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Overuse injuries among school-going children in Manipur, northeast India: A descriptive cross-sectional study

Ningthemba Yumnam[1], Akoijam Joy Singh[2], Joymati Oinam[4], Akoijam Ravi[3] & Siddharth Kapahtia[5]

Department of [1]Sports Medicine, [2]Physical Medicine & Rehabilitation, & [3]Physical Instructor, Regional Institute of Medical Sciences, [4]Department of Community Medicine, Jawaharlal Nehru Institute of Medical Sciences, Imphal, Manipur & [5]Division of Non-Communicable Diseases, Indian Council of Medical Research, New Delhi, India

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***Background & objectives*: Overuse injury is an important public health issue among children and adolescents, which may affect their overall performance. Therefore, the objective is to determine the prevalence and compare overuse injuries among school-going children in hill and valley, rural and urban areas of Manipur and identify factors contributing to overuse injuries.**

***Methods*: After obtaining approval from school authorities, a cross-sectional study was conducted in three districts of Manipur namely, Imphal West, Bishnupur, and Ukhrul, among 3,600 schoolchildren in the age group of 7-15 yr. An interview schedule using a pretested questionnaire and a proforma was used for data collection. Descriptive statistics were used, such as mean, SD, percentages, *etc*.**

***Results*: In this study, 3,600 students participated; the mean age was 13.37 yr. The overall prevalence of overuse injury was 14.39 per cent, which was the highest in Imphal West (50.19%) and among males (53.09%). The commonest overuse injuries were of lower extremities (44.98%) and were observed to be the highest in Bishnupur (49.59%) and among males (45.45%). Back pain was more prevalent in Ukhrul (37.78%) and among females (31.69%). Among lower extremity injuries, the majority had chondromalacia patellae (29.18%) and shin splint (24.03%), and among the upper extremity injuries, 81.25 per cent had neck and arm pain.**

***Interpretation & conclusions*: The overall prevalence of overuse injuries was 14.39 per cent, and the highest was in Imphal West. We observed a paradigm shift as the students' back, neck and arm pain increased. These are important public health concerns that need immediate attention, as well as the development of innovative interventions, including health education and appropriate regulations.**

Key words Cross-sectional - injury - overuse - Manipur - prevalence - students

Overuse injury has become a significant public health issue among children and adolescents because overuse injuries that go undetected and untreated and are not adequately managed or rehabilitated can progress to further additional injuries and can lead to permanent limitations, which may affect their overall

performance. An overuse injury is defined as one caused by repetitive micro trauma without a single identifiable event responsible for the injury[1]. Different studies reported that 17.4 to 50 per cent of all paediatric sports injuries are due to overuse[2-5]. According to a consensus statement on youth athletic development in the 'International Olympic Committee', the competitive careers of young athletes are too often temporarily halted or permanently derailed by overuse injuries[6]. To protect adolescent athletes' health and to allow an optimal development of their athletic performance, it is essential to identify common musculoskeletal injuries. However, data evaluating the frequency and location of different types of overuse injuries among school students are sparse[7,8]. Significant knowledge deficits exist regarding overuse injuries in children and adolescents in India, and there are no data available from the northeastern States, including Manipur. Children continue to engage in physically demanding, organized sports to a great extent despite the lack of physical readiness, predisposing themselves to injury. People in the northeastern region are unique in terms of racial, cultural, geographical, dietary, and socioeconomic backgrounds, and their involvement in physical activities and love of sports compared to those in other States of the country. Therefore, this descriptive study was undertaken to lay the groundwork regarding overuse injuries in the northeastern region of India.

The objective of this study was to determine the prevalence of overuse injuries among school-going children in the valley and hill districts of Manipur, compare the prevalence of overuse injuries in hill and valley, as well as rural and urban areas of Manipur, and identify the factors contributing to the overuse injuries.

Material & Methods

A descriptive, community-based, cross-sectional study was conducted in the Department of Physical Medicine & Rehabilitation, Regional Institute of Medical Sciences (RIMS), Imphal, Manipur, India from 2017 to 2021. Among children in the age group of 7-15 yr studying in different schools in three districts of Manipur, namely, Imphal West, Bishnupur representing urban and rural districts in the valley and Ukhrul district representing hill areas of Manipur out of the total 16 districts in the State were included. The study was conducted after obtaining the ethical approval from the Research Ethics Board (REB), RIMS, Imphal and written permission was obtained from school principals/headmasters before the start of the study. Assent was also obtained from all the students on the day of data collection. Name and other identifiers were not collected; code numbers were used.

Study: The study population comprised school students in the age group of 7-15 yr studying in Imphal West, Bishnupur and Ukhrul districts of Manipur whose parents/guardians provided consent. Consent was also taken from the students. Exclusion criteria included those students who walked long distances (>6 km) at a stretch to go to school, who did manual work to support their family (physically and financially) on a regular basis beyond school hours and had problems associated with acute injury, infection, arthritis, tumour conditions and significant systemic disease. Lastly, those who were absent on the day of screening/final examination were also excluded.

Sample size calculation: The sample size calculation was done using the $Z\alpha PQ/d^2$ formula[9] and considering the prevalence (P) of overuse injury to be 10 per cent from the out-patient department (OPD) record of athletes attending the Physical Medicine and Rehabilitation (PMR) OPD in the last three years; Q=100-P and taking a relative allowable error (d) of 10 per cent at 95% confidence interval (CI); the estimated sample size was 3600. Hence, 3600 was the enrolment target for the study. Three of the 16 districts in Manipur were selected using the lottery method, namely Imphal West, Bishnupur, and Ukhrul. As per the census report 2011[10], the population in Imphal West is around twice that of the Bishnupur and Ukhrul districts; therefore, 1,800 students were selected from Imphal West and 900 students each from Bishnupur and Ukhrul districts. Details of schools and students enrolled in each school were collected from the Board of Secondary Education, Education Department, Manipur. Government-aided schools were considered government schools. The schools were first stratified into government and private schools. Since our data collection time coincided with most of the school examinations and also the record of the number of students enrolled in each school obtained from the Board of Secondary Education, Education Department, Manipur, did not match with the actual number of students present in schools, the investigators selected government schools and private schools from each district using convenience sampling.

Operational definitions: These operational definitions were adopted in the study to maintain uniformity in screening the children for overuse injury by

investigators and assess the different contributing factors that might lead to overuse injuries in children.

Overuse injury: Any type of injury that occurs from repetitive trauma or stress to muscles, bones, tendons, or ligaments over time without sufficient recovery. So any child aged 7-15 yr presenting with pain; characterized by pain in the affected area following physical activity, or pain during activity that does not restrict performance, or pain during activity that restricts performance or chronic, persistent pain even at rest[11].

Overtraining: A condition that occurs when an individual exceeds their body's ability to recover from intense physical activity, leading to decline in performance and possible negative physiological and psychological effects[12].

Mobile addiction: Compulsive and excessive use of mobile devices, leading to negative impacts on various aspects of an individual's life and inability to control the usage, preoccupation with mobile activities, and withdrawal symptoms when the device is not accessible[13].

Bad road conditions: Poorly maintained, damaged, rough, uneven road surfaces; soft road surfaces such as unpaved road/dirt road; dangerous street drop-offs like ravines or cliff; and steep slopes in hilly regions.

Poor-quality footwear: Any worn-out footwear; old, damaged and thin footwear.

The final diagnosis of overuse injury was made after an examination by the orthopaedic surgeon. Any doubtful conditions when diagnosing a case of overuse injuries were clarified by MRI/CT/X-Ray examination. The study tools comprised a pre-designed, pretested questionnaire which consisted of three sections, namely, section A (socio-demographic characteristics), section B (sports-related questions) and section C (contributing factors relating to overuse injury) and a proforma for recording clinical findings from symptomatic students. The screening questionnaire comprising sections A, B and C, as specified above, and the proforma was used among students having symptomatic/suspected overuse injury. The study tool was validated only by content and face validity by the experts of PMR and the Orthopaedic department from RIMS and Jawaharlal Nehru Institute of Medical Sciences (JNIMS), Imphal, Manipur. Based on their recommendation, necessary changes were made. Pretesting of the questionnaire was done among 50 students between 7 and 15 yr of age studying in one of the selected schools in the Imphal East district (not included in the actual research setting). Study variables such as age, sex, location (hill or plain, rural/urban), types of sports or activity, mode of transport to the school, duration and frequency of the activities, types of overuse injury, X-ray/imaging findings (CT scan and MRI scan) were collected. An interview schedule using a pretested questionnaire was formed by the investigators for screening the students, after which another proforma was used among students with suspected overuse injuries for final diagnosis. The orthopaedic surgeon collected detailed clinical records in this regard. The investigators interviewed all the eligible students in their local language using the screening questionnaire. Then, all the investigators again screened the filled-in questionnaires to identify students who might be suffering from overuse injuries. A day was fixed for health check-ups after consultation with the school authorities and symptomatic students were examined physically by an orthopaedic surgeon to determine the nature of overuse injury. The details were entered in the proforma and necessary investigations were carried out whenever needed and recorded in the proforma. The same orthopaedic surgeon examined all the suspected students to exclude observer bias.

Statistical analysis: The data collected were first entered in Microsoft Excel, and data cleaning and analysis were done using the Statistical Package for the Social Sciences (SPSS Inc. SPSS, Version 21, IBM Corp., Armonk, NY, USA). Descriptive statistics such as mean, median, standard deviation, frequency, and percentages were used. Analytical statistics such as the Chi-square test were used to test the significance level, and a probability value (P) < 0.05 was considered as statistically significant.

Results

In the present study, 3,600 students participated. Participants consisted of males (1760, 48.89%) and females (1840, 51.11%) with a median age of 14 yr (Table I). The overall prevalence of overuse injury was 14.39 per cent (95% Cl: 13.26–15.58) among the students, which was highest in Imphal West (260, 50.19%), followed by Ukhrul district (135, 26.06%) and among male students (275, 53.09%). In this study, the commonest overuse injuries were of the lower extremities (233, 44.98%, 95% Cl: 40.64–49.38) followed by that of upper extremities (144, 27.8%, 95%

Table I. Table showing socio-demographic characteristics of the study participants (n=3600)

Sociodemographic characteristics	Number	%
Age (yr; median)	14	
7	39	1.08
8	61	1.69
9	97	2.69
10	127	3.53
11	158	4.39
12	397	11.04
13	573	15.92
14	921	25.58
15	1227	34.08
Districts		
Imphal West	1800	50
Bishnupur	900	25
Ukhrul	900	25
Gender		
Male	1760	48.89
Female	1840	51.11

Cl: 23.98–31.87) and back pain (141, 27.22%, 95% Cl: 23.43–31.27). The overall distribution of the types of overuse injuries among the students is presented in Figure.

District- and gender-wise distribution of overuse injuries showed that lower extremity injuries were observed in Bishnupur district (61, 49.59%) and among male students (125, 45.45%). In contrast, upper extremity injury was more prevalent in Imphal West district (82, 31.54%). Regarding back pain, it was found to be more prevalent in Ukhrul district (51, 37.78%) and among female students (77, 31.69%). Among the lower extremity injuries, the predominant identified type was chondromalacia patellae (68, 29.18%) and shin splint (56, 24.03%). Regarding the upper extremity injuries, most had neck and arm pain (117, 81.25%) (Tables II and III). Common types of overuse injuries among the districts were neck and arm pain (Ukhrul-24, 85.71%; Imphal West-65, 79.27%; Bishnupur-28, 82.35%), and back pain (Ukhrul- 51, 37.78%; Imphal West- 62, 23.85%; Bishnupur-28, 22.76%). Shin splint was found to be more prevalent in Ukhrul district (22, 39.29%) and among boys (38, 30.4%), whereas chondromalacia patellae was observed more in Imphal West (46, 39.65%) and among girls (42, 38.89%); Tables II and III.

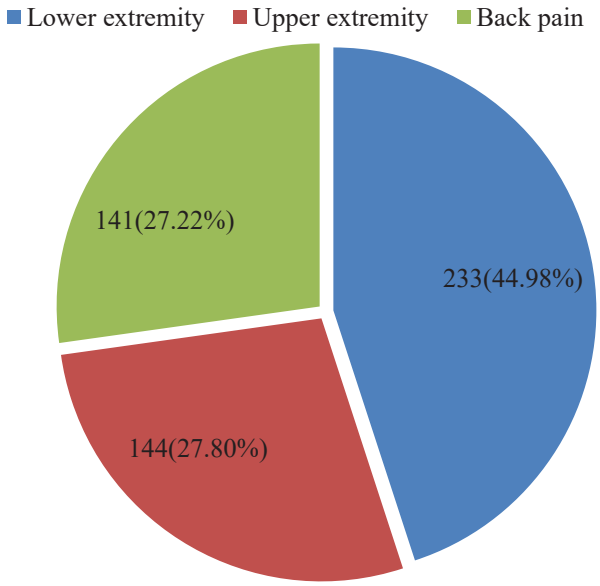

Figure. Pie chart showing overall distribution of the types of overused injuries among the students (n=518).

No statistically significant difference was found in the prevalence of overuse injury between the valley, represented by Imphal and Bishnupur districts and the hilly district (Ukhrul) of Manipur, and also between urban and rural areas of Manipur (P>0.05); Table IV.

Common contributing factors to overuse injuries were *(a)* long-term use of poor ergonomic furniture, *(b)* mobile phone addiction, *(c)* overtraining, *(d)* bad road conditions, hilly terrain, poor condition of the training field and *(e)* poor-quality footwear. The majority (44.44%) from Ukhrul followed by Bishnupur (35.77%) and female students compared to males (37.86 *vs*. 32.36%), reported prolonged sitting on poor ergonomic furniture as an associated factor. Regarding mobile phone and computer addiction, the majority from Imphal West (32.1%) followed by Bishnupur (26.83%) and male students compared to females (28.73 *vs*. 26.35%) reported such practices. Forty-four students (16.92%) from Imphal West reported overtraining and 25 students (18.52%) from Ukhrul district cited bad road conditions, hilly terrain and poor condition of the training field as the factors associated with overuse injuries (Table V).

Discussion

Recent data indicate that 17.4 to 50 per cent of all paediatric sports injuries are due to overuse[2-5]. However, in our study, the overall prevalence of overuse injury

Table II. Table showing overall prevalence of overused injuries and district-wise distribution of overused injuries among students (n=518)

Types of overused injuries	Overall (n=518), n(%)	District, n(%)		
		Imphal West (n=260)	Bishnupur (n=123)	Ukhrul (n=135)
Prevalence (95% CI)	14.39 (13.26–15.58)	50.19	23.75	26.06
A. Lower extremity	233(44.98%) (40.64–49.38)	116(44.62) 46(39.65)	61(49.59) 14(22.95)	56(41.48) 8(14.29)
Chondromalacia patellae	68 (29.18)	46(39.65)	14(22.95)	8(14.29)
Shin splint	56 (24.03)	16 (13.79)	18 (29.51)	22 (39.29)
Metatarsalgia (Forefoot pain)	28(12.02)	13 (11.21)	6 (9.84)	9 (16.07)
Pes planus	24 (10.30)	14 (12.07)	6 (9.84)	4 (7.14)
Achilles tendinitis	8 (3.43)	4 (3.45)	3 (4.92)	1 (1.78)
Osgood-Schlatter disease	7 (3)	4 (3.45)	2 (3.28)	1 (1.78)
Retrocalcaneal bursitis	8 (3.43)	3 (2.59)	3 (4.92)	2 (3.57)
Planter fasciitis (heel pain)	16 (6.87)	7 (6.03)	4 (6.56)	5 (8.93)
Patellar tendinopathy	13(5.58)	6(5.17)	4(6.56)	3(5.36)
Sever's disease	5 (2.15)	3 (2.59)	1 (1.64)	1 (1.78)
B. Upper extremity	144(27.8) (23.98–31.87)	82(31.54)	34(27.64)	28(20.74)
Neck and arm pain	117 (81.25)	65 (79.27)	28 (82.35)	24 (85.71)
Tennis elbow	13 (9.03)	7 (8.54)	4 (11.76)	2 (7.14)
Rotator cuff injury/shoulder impingement syndrome	12 (8.33)	8 (9.76)	2 (5.88)	2 (7.14)
Carpal tunnel syndrome	2 (1.38) 141 (27.22)	2 (2.43)	0	0
C. Back pain	(23.43–31.27)	62(23.85)	28(22.76)	51(37.78)

CI, confidence interval

Table III. Table showing gender-wise distribution of overuse injuries among students (n=518)

Types of overuse injuries	Gender, n(%)	
	Males (n=275)	Females (n=243)
Prevalence (95% CI)	53.09 (48.69–57.45)	46.91 (42.55–51.31)
A. Lower extremity	125 (45.45)	108 (44.44)
Chondromalacia patellae	26 (20.8)	42 (38.89)
Shin splint	38 (30.4)	18 (16.67)
Metatarsalgia (Forefoot pain)	12 (9.6)	16 (14.81)
Pes planus	13 (10.4)	11 (10.19)
Achilles tendinitis	5 (4)	3 (2.78)
Osgood-Schlatter disease	7 (5.6)	0
Retrocalcaneal bursitis	3 (2.4)	5 (4.63)
Planter fasciitis (heel pain)	7 (5.6)	9 (8.33)
Patellar tendinopathy	9(7.2)	4(3.7)
Sever's disease	5 (4.)	0
B. Upper extremity	86 (31.28)	58 (23.87)
Neck and arm pain	69 (80.23)	48 (82.76)
Tennis elbow	9 (10.47)	4 (6.9)
Rotator cuff injury/Shoulder impingement syndrome	8 (9.3)	4 (6.9)
Carpal tunnel syndrome	0	2 (3.44)
Back pain	64(23.27)	77(31.69)

Table IV. Table showing an association between valley and hilly districts and urban and rural districts regarding overuse injuries among students

District	Overuse injuries n (%)		Chi-square statistic	*P* value
	Yes	No		
Valley (Imphal+Bishnupur)	383 (14.19)	2317(85.81)	0.3638	0.546
Hill (Ukhrul)	135(15.0)	765(85)		
Urban (Imphal)	260 (14.44)	1540(85.56)	0.2982	0.585
Rural (Bishnupur)	123(13.67)	777(86.33)		

Table V. Table showing district- and gender-wise distribution of factors contributing to overuse injuries among students

Contributing factors	n(%)				
	District			Gender	
	Imphal West (n=260)	Bishnupur (n=123)	Ukhrul (n=135)	Males (n=275)	Females (n=243)
Prolong sitting on poor ergonomic furniture	77(29.62)	44(35.77)	60(44.44)	89 (32.36)	92 (37.86)
Mobile phone and computer addiction	84(32.1)	33(26.83)	26(19.26)	79 (28.73)	64 (26.35)
Overtraining	44(16.92)	18(14.63)	16(11.85)	50 (18.18)	28 (11.52)
Bad road condition/hilly terrain/training field	37(14.23)	21(17.07)	25(18.52)	41 (14.91)	42 (17.28)
Poor-quality foot wear	-	-	-	16 (5.82)	17 (6.99)

was comparatively less; 14.39 per cent (95% Cl: 13.26–15.58) among the students. Similarly, in a study among 5-17 yr age groups, a greater proportion of the older children (13–17 yr) were treated for overuse injuries, as compared with their younger counterparts (54.4 *vs.* 49.2%, respectively)[14].

In a study[3] of children aged 5 to 17 yr who presented to a sports injury clinic in South Africa, 49.5 per cent of 394 sports injuries were classified as overuse, with boys and girls displaying a similar frequency. However, in the present study, male students (275, 53.09%) sustained more overuse injuries than female students (243, 46.91%). Studies conducted by Stracciolini *et al*[15] and Cassel *et al*[16] reported females sustained more overuse injuries versus males (63 & 60%, respectively). This difference in the prevalence of overuse injuries and distribution between males and females could be due to differences in the study setting, study population or types of sports/physical activity involved. In our study, we included all school students, regardless of whether they engaged in organized sports. This finding showed that the distribution of injuries is not uniform among male and female students and may be attributed to the types of sports or physical activity they are engaged in.

A study by Bergeron *et al*[6] reported that most (61%) of the overuse injuries involved lower extremities. A study by Cassel *et al*[16] found that 41 per cent of overuse injuries were predominantly observed at the lower extremities. Similarly, another study reported that 73 per cent of the overuse injuries were in lower limbs, and knee injuries accounted for a much greater proportion of overuse injuries, followed by ankle injuries[2]. A study[17] among 302 high school athletes aged 13-18 yr showed that a significant proportion of them were more likely to have overuse knee injuries (OR 2.93, 95% Cl: 1.16–7.36, *P*=0.018). Another study[18] among 2,011 participants aged 12-18 yr reported lower extremity overuse injury (*P*=0.001, OR 1.66; 95% Cl: 1.22-2.3). Their findings are found to be consistent with the present study, where the majority of the students (44.98%) had overuse injuries to the lower extremity and the majority had chondromalacia patellae followed by shin splints among them. This high prevalence of chondromalacia patellae observed among students may be explained by customary floor-level activities of daily living, use of multi-level stairs in schools and home settings, running on metallic roads, bad road conditions, mobility in hilly terrains and using poor-quality shoes. The same explanation applies to shin

splints with the addition of overtraining. In the present study, neck and arm pain constituted the majority of upper extremity injuries, followed by elbow injury (tennis elbow). However, in a study, a majority of the upper limb injuries were to the shoulder, followed by the elbow and wrist. Overuse injuries common due to sporting activities like Osgood-Schlatter disease (7, 3%), Sever's disease (5, 2.15%), patellar tendinopathy (13, 5.58%), Achilles tendinitis (8, 3.43%), tennis elbow (13, 9.03%), bursitis (8, 3.43%), *etc*., were found to be uncommon among school children in the present study. This important finding may be explained by students not finding time for play activities due to greater engagement with multiple academic tuitions. The lack of playgrounds in the school and even the locality is another challenging issue. Furthermore, the pattern of overuse injuries seen in teens may be because they spend too much time using mobile phones, computers and other electronic devices. This could be the reason why we see a paradigm shift in the pattern of overuse injuries where more musculoskeletal problems caused by long-term mobile and computer use, like neck and arm pain (117, 81.25%) and back pain (141, 27.22%) are overshadowing sports-related overuse injuries. What is alarming is the prevalence of back pain among school children. Long-term use of ergonomically poor furniture at school and home during the fast-growing phase could be an important contributing factor over and above the habitual use of mobile phones. Similarly, mobility in hilly terrain and using multi-level steps for transport in the Ukhrul district may contribute to shin splints. The high prevalence of neck and arm pain in Imphal West district is possibly due to mobile addiction among students and chondromalacia patellae due to the use of multi-level stairs in schools and home settings, training on the metallic road, bad road conditions and using poor-quality shoes. Our study had some limitations, such as the adoption of the convenience sampling method and contributory factors of overuse injuries were assessed subjectively by the students only. However, some of the contributory factors, such as poor ergonomic furniture, bad road/hilly terrain/multi-level steps, *etc*., could be easily assessed objectively by just exploring the school classrooms and premises and the surrounding topography. Therefore, these contributory factors are important to address as they would offer opportunities for future research.

The overall prevalence of overuse injury was 14.39 per cent among the students and was highest in the Imphal West district and among male students. Though the lower extremity is the most common site for overuse injuries, we observed a paradigm shift as back pain and neck and arm pain are increasing among the students. These are important public health concerns and merit immediate attention, as well as the development of innovative interventions, including health education and appropriate regulations. The main focus should be on the improvement of the ergonomics of the students' furnitures in schools through regulatory monitoring and implementation and home settings. Other measures should include health education to regulate the long-term use of mobiles, computers and other electronic devices by the students. Improvement in training methodology is also suggested to prevent faulty or overtraining of children.

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For correspondence: Dr Akoijam Joy Singh, Department of Physical Medicine & Rehabilitation, Regional Institute of Medical Sciences, Imphal 795 004, Manipur, India
e-mail: joyakoijam2@yahoo.com