”, which explains bending or twisting. As word scoliosis indicates to sideways twisting of vertebrae.[1] The term Scoliosis defined as a three-dimensional (3D) structural deformity of the spine and judgment of deformity based on measurement of main curve including deformity. The measurement usually performed by Cobb method which measure Cobb angle. Scoliosis is recognized if cobb angle is greater than 10^{o}.[2-3]

Inheritance plays a great role in diagnosis of scoliosis. Like other persistent non-contagious illnesses, scoliosis appears an autogenetic part that described by relation among ecological aspects and venom in intonation of constitutional dissimilarities The autogenetic possessions mostly arise over deoxyribonucleic acid methylation in premier decagon of existence, because of inside and outside atmospheric hazards.[4-5]

In infants and teenagers, climate especially in schools can devote in progression of MSK disorders. At the present time, bone formation is flourishing. Origin of MSK disorders in teenagers is multicultural including, such as involvement in athletic training and workout, large interval of immobility , poor attitude of body whereas seating or carrying heavy bags particularly heavy.[6] Too much bulky school bags carried by school going children give rise to twisting of spine and excessive flexion of head with trunk. Tension on cervical and posterior musculature of trunk may give rise to superfluous tiredness and harm to child’s body framework and ultimately leads to vertebral column abnormalities. [7-9] When pupil brings school bags on a single side of trunk, then their bodies might stoop on contradictory region to recoup for additional burden and that can harmful for both vertebral column and shoulder girdle.

Majority of experimenters prescribed that 10% of child's body mass is the greatest allowable burden.[10] An important association was additionally organized among low backache as well as school bags load along with bearing moments in pupils of entire existing factions. Load of heavier school bags increased tension on vertebrae in median plane. Curving of the body in flexed posture to keeping equilibrium in having bulky loads of school bags had a bad impact on normal curve of lumbar spine. weighty school bags reasoned of uneven shoulders along with increasing arch in topmost back with thoracic area, causing to hunch, therefore students suffered from backache, shoulders with neck pain.[11-13]

Almost 3 persons from 100 experiences any type of abnormal lateral curvature, still several groups of people consider that's not such a serious impairment, scoliosis described as sideway curve of spine by degrees roundabout of 10°1 while calculated by Cobb's angle lateral curvature is existing evenly in men or women with angle of around about 10°; however along with abnormal curvature, acceptance of large number of lateral curvature in spine is in women than men. Spine of a person with lateral curvature can gaze additional matching with "S" and "C", relatively than an erect angle.[14]

Whereas pathological process of spontaneously problem arising with lateral curvature of spine remains yet doubtful, heredity conditions are playing an important role in progression of unknown causes of lateral curvature of spine, china's heredity conditions may be dissimilar than else countries as well as can be considered discrepancy in popularity. Occurrence of lateral curvature defects between different origins, as well as curvature seriousness is linked with ethnicity.[15] Ratio of occurrence of lateral curvature defects was 11.1% in Europeanand 6.5% in Africans raised. Occurrence of Scoliotic spine in Asian school girls was seriously greater than in AmericanIndian(16-17 years) school girls and Austronesia girls(11-12 years) found by a

study.[16-18] So advanced researches are essential to verify occurrence along with division of different criteria of Scoliosis spine conforming to increasing age with sex in community of Pakistan. This study was performed to determine the frequency of scoliosis, sex relation among children and their relation with weight of backpacks. .

Objective:

The purpose of this study was to analyze the results from screening to determine the current frequency of scoliosis, and to discuss optimal large-scale scoliosis screening programs in school.

Materials and Methods:

Ethical approval and written permission to conduct the research was obtained from the higher authorities of The Lahore institute of science and technology (affiliated with GCUF). Informed consent was obtained from 374 respondents who were agreed to take part in the research. It was a Descriptive Cross-Sectional study which aim was to find out the scoliosis frequency among school going students carrying heavy bags and associated functional limitation. Study was conducted in 6 months after approval of synapse. This study was conducted from government school (workers welfare school Lahore, SM higher secondary school, government high school), private (Laraib public model high school, Darr-ul-Ilam (3 campuses), Soldiers public school, Dreamsland international school) and all these schools were in Lahore. Students of 5^{th} to 10^{th}class were included in the study. An inclusion criterion for participants, Both male and female school going students, Students of age 11-16 years old, Students who willing to participate in the study, Students with bags weight of 0.5- 12kg. Exclusion criteria for respondents were School going Students of age 11-16 years old with any kind of spine injury in

past and those with recent trauma or with recent surgery, Any Pediatric congenital abnormalities (spina bifida, congenital hip dysplasia, dwarfism, structural scoliosis, kyphosis etc), School going Students with any pathology that can affect spine (TB, tumor etc) or reason of back pain (kidney or liver problems, bowel or bladder problems etc), Students with bags weight less than 0.5 or greater than 12, Students who did not agree to participate in the study.

Material Required.

- Permission letter
- Consent form
- SRS-22r patient Questionnaire

Data Collection Tool

SRS-22r patient Questionnaire is a valid, reliable. The questionnaire was divided into two parts that is, section A, B and C. Demographic information was asked in section A, that included the Personal information asked about some characteristics: age, gender, class, medical record, weight of student and weight of bags. In section B respondents were asked to fill the SRS-22r patient Questionnaire. The questionnaires have questions about intensity of back pain were asked about the pain in previous one month and also six months that experienced due to caring bags and school routines, student perspective about their back shape, level of satisfaction about their back shape, dressing and relationships, level of school activity, ability to do work, and use of medication for back pain. In the section C there were points for physical examination of participants having uneven shoulders, uneven hips, head not centered over body and unequal arm trunk distance both sides of body. Forward bend test which is used in this research is taken from another previous research of this same topic.[19]

Proper consent form attached to the questionnaire for the PTs just to know either they agreed to take part in research or not. And thank you note was also written at the end of questionnaire.

Data Collection Procedure

For data collection procedure we use the SRS-22r patient Questionnaire which took from another research, physical exam of student for scoliosis, forward bend test as used in prior numerous studies. Questionnaire separated into sections for the easiness of students. We hand over each questionnaire individually to every student in the Lahore at their school. We explained each and every part to them for their facilitation. We also describe the aims and objectives of the questionnaire. And at that time we also give the idea about the purpose of each question in the questionnaire to the student. During physical exam, we physically examine each student for spinal, shoulder, hips or head abnormality and also any congenital abnormality. Forward bend test by every student (as they bend forward with relaxed back and knees in order that their fingertips going to touch their toes), and we describe the test procedure to every student for their ease to perform it. Data collection was definitely a challenging task for us but that was also quite prepossessing too. Some of the students are reluctant to fill the questionnaire considering it is not important or just by saying that they have not enough time to fill the questionnaire. Some student filled the questionnaire at the same time as we handed on questionnaire to them. There were also some student who has injury or pathology that were excluded data collection procedure. [20]

Statistical Analysis

SPSS 26.0, Window 7 was used for data analysis. Personal information conclusion was expressed; Mean ± SD, min & max values. Forward bend test were expressed as percentages and

frequencies. SRS-22r patient Questionnaire was explained in percentages. Descriptive statistics was used for Bar and Pie graphs to analyze some questions related to scoliosis.

Results:

The above table contains the mean, Stander Deviation (SD) and range of age, gender, class, student weight, bags weight and minimum and maximum values of respective variables. The total respondent took part in this study were 374. The Mean±SD of age(yrs) was 14.17±1.530 and the range was 11-16 in which 11 was the minimum value and 16 was maximum value. The Mean±SD of class was 8.53±1.559 and rang was 5-10 in which minimum value was 5 and maximum value was10. The Mean±SD of student weight (kg) was 43.837±11.9861 and the ranges were 13.0-83.0 in which 13.0 was the minimum value and 83.0 was maximum value. The Mean±SD of bags weight (kg) was 5.211±1.9912 and range was 0.5-11.9 in which 0.5 was minimum value and 11.9 was maximum value. The above contains the frequency and percentages of demographic data of respondents (374). The age is divided into 2 groups (11-13-, 14-16). Total 102 were in group 11-13 with %age of 27.3,and 272 were in group 14-16 with %age of 72.7. Class was categorizing into 2 groups (5-7, 8-10). Total 79 were in group 5-7 with %age of 20.9 and 296 were in group 8-10 with %age of 79.1. Student weight was divided into 5 groups, 30(8.0) were in group 10-25, 108(29.2) were in group 25-40, 182(48.4) were in group 40-55, 47(12.5) were in group 55-70, 7(1.9) were in group 70-85. Bags weight was categorize into 4 groups, 45(12.0) were in group 0.5-3, 217(58.1) were in group 3-6, 97(25.9) were in group 6-9, 15(4.0) were in group 9-12 (Table-1). The above pie chart elaborates that among participant 129(34.49%) were male, and 245(65.51%) were female students (fig:-1). The values of weight among students were having Scoliotic hump, on the x-axis shows the weight and y-axis shows the number of students were having weigh in that range. Among respondents who were having

scoliosis 12.70% had 10-30kg weight, while 83.40% students had 31-60 kg weight and 3.9% students having 61-90 kg weight (fig:-2). In the above table out of 374 participants, 123(32.9%) reported that no back pain was experienced in past 6 months, while 164(43.8) experienced mild pain, 53(14.2) reported moderate pain, 26(7.0) reported moderate to severe pain and 8(2.1) reported that sever back pain was experienced in past 6 months. Among respondents 51.1%(n=119) reported that no back pain experienced in past 1 month, 33.4%(n=125) experienced mild pain, 29.9%(n=112) reported moderate pain, moderate to severe pain reported by 11.0%(n=41) and 2.9%(n=11) reported that sever back pain was experienced during past 1 month. Respondents who reported no back pain at rest 38.0%(n=142), 18.2%(n=68) experienced mild back pain, while 29.9%(n=112) reported moderate pain, 11.0%(n=41) reported sever back pain and 2.9%(n=11) reported that experienced back pain at rest (table-2). Out of 374 participants, 28.9%(n=108) respondents reported that none of the time were the nervous person during past 6 months, 45.2%(n=169) reported a little of the time were a nervous person, 16.6%(n=62) considered it some of the time, while 7%(n=26) considered it most of the time and 2.4%(n=2.4) reported that all of the time were the nervous person during past 6 months. Among respondents 43.0%(n=161) reported that none of the time were felt so down in the dumped in past 6 months, 19.0%(n=71) considered it a little of the time, while 26.2%(n=98) considered it some of the time, 7%(n=26) considered it most of the time and 4.8%(n=18) reported that all of the time were the nervous person during past 6 months. 9.1%(n=34) reported that none of the time felt calm and peaceful during past 6 month, 17.6%(n=66) considered it a little of the time, 28.6%(n=107) considered it some of the time, while 24.1%(n=90) reported most of the time and 20.6%(n=77) reported that all of the time were felt calm and peaceful during past 6 months. 41.2%(n=154) considered that none of the time were felt that back condition affects personal

relationships, 28.6%(n=107) considered it a little of the time, 18.4%(n=69) considered it some of the time, while 6.4%(n=24) reported it most of the time and 5.3%(n=20) respondents reported that all of the time were the back conditions affect personal relationships.

Among respondents 50.8%(n=190) reported that none of the time were felt down hearted and blue during past 6 months, 26.7%(n=100) considered it a little of the time, 14.7%(n=55) considered it some of the time, 4.8%(n=18) considered it most of the time and 2.9(n=11) reported that all of the time were felt down hearted and blue during past 6 months. 3.5%(n=13) reported that none of the time were feel attractive with back condition, 3.2%(n=12) considered it a little of the time, 12.8%(n=48) considered it some of the time,23.3%(n=87) considered it most of the time and 57.2%(n=214) reported that all of the time were feel attractive with current back condition. Among respondent none of the time were a happy person during past 6 months 11.2%(n=42), 21.4%(n=80) considered it a little of the time, 24.3%(n=91) considered it some of the time, while 23.0%(n=86) considered it most of the time and 20.1%(n=75) reported that all of the time were a happy in past 6 months (Table-3). Out of 374 participants 44.9 %(n=168) were have right shoulder elevation, 28.1 %(n=105) left shoulder elevation and 27.0 %(n=101) were have no visible physical shoulder abnormality. 16.0 %(n=60) participants were have right hip higher than left, 14 %(n=3.7) left hip elevation and 49.2 %(n=184) were have even hips both sides of body. Among participants 124(33.2%) were have right head deviation while 66(17.6%) left and 184(49.2%) have head centered over body. 154(41.2%) were have larger right side arm-trunk gap while 88(23.5%) have left and 132(35.3%) had equal gap on both sides of body. Among respondents 103(27.2%) have thoracic hump on right side of trunk while 79(21.1%) have left and192 (51.3%) have no hump (table-4).

The table above shows the relationship between frequency of scoliosis and gender. Result shows that correlation between Gender and Scoliosis was 84.1% and there was a significant result with p-value .004 (table-5). The table above shows the relationship between frequency of scoliosis and bags weight. Result is supported by the p value which is 0.001. The value of p for the correlation of scoliosis with bags weight is less than 0.05.Therefore; it shows that frequency of scoliosis has correlation with the bags weight of the students (table-6).

Table 1: Demographic Description of the Respondents (N=374)

	n%
Age	
11-13	102(27.3)
14-16	272(72.7)
Class	
5-7	78(20.9)
8-10	296(79.1)
Students weight	
10-25	30(8.0)
25-40	108(29.2)
40-55	182(48.4)
55-70	47(12.5)
70-85	7(1.9)
Bags weight	
0.5-3	45(12.0)
3-6	217(58.1)
6-9	97(25.9)
9-12	15(4.0)

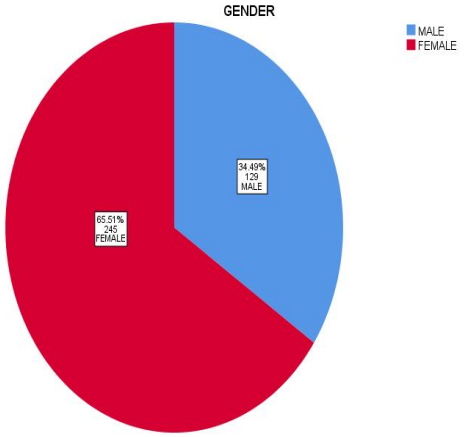

Fig 1: **Description of Gender among Respondents**

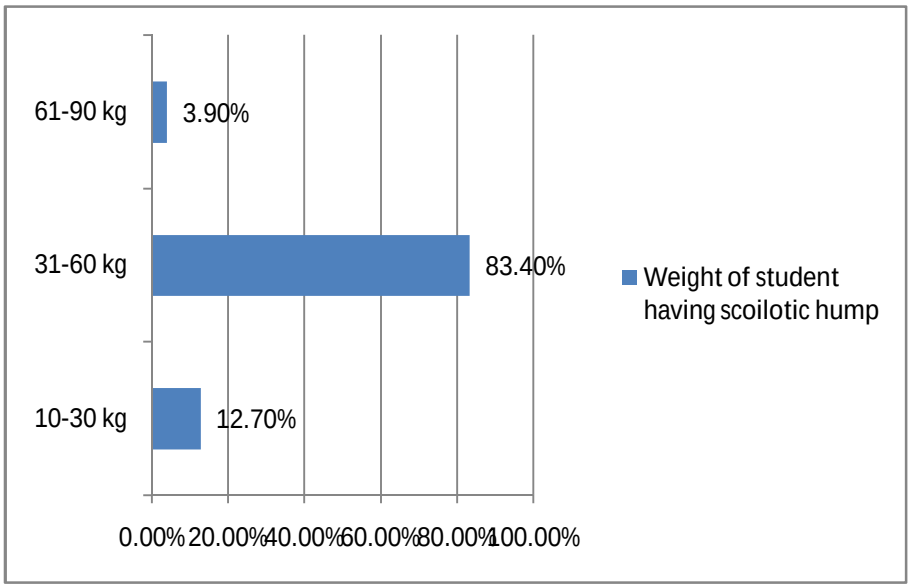

Fig 2: Description of Number of Students Having Scoliosis among Respondents

Table 2: Description of Back Pain among Respondents

Pain	None n (%)	Mild n (%)	Moderate n (%)	Moderate to severe n(%)	Sever n (%)
Back pain experienced in past 6 month	123(32.9)	164(43.8)	53(14.2)	26(7.0)	8(2.1)
Back pain experienced in past 1 month	119(51.1)	125(33.4)	31(8.3)	20(5.3)	7(1.9)
Back pain at rest	142(38.0)	68(18.2)	112(29.9)	41(11.0)	11(2.9)

Table 3: Description of Mental Health Respondents

Mental health Domains	None of the time n (%)	A little of the time n (%)	Some of the time n (%)	Most of the time n (%)	All of the timen (%)
Nervous person in past 6 month	108(28.9)	169(45.2)	62(16.6)	26(7.0)	9(2.4)
Felt down and dumped in past 6 month	161(43.0)	71(19.0)	98(26.2)	26(7.0)	18(4.8)
Felt calm and peaceful during 6 month	34(9.1)	66(17.6)	107(28.6)	90(24.1)	77(20.6)
Back condition affects your personal relationships	154(41.2)	107(28.6)	69(18.4)	24(6.4)	20(5.3)
Felt down and hearted in past 6 month	190(50.8)	100(26.7)	55(14.7)	18(4.8)	11(2.9)
Feel attractive with your back shape	13(3.5)	12(3.2)	48(12.8)	87(23.3)	214(57.2)
Happy person during past 6 month	42(11.2)	80(21.4)	91(24.3)	86(23.0)	75(20.1)

Table 4: Location of Visible Physical Abnormalities in Trunk among Participants

Physical abnormalities	Right side of body n (%)	Left side of body n (%)	No visible abnormality n (%)
Uneven shoulders(shoulder blade higher than other	168(44.9)	105(28.1)	101(27.0)
Uneven hips(one hip higher than other)	132(35.3)	90(24.1)	152(40.6)
A head slightly off center or deviated(head not centered over body)	124(33.2)	66(17.6)	184(49.2)
Lager gap on one side between arms and waist	154(41.2)	88(23.5)	132(35.3)
Thoracic hump when bending over	103(27.2)	79(21.1)	192(51.3)

Table 5: Frequency of Scoliosis in Association with Gender of Respondents

		scoliosis	GENDER
Scoliosis	Pearson Correlation	1	.841
	Sig. (2-tailed)		.004
	N	374	374
GENDER	Pearson Correlation	.841	1
	Sig. (2-tailed)	.004	
	N	374	374

Table 6: Frequency of Scoliosis in Association with Weight of Bags among Respondents

		students weight
Pearson Correlation	**bag's weight**	.848
	Sig. (2-tailed)	.001
	N	374

Discussion

The discussion on the results of the data based on school going students (n=374) who were participants of the study. The aim of present inquiry was to evaluate the incidence and factors for scoliosis between school going students. Since the present study population consist of both private and government schools of areas and& its social with demographic qualities were almost identical to Lahore city, the frequency of scoliosis as estimated in this study is a good indicator of its frequency throughout the city, in the age11-16 years of school students.

Prior observation of lateral curvature of spine in pupils put a stop to destroying bodily with intellectual issues linked with exaggerated curvatures. Curves exceeding than hundred points are linked with greater pulmonary issues. Likewise, large deformities are familiar to experience intellectual impacts on thoughts of teenagers and youngsters who are frequently noticed to experienced low dignity 50 degrees curve that have been examined at skeletal maturity progressed at 1°/year rate, that were lead to considerable morbidity.[21]

Studies have indicate that the weight of bag packs and the time duration of carrying bag packs may influence both shoulder blades and neck position. One more work came to an end that backache was not worthy associated with body workout even got strong relation with day time

exhaustion and other psychological elements. Outcomes also suggest that emotional factors are relatively than unemotional factors were increasing significance in adolescents backache, along with sign of pain in students who carry heavy bags.[22]

The present study have shown that high proportion of pupils (29.9%) carried an markedly heavy bags (greater than 10% of their body weight); the weight of all bags on average5.21 ± 1.99kg with a highest of 11.9 and minimum of 0.5 kg. These values are similar to which the weight of all bags on average was 4.0 ± 1.7kg with a highest of 11.4 kg.[23] in this study it was found average weight 6.44 ± 2.37kg with a highest of 6.68kg; however, the last research only added students in the 5thand 6th school grades, whereas the present study also included students from the 1-10th class students.[24]The present study found no association between frequency of scoliosis and weight of bags as the value of p for the correlation of scoliosis with bags weight is 0.351 which is greater than 0.05.[25] A similar result was obtained that no difference in postural response with a backpack weighing up to 10% of body weight compared to a lighter weight backpacks, and could not support the rule of establishing a limit load of 10% of body weight.[26]

The frequency rate of scoliosis was 48.3% among which slightly higher frequency of right Scoliotic hump (27.2%) than left Scoliotic hump (21.1%).Outcome of this study have similarity with results from previous researches. In this study female respondents (n=245, 56.5%) were more likely than males (n=129, 34.5%) revealing that females were better respondents than males in this study.[27] Among participants the most affected part was back, 67.1% reported to have mild to severe back pain among which 9.1% have moderate to severe back pain experience in past 6 months, while 48.9% reported mild to severe back pain among which 7.2% have moderate to severe back pain experienced in past 1 month. The results of other studies reported most frequently effected body part is low back by among adolescence by scoliosis.[28]

Conclusion

The present study shows higher frequency of scoliosis with having no significant association between frequency scoliosis and weight of student's bags. But this study shows the significant association between frequency of scoliosis and average weight students among respondents.

Limitations

- Severity of the spinal curve was not calculated in this study due to unavailability of scoliometer device due to COVID-19.
- The sample was taken from Lahore city only which may affect the generalizability of our study results over the population.
- The etiology of back pain in schoolchildren was not investigated in this study.
- Distance covered from house-to school or time duration of carrying bags was not calculated in this study.
- Questionnaire consist of close ended question, due to this the additional responses of students may be limited.
- The psychosocial factors that may be the cause of low back pain in schoolchildren were not measured in this study, which is one of the limitations of this study.
- The financial issues influence the research project as we were not funded for this.

Suggestions

Some risk reduction strategies include:

- Using suitable kind of backpack.
- Make sure it is packed correctly
- Showing the students, the correct lifting and carrying techniques

Recommendations

- The most effective way to reduce pain and discomfort is lighting paper weight and making book size smaller.
- Reorganize the weekly timetable to suit the students' ability.
- Leaving the books and other paper at school
- We have little information about the severity and range of problems, further research is needed for this.
- Further detailed research should be done by researchers to specify the association of scoliosis with specific students' risk factors.

Consent

As per international standard or university standard, parental(s) written consent has been collected and preserved by the author(s).

Ethical Approval:
As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

References

1. Tahirbegolli, B., Obertinca, R., Bytyqi, A., Kryeziu, B., Hyseni, B., Taganoviq, B. and Shabani, B., 2021. Factors affecting the prevalence of idiopathic scoliosis among children aged 8–15 years in Prishtina, Kosovo. *Scientific Reports*, *11*(1), pp.1-7.
2. Etemadifar, M., Hadi, A., Nazem, K., Esfahani, M.A., Rabiei, A., Taghvaee, F., Mostajeran, M. and Nemati, A., 2020. Epidemiology of adolescent idiopathic scoliosis in Isfahan, Iran: A school-based study during 2014–2015. *Journal of Research in Medical Sciences: The Official Journal of Isfahan University of Medical Sciences*, *25*.
3. Taleschian-Tabrizi, N., Alinezhad, F., Pezeshki, M.Z., Dastgiri, S., Eftekharsadat, B. and Dolatkhah, N., 2022. Prevalence of Spinal Deformities among School Age Children in Iran: A Systematic Review and Meta-Analysis. *International Journal of Pediatrics*, *10*(7), pp.16402-16416.
4. Chinnasamy V, Subramaniyan V, Chandiran S, Kayarohanam S, Kanniyan DC, Velaga VSSR, Muhammad S. Antiarthritic Activity of Achyranthes Aspera on Formaldehyde - Induced Arthritis in Rats. Open Access Maced J Med Sci. 2019 Aug 30;7(17):2709-2714. doi: 10.3889/oamjms.2019.559. PMID: 31844425; PMCID: PMC6901860.
5. Scaturro, D., Costantino, C., Terrana, P., Vitagliani, F., Falco, V., Cuntrera, D., Sannasardo, C.E., Vitale, F. and Letizia Mauro, G., 2021. Risk Factors, Lifestyle and Prevention among Adolescents with Idiopathic Juvenile Scoliosis: A Cross Sectional Study in Eleven First-Grade Secondary Schools of Palermo Province, Italy. *International Journal of Environmental Research and Public Health*, *18*(23), p.12335.
6. Nasir NN, Sekar M, Fuloria S, Gan SH, Rani NNIM, Ravi S, Begum MY, Chidambaram K, Sathasivam KV, Jeyabalan S, Dhiravidamani A, Thangavelu L, Lum PT, Subramaniyan V, Wu YS, Azad AK, Fuloria NK. Kirenol: A Potential Natural Lead Molecule for a New Drug Design, Development, and Therapy for Inflammation. Molecules. 2022;27(3):734. doi: 10.3390/molecules27030734. PMID: 35163999; PMCID: PMC8839644.
7. Burhanuddin, S., 2022. Screening And Therapy Of Sports On Scoliosis At Secondary Schools In Makassar Indonesia. *Multicultural Education*, *8*(8), pp.59-69.
8. Forooqui, S.I., Ullah, H., Mukadam, M.A., Zohra, B., Sarfaraz, I., Qamar, D. and Zahid, F., 2018. PREVALENCE OF ADOLESCENT IDIOPATHIC SCOLIOSIS AMONG PRIMARY AND SECONDARY GIRLS SCHOOLS OF SIKANDERABAD, KARACHI, PAKISTAN. *Pakistan Journal of Rehabilitation*, *7*(1), pp.28-34.

9. Kagwiza, J., Biraguma, J., Nyandwi, T., Chevan, J., Mostert, K. and M'kumbuzi, V.R.P., 2019. Epidemiology of spinal deformities among secondary school children in Rwanda. *African Journal for Physical Activity and Health Sciences (AJPHES)*, *25*(1), pp.93-104.
10. Zaheer, M., Fatima, N., Riaz, U. and Haseeb, N., 2022. Association of heavy bag lifting time with postural pain in secondary school students. *Pakistan BioMedical Journal*, pp.64-67.
11. Gheysvandi, E., Dianat, I., Heidarimoghadam, R., Tapak, L., Karimi-Shahanjarini, A. and Rezapur-Shahkolai, F., 2019. Neck and shoulder pain among elementary school students: prevalence and its risk factors. *BMC public health*, *19*(1), pp.1-11.
12. Gustafsson, M.L., Laaksonen, C., Aromaa, M., Löyttyniemi, E. and Salanterä, S., 2018. The prevalence of neck-shoulder pain, back pain and psychological symptoms in association with daytime sleepiness–a prospective follow-up study of school children aged 10 to 15. *Scandinavian Journal of Pain*, *18*(3), pp.389-397.
13. Keeratisiroj, O. and Siritaratiwat, W., 2018. Prevalence of self-reported musculoskeletal pain symptoms among school-age adolescents: age and sex differences. *Scandinavian Journal of Pain*, *18*(2), pp.273-280.
14. Dianat, I., Alipour, A. and Asgari Jafarabadi, M., 2018. Risk factors for neck and shoulder pain among schoolchildren and adolescents. *Journal of paediatrics and child health*, *54*(1), pp.20-27.
15. Takagishi, K., Matsuura, T., Masatomi, T., Chosa, E., Tajika, T., Iwama, T., Watanabe, M., Otani, T., Inagaki, K., Ikegami, H. and Aoki, M., 2019. Shoulder and elbow pain in junior high school baseball players: results of a nationwide survey. *Journal of orthopaedic science*, *24*(4), pp.708-714.
16. Ayed HB, Yaich S, Trigui M, Hmida MB, Jemaa MB, Ammar A, Jedidi J, Karray R, Feki H, Mejdoub Y, Kassis M. Prevalence, risk factors and outcomes of neck, shoulders and low-back pain in secondary-school children. Journal of research in health sciences. 2019;19(1):e00440.
17. Dianat, I., Alipour, A. and Asghari Jafarabadi, M., 2018. Multigroup latent class model of musculoskeletal pain combinations in children/adolescents: identifying high-risk groups by gender and age. *The Journal of Headache and Pain*, *19*(1), pp.1-8.

18. Subramaniyan V, Chakravarthi S, Jegasothy R, Seng WY, Fuloria NK, Fuloria S, Hazarika I, Das A. Alcohol-associated liver disease: A review on its pathophysiology, diagnosis and drug therapy. Toxicol Rep. 2021 Feb 19;8:376-385. doi: 10.1016/j.toxrep.2021.02.010. PMID: 33680863; PMCID: PMC7910406.
19. Delele, M., Janakiraman, B., Bekele Abebe, A., Tafese, A. and Van De Water, A., 2018. Musculoskeletal pain and associated factors among Ethiopian elementary school children. *BMC musculoskeletal disorders*, *19*(1), pp.1-8.
20. Oka, G.A., Ranade, A.S. and Kulkarni, A.A., 2019. Back pain and school bag weight–a study on Indian children and review of literature. *Journal of Pediatric Orthopaedics B*, *28*(4), pp.397-404.
21. Akbar, F., AlBesharah, M., Al-Baghli, J., Bulbul, F., Mohammad, D., Qadoura, B. and Al-Taiar, A., 2019. Prevalence of low Back pain among adolescents in relation to the weight of school bags. *BMC musculoskeletal disorders*, *20*(1), pp.1-9.
22. Mandic, S., Keller, R., García Bengoechea, E., Moore, A. and Coppell, K.J., 2018. School bag weight as a barrier to active transport to school among New Zealand adolescents. *Children*, *5*(10), p.129.
23. Assiri, A., Mahfouz, A.A., Awadalla, N.J., Abolyazid, A.Y. and Shalaby, M., 2020. Back pain and schoolbags among adolescents in Abha City, Southwestern Saudi Arabia. *International Journal of Environmental Research and Public Health*, *17*(1), p.5.
24. Vaghela, N.P., Parekh, S.K., Padsala, D. and Patel, D., 2019. Effect of backpack loading on cervical and sagittal shoulder posture in standing and after dynamic activity in school going children. *Journal of Family Medicine and Primary Care*, *8*(3), p.1076.
25. Barbosa, J., Marques, M.C., Izquierdo, M., Neiva, H.P., Barbosa, T.M., Ramírez-Vélez, R., Alonso-Martínez, A.M., García-Hermoso, A., Aguado-Jimenez, R. and Marinho, D.A., 2019. Schoolbag weight carriage in Portuguese children and adolescents: a cross-sectional study comparing possible influencing factors. *BMC pediatrics*, *19*(1), pp.1-7.
26. Natasha, A.A., Syukri, A.A., Diana, M.K.S.N., Ima-Nirwana, S. and Chin, K.Y., 2018. The association between backpack use and low back pain among pre-university students: A pilot study. *Journal of Taibah University Medical Sciences*, *13*(2), pp.205-209.
27. Perrone, M., Orr, R., Hing, W., Milne, N. and Pope, R., 2018. The impact of backpack loads on school children: A critical narrative review. *International journal of environmental research and public health*, *15*(11), p.2529.

28. Rezapur-Shahkolai, F., Gheysvandi, E., Tapak, L., Dianat, I., Karimi-Shahanjarini, A. and Heidarimoghadam, R., 2020. Risk factors for low back pain among elementary school students in western Iran using penalized logistic regression. *Epidemiology and Health*, *42*.