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Musculoskeletal discomforts and backpack carriage among school children in Bangladesh

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Abstract

Background: There has been a growing concern on the musculoskeletal discomforts associated with heavy backpack carriage on health among school children who are at an important stage of growth and development. Class-based learning has pushed students to carrying heavy backpacks hence leaving them exposed to musculoskeletal problems.

Objective: The aim of this study was to assess the musculoskeletal discomforts and backpack carriage among school children in Bangladesh.

Methods: A descriptive cross-sectional study was conducted by convenience sampling technique among 171 school children class five to seven at Uttam School and College in Rangpur, Bangladesh. This study was approved from the IRB, NIANER. Data was collected from February to March, 2022 by using self-administered structured and previously validated questionnaires. (1) Demographic data questionnaires consisting of two parts- Children and backpack related questionnaires, (2) Nordic Musculoskeletal Discomfort Questionnaires. Data were analyzed by using descriptive statistics including frequency, percentage, mean, standard deviation and Pearson Chi-Square test.

Results: Results showed that the mean age was 12.09 year (SD=1.12). Majorities (54.4%) of the students were female and 45.6% were male. The mean weight of backpack was 5.32 kg (SD=.98). The results indicated that 95.3% of the students carried backpacks weighing more than 10% and only 4.7% carried backpacks weighing less than 10% of their body weight. Neck musculoskeletal discomforts were the most common for the 12-month (164; 95.5%) period. Findings also reveal that backpack weight percentage and musculoskeletal discomforts were statistically highly significant relationship respectively neck (χ^2=9.243, p=.002), shoulder (χ^2=27.947, p=.000), upper back (χ^2=24.088, p=.000), elbow (χ^2=8.692, p=.00 3), wrist (χ^2=8.898, p=.003), lower back (χ^2=41.095, p=.000), hips (χ^2=7.553, p=.007), knees(χ^2=7.058, p=.008) and ankles (χ^2=11.001, p=.001).

Conclusion: The study findings provide the first insights into backpack use and act as a baseline data for nurses to develop appropriate awareness to reduce the musculoskeletal discomforts related to backpack carriage among school children in Bangladesh. Further study is recommended to identify the factors related to musculoskeletal discomforts associated with backpack carriage among diverse school children.

Keywords: Backpack carriage, musculoskeletal discomforts, school children

Introduction

Introduction

Carrying a backpack is common practice among school children (Ismaila, 2018) [16]. Nowadays, nearly 90% of school children in developed countries carry a backpack (Drzal Grabiec *et al*., 2015) [13]. The World Health Organization recommends that backpack weight does not exceed 10% of the child's weight (Kuai, Liu, Ji, & Zhou, 2017) [25]. Backpack carriage among school children is a topic of growing research and public health interest (Abaraogu *et al*., 2020) [1]. Long duration of backpack carrying might lead to Musculoskeletal Disorders or Discomforts (MSDs) among school children (Kananikandeh & Safieh, 2020) [17]. Students carry heavy backpacks weighing beyond the recommended safe limits of 10-15% of their body weight and this has potential consequences such as musculoskeletal discomforts (MSDs) i.e. lower and upper back pain, shoulder pain and neck pain (Rai & Agarawal, 2013; Chalise, Sherpa, Bharati, & Ambu, 2020) [31, 5].

Musculoskeletal discomforts occur due to repetitive injury to musculoskeletal system. It primarily affects muscles and tendons and causes secondary damage to nerves and joints in the neck, upper back, shoulders, arms, and hands (Kistner, Fiebert, Roach, & Moore, 2013; Hadziomerovic *et al*., 2018) [22, 14]. In recent years, musculoskeletal discomforts an increase complaint among school students has been reported (Koohpaei *et al*., 2017) [23]. Presence of musculoskeletal pain (including neck/ shoulder pain) in

childhood can be an important factor for the occurrence of these pains in adulthood (Dianat, Alipour, & Asgari, 2018) [9].
The overall lifetime prevalence of musculoskeletal discomforts among school children in developed countries ranges from 16 to 86% and in developing countries these figures are higher, ranging from 46.3 to 88.8% (Delele, Janakiraman, Abebe, Tafese, & van de Water, 2018) [7]. Approximately 86% of the children reported some kind of musculoskeletal discomforts. The occurrence of shoulder, wrists/ hands, and low back pain among school children was 70%, 18.5% and 8.7%, respectively (Dianat, Javadivala, & Allahverdipour, 2011) [11]. A study conducted in Ireland found that prevalence of musculoskeletal discomfortswas as high as 63.4% on student of mean age 10.6, where backpack related discomforts was onthe shoulders 27.3% than onthe back 15% (Dockrell, Ciaran & Blake, 2015) [12]. Dianat and Karimi, (2014) [8] in Iran reported that musculoskeletal discomforts were in neck (36.4%), shoulders (34.2%), low back (29.6%), upper back (21.7%) and wrists/ hands (19.5%). Recent studies confirmed high prevalence rate (10% to 40% depending upon back pain definitionand age) of back painamong students in manycountries like New Zealand, United Kingdom, Italy, America, Finland and Switzerland (Mathur, Desai, & Khan, 2017) [26]. An Indian study reported that 10%-30% of healthy children experience back pain, especially low back pain, by their teenage years (Balamurugan, 2014) [3]. Sharmin Zaman Jyoti (2016) reported that 'In Bangladesh, 80% of school children regularly carry backpack that are up to 20 percent oftheir body weight on their back' and Corraya, (2017) [6] found that 83.62% carried backpack weight more than 10% of their body weight.

Backpack carriage has been reported to be a common cause of musculoskeletal discomforts and school students habit ually use backpack. In Bangladesh, there is very limited study on the issues of musculoskeletal discomforts and backpack carriage among school children. Research in this area may promote health programs and policy for mulation aimed at reducing the burden of backpack related discomforts among school children in Bangladesh. Thus, there is a need to do such study in our country context. Therefore, the researcher is intended to conduct this study to assess the musculoskeletal discomforts and their association with backpack carriage among school children in context of Bangladeshi cultures. The findings of the study may provide message for the nurses in Bangladesh as well as the entire nurse over the world that help school students to reduce the risk of musculoskeletal discomforts related to backpack carriage. Also act as a baseline data for school health nurses as well as overall nurse to develop an appropriate awareness to reduce the musculoskeletal discomforts of backpack carriage among the school children.

Methods

StudyDesign

A Descriptive cross-sectional study design was conducted to assess the musculoskeletal discomforts and backpack carriage among school children in Bangladesh. The study was conducted from July 2021 to June 2022.

Study Participants: The study population was all school children at Uttam School and College, Sadar, Rangpur. The total student of this school is about 1000; among them 500 students read in class five to seven. The study participants of this study were estimated by using 'G'power analysis withthe accepted significant level (α) 0.05, anexpected power 0.80 (1-β) and an effect size 0.20 as near the medium effect size of the study. Actual sample size was 150 and considering 10% attrition rate, estimated sample size was 171. A convenience sample technique was used to select the participants. The inclusion criteria: (1) School childrenaged from10 to 14 years old; (2) studying inclass fiveto seven; (3) Those parents or guardian willing to allow them to participate in this study by signing an informed consent form and (4) The children who are physically fit and able to carry backpack. The Exclusion criteria: School children with any neurological and musculoskeletal deformity were excluded from this study.

Instruments

The instruments are divided into two sections. Section I Demographic Data Questionnaires (DDQ), and Section II Nordic Musculoskeletal Discomfort Questionnaires (NMDQ). These instruments are described in detail below-

Section I: The Demographic Data Questionnaires: The Demographic Data Questionnaires was designed by the researcher based on the literature review. It was divided into two parts. Part-1 Children related questionnaires consist of 6 items student's age, sex, weight, height, class and previous health history. Part-2 Backpack related questionnaires consist 7 items (weight of backpack, carrying method of backpack, duration of backpack carriage etc.). Part- 2 questionnaires were validated by the field of three panels of experts in the field of nursing expert.

Section II: Nordic Musculoskeletal Discomfort Questionnaires (NMDQ): A previously validated 4 items NMDQ which was developed byNordic Council of Ministers (Kuorinka *et al*., 1987) will be used. NMDQ is a questionnaire which contains sets of questions alongs idea body map drawing indicating musculoskeletalpains, discomforts or aches in specific regions of the body. This questionnaire consists of 4 items with 9 areas of body. Respondents will be asked to answer the question with yes/no response. Higher score of yes indicates increase intensity of pain or discomforts in defined area. NMDQ is not for diagnostic purpose, it is only used for screening purpose. The NMDQ tool used in the study particularly focused on musculoskeletal pain or discomforts related to backpack use. The internal consistency and reliability of the NMDQ in previous study was yielded at Cronbach's alpha value of 0.83 (Gupta, Bhavana, & Rishikesh, 2018). This is an open access questionnaire.

Data Collection Methods

The study was approved from Institutional Review Board (IRB) at National Institute of Advanced Nursing Education and Research (NIANER), (IRB NO. Exp. NIA-S-2020/ 108). Request letter was taken from the National Institute of

Advanced Nursing Education and Research (NIANER), Mugda, Dhaka, Bangladesh. The researcher was explained the study objectives, benefits and methods of data collection to the authority of selected school and received permission for data collection. Data collection was conducted bythe researcher with the help of school teacher. After obtaining permission from school head teacher and signing written informed consents forms by the school children and their guardians, data was collected from February to March, 2022. Questionnaires were distributed to an individual participant. Participants were informed about how to fill up the questionnaires without consulting and sharing others. The researcher was checked the questionnaires to ensure that they were properly completed. They were ensured that they have right to withdraw themselves from the study at any time without any penalty. It was taken 30 minutes to complete the questionnaires. Anonymity and confidentiality of the respondents were strictly maintained.

Data Analysis

Data were analyzed by using statistics Package for Social Science (SPSS) version 21. Descriptive statistics data such as frequency, percentage, mean and standard deviation were used for analyzing the demographic characteristics of the participants. Inferential statistics Pearson's Chi-Square test was used to examine the relationship between demographic characteristics and musculoskeletal discomforts among the school children in Bangladesh.

Results

Demographic Characteristics of the School Children

Table 1 shows that distribution of the frequency, percentage, mean and standard deviation of the demographic characteristics ofthe school children. The results revealed that the meanage was 12.09 (SD=1.12). Majorities (54.4%) of the students were female and 45.6% were male. Most of the students 67.8% were read in class six and seven, 32.2% students read in class five. The mean weight of the students was 40.83 (SD=6.76). More than half of the students (55.6%) weight was less than 40 kg and 44.4% student's weight were 40 kg and more. The mean height was 149.5 (SD=7.43). Maximum students (63.2%) height was 149 cmand more and 36.8% student's weight was less than 149 cm. Majority of the students 88.3% were no previous medical problem and few students 11.7% were previous medical problem.

Table 1: Distribution of Demographic Characteristics of the School Children

Variable	Categories	n	%	M(SD)
Age	Min-------Maxi: 10-14 years			12.09(1.12)
	Less than 12	109	63.7	
	12 and more	62	36.3	
Gender	Male	78	45.6	
	Female	93	54.4	
Class	Class 5-----Class 7			
	Class 5	55	32.2	
	Class 6 and more	116	67.8	
Weight	Min-------Maxi: 28-70 kg			40.83(6.76)
	Less than 40	95	55.6	
	40 and more	76	44.4	
Height	Min-------Maxi: 124-176 cm			149.5(7.43)
	Less than 149	63	36.8	
	149 and more	108	63.2	
Previous medical Problem	Yes	20	11.7	
	No	151	88.3	

Backpack Related Characteristics

Table 2 shows distribution of Backpack related characteristics of the school children's. The mean weight of backpack was 5.32 (SD=.98). Weight of backpack (57.3%)was less than 5kg and 42.7% was 5 kg and more. The results indicated that 95.3 % of the students carried backpacks weighing more than 10% and only 4.7% carried backpacks weighing less than10%oftheirbodyweight. Results shows that 73.1%studentswalk to school and about 26.9% of students use other method (e.g. motorbike, walking + bus, walking + bicycle). Half of the students (50.9%) take 16 minutes and more to get to school and 49.1% of students take less than equal 15 minutes to reach school. Among 171 students, 54.4% wore the backpacks on the body over one shoulder while 45.6% carried the backpack using other carrying methods. Most of the students (92.4%) students declared that backpack felt heavy and only 7.6% did not feel that backpack was heavy. The proportion of students who did not take a break from carrying backpack was high (74.9%) andonly25.1% student's take break. Students who were take break among them 22.8% students' take break 2 minutes and more. Very few 3.5% students take break less than 2 minutes. Majority of the students (72.5%) climbing upstairs and down while going to school and 81.9% students carried their backpack by self.

Table 2: Distribution of Back pack usage by the school children (N=171)

Variable	Categories	n	%	M(SD)
Weight of Backpack	Min-------Maxi: 3-7 kg			5.32(.98)
	Less than 5 kg	98	57.3	
	5 kg and more	73	42.7	
Backpack weight (%)	Less than 10%	8	4.7	
	10% and more	163	95.3	
Mode of transportation	Walking	125	73.1	
	Others	46	26.9	
Time taken to travel to/from school	Less than equal 15 min	84	49.1	
	16 min and more	87	50.9	
Method of backpack carriage	On one shoulder	93	54.4	
	Others	78	45.6	
Backpack is heavy	Yes	158	92.4	
	No	13	7.6	
Take a break from carrying the backpack	Yes	43	25.1	
	No	128	74.9	
Break time during carrying backpack	Less than 2 min	6	3.5	
	2 min and more	39	22.8	
Climbing upstairs and down	Yes	47	27.5	
	No	124	72.5	
Parents or anybody help carry backpack	Yes	31	18.1	
	No	140	81.9	

Musculoskeletal Discomforts among the School Children

Table 3 shows that distribution of frequency and percentage of musculoskeletal discomforts of the school children. Results showed that prevalence of musculoskeletal discomforts were Neck (95.9%), Shoulder (90.6%), Upper back (80.1%), Elbow (50.9%), Wrist/ hands (51.5%), Lower back (83%), Hips/ Thighs (47.4%), Knees (67.8%), Ankles/ Feet (56.7%). Neck musculoskeletal discomforts were the most common for the 12-month prevalence (164; 95.5%), whereas the hips were the least reported in the last 12 months (hips: 81, 47.4%) prevalence.

Table 3: Month's prevalence of musculoskeletal discomforts among the school children (N=171)

Variables	12-months prevalence musculoskeletal discomforts			
	Yes		No	
	n	%	n	%
Neck	164	95.9	7	4.1
Shoulders	155	90.6	16	9.4
Upper back	137	80.1	34	19.9
Elbow	87	50.9	84	49.1
Wrist/hands	88	51.5	83	48.5
Lower back	142	83	29	17
Hip/Thighs	81	47.4	90	52.6
Knees	116	67.8	55	32.2
Ankles/Feet	97	56.7	74	43.3

Relationship between demographic characteristics, Backpack characteristics and musculoskeletal discomforts among the school children

Table 4 showed that there was a significant relationship between age and musculoskeletal discomforts (χ^2=3.907, p=.048). Age less than 12 years found more neck discomforts compared with age more than 12 years. Concerning gender students reported neck (χ^2=6.122, p=.048), shoulder (χ^2=5.135, p=.023), wrist (χ^2=4.441, p=.035), and lower back (χ^2=4.575, p=.032) discomforts. In relation to class, results showed that there was a significant relationship between class and upper back (χ^2=4.099, p=.043), knees (χ^2=14.038, p=.000), and ankles (χ^2=6.645, p=.010) discomforts. However, the other variable is non-significant.

Table 4: Relationship between demographic characteristics and musculoskeletal discomforts among the school children

Sl Variable	Neck			Shoulder			Upper Back			Elbow			Wrist/Hand			Lower Back			Hips/ Thighs			Knees			Ankles/feet		
	Yes	No		Yes	No		Yes	No			Yes	No		Yes	No		Yes	No				Yes	No		Yes	No		Yes
	n	n	z^2	n	n	z^2	n	n	z^2		n	n	z^2	n	n	z^2	n	n	z^2			n	n	z^2	n	n	z^2	n
	(%)	(%)	(P)	(%)	(%)	(P)	(%)	(%)	(P)		(%)	(%)	(P)	(%)	(%)	(P)	(%)	(%)	(P)			(%)	(%)	(P)	(%)	(%)	(P)	(%)
1. Age																												
Lessthan12	107	2	3.907	99	10	0.012	86	23	0.280	59	50	1.272	58	51	.368	92	17	.396	52	57	.014	77	32	1.085	61	48	0.71
	(98.2)	(1.8)	**(0.048)**	(90.8)	(9.2)	(0.914)	(78.9)	(21.1)	(0.597)	(54.1)	(45.9)	(0.259)	(53.2)	(46.8)	(0.544)	(84.4)	(15.6)	(0.529)	(47.7)	(52.3)	(0.907)	(70.6)	(29.4)	(0.298)	(56)	(44)	(0.79)
12andmore	57	5		56	6		51	11		28	34		30	32		50	12		29	33		39	23		36	26	
	(91.9)	(8.1)		(90.3)	(9.7)		(82.3)	(17.7)		(31.5)	(30.5)		(48.4)	(51.6)		(80.6)	(19.4)		(29.4)	(53.2)		(62.9)	(37.1)		(58.1)	(41.9)	
2. Gender																												
Male	78	0	6.122	75	3	5.135	66	12	1.822	45	33	2.665	47	31	4.441	70	8	4.575	43	35	3.464	56	22	1.030	49	29	2.171
	(100)	(0)	**(0.013)**	(96.2)	(3.8)	**(0.023)**	(84.6)	(15.4)	(.177)	(57.7)	(42.3)	(.103)	(60.3)	(39.7)	**(.035)**	(89.7)	(10.3)	**(.032)**	(55.1)	(44.9)	(0.063)	(71.8)	(28.2)	(.310)	(62.8)	(37.2)	(.1412)
Female	86	7		80	13		71	22		42	51		41	52		72	21		38	55		60	33		48	45	
	(92.5)	(7.5)		(86)	(14)		(76.3)	(23.75)		(47.3)	(45.7)		(44.1)	(55.9)		(77.4)	(22.6)		(40.9)	(59.1)		(64.5)	(35.5)		(51.6)	(48.4)	
3. Class																												
Class-5	55	0	3.461	53	2	3.128	49	6	4.099	35	20	5.281	34	21	3.481	50	5	3.564	32	23	3.803	48	7	14.038	39	16	6.645
	(100)	(0)	(0.063)	(96.4)	(3.6)	(0.077)	(89.1)	(10.9)	**(0.043)**	(63.6)	(36.4)	**(0.022)**	(61.8)	(38.2)	(0.062)	(90.9)	(9.1)	(0.059)	(58.2)	(41.8)	(0.051)	(87.3)	(12.7)	**(.000)**	(70.9)	(29.1)	**(0.01)**
Class-6&7	109	7		102	14		88	28		52	64		54	62		92	24		49	67		68	48		58	58	
	(94)	(6)		(87.9)	(12.2)		(75.9)	(24.1)		(44.8)	(55.2)		(46.6)	(53.4)		(79.3)	(20.7)		(42.2)	(57.8)		(58.6)	(41.4)		(50)	(50)	
4. Weight																												
Lessthan40	93	2	2.152	88	7	.996	77	18	.117	53	42	2.064	50	45	.117	83	12	2.842	43	52	.380	68	27	1.372	54	41	.001
	(97.9)	(2.1)	(0.142)	(92.6)	(7.4)	(0.318)	(81.1)	(18.9)	(0.732)	(55.8)	(44.2)	(.151)	(52.6)	(47.4)	(0.732)	(87.4)	(12.6)	(0.092)	(45.3)	(54.7)	(0.538)	(71.6)	(28.4)	(0.241)	(56.8)	(43.2)	(.972)
40andmore	71	5		67	9		60	16		34	42		38	38		59	17		38	38		48	28		43	33	
	(93.4)	(6.6)		(88.2)	(11.8)		(78.9)	(21.1)		(44.7)	(55.3)		(50)	(50)		(77.6)	(22.4)		(50)	(50)		(63.2)	(36.8)		(56.6)	(43.4)	
5. Height																												
Lessthan149	61	2	.215	56	7	362	49	14	.343	30	33	.424	31	32	.203	54	9	.506	27	36	.814	41	22	.347	31	32	2.297
	(96.8)	(3.2)	(0.643)	(88.9)	(11.1)	(0.547)	(77.8)	(22.2)	(0.558)	(47.6)	(52.4)	(0.515)	(49.2)	(50.8)	(0.652)	(85.7)	(14.3)	**(0.477)**	(42.9)	(57.1)	(0.367)	(65.1)	(34.9)	(0.0556)	(49.2)	(50.8)	(0.13)
149and more	103	5		99	9		88	20		57	51		57	51		88	20		54	54		75	33		66	42	
	(95.4)	(4.6)		(91.7)	(8.3)		(81.5)	(18.5)		(52.4)	(47.2)		(52.8)	(47.2)		(81.5)	(18.5)		(50)	(50)		(69.4)	(30.6)		(61.1)	(38.9)	
6. Previous medical problem such as fracture or surgery																												
Yes	20	0	.967	20	0	2.338	14	6	1.455	11	9	.154	10	10	0.19	15	5	1.040	7	13	1.390	15	5	.533	10	10	.417
	(100)	(0)	(0.325)	(100)	(0)	(0.126)	(70)	(30)	(0.228)	(55)	(45)	(0.695)	(50)	(50)	(0.889)	(75)	(25)	(0.308)	(35)	(65)	(0.238)	(75)	(25)	(0.465)	(50)	(50)	(0.518)
No	144	7		135	16		123	28		76	75		78	73		127	24		74	77		101	50		87	64	
	(95.4)	(4.6)		(89.4)	(10.6)		(81.5)	(18.5)		(50)	(49.7)		(51.7)	(48.3)		(84.1)	(15.9)		(49)	(51)		(66.9)	(33.1)		(57.6)	(42.4)	

Relationship between backpack related characteristics and musculoskeletal discomforts among the school children

Table 5 showed that there was a significant relationship between weight of backpack and upper back discomforts (χ^2=4.563, p=.033). Findings also reveal that backpack weight percentage and musculoskeletal discomforts were statistically highly significant relationship respectively neck (χ^2=9.243, p=.002), shoulder (χ^2=27.947, p=.000), upper back (χ^2=24.088, p=.000) elbow (χ^2=8.692, p=.00 3), wrist (χ^2=8.898, p=.003), lower back (χ^2=41.095, p=.000), hips (χ^2=7.553, p=.007), knees(χ^2=7.058, p=.008) and ankles (χ^2=11.001, p=.001). Results also indicates that mode of transport and musculoskeletal discomforts (respectively upper back: χ^2=4.944, p=.030; wrist/hand: χ^2=6.392, p=.011; lower back: χ^2=4.868, p=.02; and knees χ^2=6.294, p=.012) were significant relationship. Similarly, carrying methods and musculoskeletal discomforts (knees: χ^2=5.428, p=.020; ankles χ^2=4.381, p=.036) were an association. In addition to backpack heaviness, there was a significant relationship between shoulder (χ^2=14.052, p=.000), wrist (χ^2=4.5538, p=.033) and ankles (χ^2=3.861, p=.049) discomforts. Also break taker and musculoskeletal discomforts were significant relationship respectively (neck: χ^2=3.970, p=.046; upper back: χ^2=3.863, p=.049; elbow: χ^2=9.796, p=.002; wrist: χ^2=10.365, p=.001; lower back: χ^2=13.106, p=.000), and hips (χ^2=6.766, p=.009). Results also showed that climbing up stairs and musculoskeletal discomforts (elbow: χ^2=7.679, p=.006; hand: χ^2=5.452, p=.020; hips: χ^2=8.984, p=.003 and ankles: χ^2=6.811, p=.009) were significant relationship. Similarly, anybody help or not while carrying backpack and elbow (χ^2=8.237, p=.004), knees (χ^2=6.438, p=.011) discomforts were significant and elbow (χ^2=8.237, p=.004), knees (χ^2=6.438, p=.011) discomforts were significant relationships. However, the other variable is non-significant.

Table 5: Relationship between backpack related characteristics and musculoskeletal discomforts among the school children

Sl Variable		Neck		Shoulder			Upper Back			Elbow			Wrist/Hand			Lower Back			Hips/Thighs			Knees			Ankles/feet		
	Yes	No		Yes	No		Yes	No		Yes	No		Yes	No		Yes	No		Yes	No		Yes	No		Yes	No	
	n	n	z^2	n	n	z^2	n	n	z^2	n	n	z^2	n	n	z^2	n	N	z^2	n	n	z^2	n	n	z^2	n	n	z^2
	(%)	(%)	(P)	(%)	(%)	(P)	(%)	(%)	(P)	(%)	(%)	(P)	(%)	(%)	(P)	(%)	(%)	(P)	(%)	(%)	(P)	(%)	(%)	(P)	(%)	(%)	(P)
1. Weight of backpack																											
Lessthan5kg	92	6	2.407	86	12	2.258	73	25	4.563	48	50	.31	47	51	1.128	78	20	1.939	44	54	.562	68	30	.253	55	43	.034
	(93.9)	(6.1)	(0.121)	(87.8)	(12.2)	(0.133)	(74.5)	(25.5)	**(0.033)**	(49)	(51)	(0.565)	(48)	(52)	(0.288)	(79.6)	(20.4)	(0.164)	(44.9)	(55.1)	(0.453)	(69.4)	(30.6)	(0.615)	(56.1)	(43.9)	(0.854)
5 kg and more	72	1		69	4		64	9		39	34		41	32		64	9		37	36		48	25		42	31	
	(98.6)	(1.4)		(94.5)	(5.5)		(87.7)	(12.3)		(53.4)	(46.6)		(56.2)	(43.8)		(87.7)	(12.3)		(50.7)	(49.3)		(65.8)	(34.2)		(57.5)	(42.5)	
2. Backpack weight%																											
Less than 10%	6	2	9.243	3	5	27.947	1	7	24.088	0	8	8.692	0	8	8.898	0	8	41.095	0	8	7.553	2	6	7.058	0	8	11.001
	(75)	(25)	**(0.002)**	(37.5)	(62.5)	**(.000)**	(12.5)	(87.5)	**(.000)**	(0)	(100)	**(.003)**	(0)	(100)	**(.003)**	(0)	(100)	**(.000)**	(0)	(100)	**(.007)**	(25)	(75)	**(.008)**	(0)	(100)	**(.001)**
10% and more	158	5		152	11		136	27		87	76		88	75		142	29		81	82		114	49		97	66	
	(96.9)	(3.1)		(93.3)	(6.7)		(83.4)	(16.6)		(53.4)	(46.6)		(54)	(46)		(83)	(17)		(49.7)	(50.3)		(69.9)	(30.1)		(59.5)	(40.5)	
3. Mode of Transport																											
Walking	118	7	2.686	110	15	3.828	95	30	4.994	57	68	5.178	57	68	6.392	99	26	4.868	54	71	3.239	78	47	6.294	67	58	1.849
	(94.4)	(5.6)	**(.101)**	(88)	(12)	**(.050)**	(76)	(24)	**(.030)**	(45.6)	(54.4)	**(.023)**	(45.6)	(54.4)	**(.011)**	(79.2)	(20.8)	**(.027)**	(43.2)	(56.8)	(.072)	(62.4)	(37.6)	**(.012)**	(53.6)	(46.4)	(.174)
Others	46	0		45	1		42	4		30	16		31	15		43	3		27	19		38	8		30	16	
	(100)	(0)		(97.8)	(2.2)		(91.3)	(8.7)		(65.2)	(34.8)		(67.4)	(32.6)		(93.5)	(6.5)		(58.7)	(41.3)		(82.6)	(17.4)		(65.2)	(34.8)	
4. Travel Time																											
Less than equal 15 min	80	4	.188	77	7	.204	66	18	.248	47	37	1.702	47	37	1.33	70	14	.010	41	43	.138	55	29	.421	49	35	.174
	(95.2)	(4.8)	**(.665)**	(91.7)	(8.3)	**(.652)**	(78.6)	(21.4)	(.619)	(56.0)	(44.0)	(.192)	(56.0)	(44.0)	(.248)	(83.3)	(16.7)	(.920)	(48.8)	(51.2)	(.711)	(65.5)	(34.5)	(.516)	(58.3)	(41.7)	(.677)
16 min and more	84	7		78	9		71	16		40	47		41	46		72	15		40	47		61	26		48	39	
	(96.6)	(3.4)		(89.7)	(10.3)		(81.6)	(18.4)		(46.0)	(54.0)		(47.1)	(52.9)		(82.8)	(17.2)		(46.0)	(54.0)		(70.1)	(29.9)		(55.2)	(44.8)	
5. Carrying Method																											

One Shoulder	90	3	.391	87	6	2.029	77	16	.918	44	49	1.037	45	48	.772	80	13	1.286	40	53	1.553	56	37	5.428	46	47	4.381
	(96.8)	(3.2)	(.532)	(93.5)	(6.5)	(.154)	(82.8)	(17.2)	(.338)	(47.3)	(52.7)	(.309)	(48.4)	(51.6)	(.380)	(86)	(14)	(.257)	(43)	(57)	(.213)	(60.2)	(39.8)	**(.020)**	(49.5)	(50.5)	**(.036)**
Others	74	4		68	10		60	18		43	35		43	35		62	16		41	37		60	18		51	27	
	(94.9)	(5.1)		(87.2)	(12.8)		(76.9)	(23.1)		(55.1)	(44.9)		(55.1)	(44.9)		(89.5)	(20.5)		(52.6)	(47.4)		(76.9)	(23.1)		(65.4)	(34.6)	
6. Backpack is heavy																											
Yes	152	6	.464	147	11	14.052	127	31	090	83	75	2.276	85	73	4.538	132	26	.374	78	80	3.330	110	48	3.032	93	65	3.861
	(96.2)	(3.8)	(.469)	(93)	(7)	**(.000)**	(80.4)	(19.6)	(.764)	(52.5)	(47.5)	(.131)	(53.8)	(46.2)	**(.033)**	(83.5)	(16.5)	(.541)	(49.4)	(50.6)	(.068)	(69.6)	(30.4)	(.082)	(58.9)	(41.1)	**(.049)**
No	12	1		8	5		10	3		4	9		3	10		10	3		3	10		6	7		4	9	
	(92.3)	(7.7)		(61.5)	(38.5)		(76.9)	(23.1)		(30.8)	(69.2)		(23.1)	(76.9)		(76.9)	(23.1)		(23.1)	(76.9)		(46.2)	(53.8)		(30.8)	(69.2)	
7. Take Break																											
Yes	39	4	3.970	38	5	.349	30	13	3.863	13	30	9.796	13	30	10.365	28	15	13.106	13	30	6.766	26	17	1.431	20	23	2.441
	(90.7)	(9.3)	**(.046)**	(88.4)	(11.6)	(.554)	(69.8)	(30.2)	**(.049)**	(30.2)	(69.8)	**(.002)**	(30.2)	(69.8)	**(.001)**	(65.1)	(34.9)	**(.000)**	(30.2)	(69.8)	**(.009)**	(60.5)	(39.5)	(.232)	(46.5)	(53.5)	(.118)
No	125	3		117	11		107	21		74	54		75	53		114	14		68	60		90	38		77	51	
	(97.7)	(2.3)		(91.4)	(8.6)		(83.6)	(16.4)		(57.8)	(42.2)		(58.6)	(41.4)		(89.1)	(10.9)		(53.1)	(46.9)		(70.3)	(29.7)		(60.2)	(39.8)	
8. Break time																											
Less than 2 min	4	2	3.462	6	0	.675	4	2	.067	4	2	2.924	4	2	2.924	4	2	.000	4	2	2.924	4	2	.058	4	2	.876
	(66.7)	(33.3)	**(.063)**	(100)	(0)	**(.411)**	(66.7)	(33.3)	(.796)	(66.7)	(33.3)	(.087)	(66.7)	(33.3)	(.087)	(66.7)	(33.3)	(1.000)	(66.7)	(33.3)	(0.87)	(66.7)	(33.3)	(.089)	(66.7)	(33.3)	(.349)
2 min and more	36	3		35	4		28	11		12	27		12	27		26	13		12	27		24	15		18	21	
	(92.3)	(7.7)		(89.7)	(10.3)		(71.8)	(28.2)		(30.8)	(69.2)		(30.8)	(69.2)		(55.7)	(33.3)		(30.8)	(69.2)		(61.5)	(38.5)		(46.2)	(53.8)	
9. Climbing up stairs and down																											
Yes	47	0	2.766	45	2	1.989	41	6	2.061	32	15	7.679	31	16	5.452	42	5	1.839	31	16	8.984	39	8	6.811	33	14	4.803
	(100)	(0)	(.096)	(95.7)	(4.3)	(.158)	(87.2)	(12.8)	(.151)	(68.1)	(31.9)	**(.006)**	(66)	(34)	**(.020)**	(89.4)	(10.6)	(.175)	(66)	(34)	**(.003)**	(83)	(17)	**(.009)**	(70.2)	(29.8)	**(.028)**
No	117	7		110	14		96	28		55	69		57	67		100	24		50	74		77	47		64	60	
	(94.4)	(5.6)		(88.7)	(11.3)		(77.4)	(22.6)		(44.4)	(55.6)		(46)	(54)		(80.6)	(19.4)		(40.3)	(59.7)		(62.1)	(37.9)		(51.6)	(48.4)	
10. Help carry backpack																											
Yes	31	0	1.616	28	3	.005	27	4	1.158	23	8	8.237	20	11	2.583	26	5	.019	17	14	.848	27	4	6.438	22	9	3.129
	(100)	(0)	(.204)	(90.3)	(9.7)	(.946)	(87.1)	(12.9)	(.282)	(74.2)	(25.8)	**(.004)**	(64.5)	(35.5)	(.108)	(83.9)	(16.1)	(.892)	(54.8)	(45.2)	(.357)	(87.1)	(12.9)	**(.011)**	(71)	(29)	(.077)
No	133	7		127	13		110	30		64	76		68	72		116	24		64	76		89	51		75	65	
	(95)	(5)		(90.7)	(13.1)		(78.6)	(21.4)		(45.7)	(54.3)		(48.6)	(51.4)		(82.9)	(17.1)		(45.7)	(54.3)		(63.6)	(36.4)		(53.6)	(46.4)	

Discussion

The findings of this study showed that the mean age of the school children was 12.09 (1.12) years range from 10-14 years. It reveals that more than half of the children were in the age group of less than 12 years. A similar study in Ireland found that the average school children mean age was 10.6 years ±7.14 months (Dockrell, Simms & Blake, 2015) [12]. The present study showed that majority of the students were female (54.4%) and 45.6% were male. This finding is quite similar with a study in Pakistan showed that (53.1%) were female and (46.9%) were male (Khan, Adam, Jamshaid, & Tahir, 2021) [20]. The study findings showed that mean weight and height of the school children was 40.83 (6.76) kg and 149.5 (7.43) cm, respectively. Consistent study showed that respectively weight 49.7 (11.36) kg and height 158.1 (12.62) cm (Dianat, Alipour, & Asgari Jafarbadi, 2018) [9].

The results of the study demonstrated that the mean weight of backpack was 5.32 (.98) kg which is similar to a study found that mean backpack weight was 5.98 kg (Kiat, Abidin, Rasdi, & Ismail, 2018) [21]. The findings of this study showed that 95.3% children carried backpack weight more than 10% of their body weight. The result was consistent with the study conducted in other countries; found that most of the children weighing backpack 10% and more of their body weight (Olmedo-Buenrostro *et al*., 2016; Dockrell, Simms & Blake, 2015; Kiat, Abidin, Rasdi, & Ismail, 2018; Shahid, Aziz, Arif, & Fahim, 2018) [30, 12, 21, 33]. This study results showed that 73.1% children going to school by walking which is consistent with a study found that 84% of children going to school by walking (Buraketal., 2019) [4]. The present study finding showed that popular (54.4%) backpack carrying method was on one shoulder. However, the inconsistent study conducted by Dianat and Karimi (2014) [8] found that the most popular (73.1%) method of carrying a backpack was on both shoulders.

In addition, the study results indicated that 92.4% children reported that they felt their backpack was heavy. Similar study showed that majority of the school children reported that they felt their backpack was heavy 69.8% (Corraya, 2017) [6]. Moreover, in regards to break, 74.9% children did not take break while carrying backpack. Consistent study found that 63% children did not take break while carrying backpack (Khalil & Alrubaey, 2019) [19]. Although the study showed that 81.9% school children carried their backpack independently which is similar to a study found that 77% school children carried their backpack independently (Burak *et al*., 2019) [4].

In this study, results showed that prevalence of musculoskeletal discomforts were Neck (95.9%), Shoulder (90.6%), Upperback (80.1%), Elbow (50.9%), Wrist/ hands (51.5%), Lower back (83%), Hips/ Thighs (47.4%), Knees (67.8%), Ankles/ Feet (56.7%). This study results were consistent with the study conducted by (George, Nayak, & Shetty, 2015) [10] which was showed that Neck (32.4%), Shoulder (35.50%), Upperback (20.70%), Elbow (23%), Wrist/ hands (19.10%), Lower back (15.60%), Hips/ Thighs (16.20%), Knees (26.60%), Ankles/ Feet (29.40%) respectively. Consequently, study findings showed that neck musculoskeletal discomfort was the most common in the 12 months prevalence which is inconsistent with a study showed that shoulder musculoskeletal discomfort was the most common in the 12 months prevalence (Abaraogu, Duru, Imaji, Ezenwankwo, & Fawole, 2020) [1].

The present study showed that, there was a significant relationship between age and musculoskeletal discomforts particularly neck pain (P<0.05). The similar study showed that there was an association between age and musculoskeletal discomforts (Ogana, 2016) [29]. This possible explanation may be younger children need more attention because they are more affected by the heavy backpack. Children's level of awareness increases with age, as older children are more aware of the health implication of carrying heavy backpack than the younger ones (Adeyemi, Rohani, & Rani, 2014) [2]. This supports the call for increased awareness programs among children (Vidal *et al*., 2013) [35], as other studies had also reported that younger children are at higher risk of musculoskeletal pain due to heavier backpacks (Kellis and Emmanouilidou, 2010) [18].

In addition, there was a significant relationship between gender and musculoskeletal discomforts particularly neck (P=.013), shoulder (P=.023), Wrist (P=.035) and lower back pain (P=.032) respectively. Consistent study conducted in other countries found that there was a positive association (Dianat, Javadivala, &Allahverdipour, 2011; Korovessis, Repantis, & Baikousis, 2010) [11, 24]. Moreover, the study results reveal that musculoskeletal discomforts were higher in malecompared to female children which is dissimilar with a study results conducted in Nigeria (Abaraogu, Duru, Imaji, Ezenwankwo, & Fawole, 2020) [1]. The possible reasonwas girls have a lower painthresholds and tolerance thanboys and this factor could have accounted for the high prevalence of self-report musculoskeletal pain (Hamzat, Abdulkareem, Akinyinka, & Fatoye, 2014) [15].

Furthermore, the study results reveal that there was an association between level of class and musculoskeletal discomforts particularly, upper back (P=.043), Elbow (P=.022), Knees (P=.000) and ankles pain (P=.010). Relevant studyfound that fifth class children experienced more musculoskeletal discomforts than six and seven class children (George, Nayak, & Shetty, 2015) [10]. So, it could be explained that class five school children were younger than classsix and sevengenerally. Younger childrenareat higher risk of musculoskeletal pain due to heavier backpacks (Kellis and Emmanouilidou, 2010) [18]. In addition, Shamsoddini *et al*., (2010) [34] found that musculoskeletal discomfort experienced by growing children was significantly related to backpack weight usually. However, there wasno relationship between musculoskeletal discomforts and children's weight, height and previous medical problems (*P*>0.05) in this current study results.

The present study showed that, there was a significant relationship between weight of backpack and musculoskeletal discomforts (P=.033). Consequently, Shamsoddini *et al*., (2010) [34] observed that musculoskeletal discomfort experienced by growing children was significantly related to backpack weight. The possible cause may be lifting, carrying and handling a heavy backpack on the back cause forward leaning and bad posture, which can result in excess load on the spine, pain and discomfort in the neck, shoulders and back (Hamzat, Abdulkareem, Akinyinka, & Fatoye, 2014) [14].

The study also found that there was an association between musculoskeletal discomforts (Neck, P=.002; Shoulder, P=.000; Upper back, P=.000; Elbow, P=.003; wrist, P=.003; Lower back, P=.000; Hips, P=.007; Knees, P=.008; Ankles, P=.001) and backpack weight as percentage of bodyweight. This result is similar to the studyby Mwaka *et al*., (2014) [27],

which indicated that prolonged backpack use is associated with musculoskeletal discomforts among children who carry backpacks weighing more than 8.5% of their body weight.

Consequently, the study findings showed that mode of transport and musculoskeletal discomforts (Upper back, Elbow, Wrist, Lower back, Hips & Knees) were significant relationship (P<0.05). In addition, musculoskeletal discomforts were more prevalent among students who used walking mode which is congruence with a study conducted in Pakistan (Zaidietal., 2016) [36]. There as on may be active form of transportation like walking to school might offset the potentially provocative effects of prolonged backpack carriage (Rai and Agarawal, 2013) [31] and could endorse the fact that daily carrying of heavy backpack for a prolonged time period could result in repetitive stress injuries to the children's growing bodies predisposing them to musculoskeletal pain and disorders (Ogana, 2016) [29].

Moreover, the study results showed that regarding backpack carrying method, there was an association with musculoskeletal discomforts (Knees & Ankles; P<0.05). Similar study found that carrying backpack bytwo hands, in front ofthe body, byone hand, over one shoulder is expected to increase the prevalence of musculoskeletal discomforts (Dianat *et al*., 2017; Noll *et al*., 2016; Ogana, 2016) [37, 28, 29]. The possible cause may be harmful effect of asymmetrical carrying method rather than symmetrical ones (over both shoulders) such as carrying backpack byone or both hands result in asymmetry in muscle activity and might boost lateral bending ofspine and trunk, addedto shoulder abnormality like changes inthe shoulders level (Sahib, 2016) [32].

The study also reveals that feeling of backpack heaviness and musculoskeletal discomforts (Shoulder, Wrist & Ankles; P<0.05) were an association. The study findings showed there was an association between break taker and musculoskeletal discomforts (Neck, Upper back, Elbow, Wrist, Lower back & Hips; P<0.05). Consistent study found musculoskeletal discomforts were more prevalent among non- rest break takers (Khalil & Alrubaey, 2019) [19]. Analysis revealed that only rest break is found to have a significant influence on back pain prevalence, as non-rest break taken are expected to increase back pain prevalence (Ogana, 2016) [29] and rest break is necessary factor that might offset the endanger effect of prolonged backpack carriage particularly heaver one (Khalil & Alrubaey, 2019) [19].

The present study showed that there was an association between musculoskeletal discomforts with climbing upstairs and down while carrying backpack. Study findings showed that there was an association between musculoskeletal discomforts (Elbow & Knees; P<0.05) with any body help or not while carrying backpack. Congruence study found that musculoskeletal discomforts were more prevalent those who are carrying their backpack independently (Burak *et al*., 2019) [4]. However, study results showed that there was no relationship between musculoskeletal discomforts and travel time and break time (*P*>0.05). These findings were consistent withother studies (Abaraogu, Duru, Imaji, Ezenwankwo, &Fawole, 2020; Ogana, 2016) [1, 29].

Limitations

There are certain limitations to be considered. Convenience sampling technique was used. Moreover, this study was conducted at only one school which may not be generalized to the entire students at Bangladesh. Therefore, data were collected through a questionnaire which had four dimensions. Due totime limitations, researcher discusses onlyone dimension inthis study.

Conclusion

The findings of the present study provide additional information about the use of backpack carriage and musculoskeletal symptoms among schoolchildren. The results indicated that the prevalence of musculoskeletal discomforts among school children was considerably high. In terms of relationship, there was a statistically significant relationship between age, gender, class and musculoskeletal discomforts among school children. This results also showed that weight of backpack, backpack weight as percentage of body weight, mode of transport, heaviness of backpack, breaktaker, climbing up stairs and down, any body help or not while carrying backpack and musculoskeletal discomforts were statistically significant relationship. However, in some characteristics did not show any significant results. Thus, a musculoskeletal discomfort has emerged as a significant health problem with growing school children. Therefore, it suggests that to make a necessary policy by the government that the students should to carry the backpack within the safe limit and to reduce musculoskeletal discomforts.

Recommendations

Based on study limitations, there were some recommendations that can be suggested for the future study. Further studies in different settings may be recommended to generalize the findings. Therefore, it is the requirement ofthe hour for planning ofinterventionprograms at school setting involving the parents, teachers, and school health nurses emphasizing the impacts of heavy backpack.

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