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Effect of Heavy Backpack on Cardiovascular Parameters in Middle School Children

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Abstract

In this article we study the effect of heavy backpack on middle school children. This topic is of great concern among educational professionals and clinicals to investigate the health problems faced by school children. On the daily basis, school students spend a significant amount of time carrying stuffed and heavy backpack. Aim of this study was to find out the effect of heavy backpack on cardiovascular parameters in middle school children. We have assessed 100 middle school students (11-14 years old). Children were divided into 2 groups according to their body mass index (BMI) in the following categories like underweight (UG) and healthy weight (HG) BMI. A six- minute walk test (6MWT) was performed by the children in two ways with and without backpack and cardiovascular parameters (blood pressure and pulse rate) were measured before and after the 6MWT. Backpack loads were assigned according to the individual body weight. There was no significant effect seen on the pulse rate (PR) and diastolic blood pressure (DBP). Backpack carriage have a significant effect on the systolic blood pressure (SBP). We noted that the systolic blood pressure increases more in heathy weight children than in underweight children with heavy backpack. Our findings highlight that cardiovascular parameter (such as systolic blood pressure) is affected by carrying loads in the backpacks.

Keywords: Six- minute walk test, Systolic and diastolic blood pressure, Pulse rate, Backpack, Body mass index.

Introduction

External factor like backpack is a common cause for the problems related to posture and cardiovascular parameters in children. There have been numerous studies on backpack in which various authors reported the influence of backpack and its effect on cardiovascular parameters in school children. It has been proven by authors that the heavy load in the backpack cause deviation in the cardiovascular system parameter, posture, and gait [1].

According to the recent studies, they have suggested that the loads i.e. school bags must not be loaded too much. Backpack must be lighter and its weight must be 10 to 20% of total weight of the child. In the following year, a review given by Breckley and Stevenson stated that the major portion of work considered the loads have a severe negative impact on the body of the children [2]. Chansirinekor W, Wilson D, grimmer K and Dansie B (2001) reported that carrying a backpack weighing 15% of body weight of the child seems to be very heavy to maintain the correct standing posture for adolescents [3]. Maximum load that is prescribed from these studies can vary from 25 to 40% of body weight of the child (Haisman 1988) [3]. Hong Y, Li Jx reported that the if the child's backpack weight is 8% of the body weight of the child. It is considered to be normal and there will not be any significant effect on child body posture [4].

According to the study done by H. Daneshmandi in springer-Verlag (2008). It has been found that if the backpack load is more than 13% of the total body weight then it has a significant effect on SBP, DBP, and the frequency at which heart contracts. However, for a backpack load of 8% of body weight there will be not be any significant effect on the body. In this study they had performed the test on treadmill for 3 minutes. The study was carried out

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on children of 12.5 years of age [5]. To the best of our knowledge there is paucity in published literature regarding the study that shows effect on 11-14 years of children, and the study will be conducted by doing 6MWT. Hence there is a need to determine the effect of the backpack load on cardiovascular parameters among this age group. The study is aimed to determine the impact of backpack loads particularly on cardiovascular parameters in both healthy and underweight school children.

Materials and Methods

The study design was cross – sectional. Data of 100 middle school children of NGO in Noida was taken with age group of 11-14 years in which 50 students are of UG (underweight) BMI (body mass index) and 50 of HG (healthy weight) BMI (12.5–25). children with any cardiorespiratory disease, any history of musculoskeletal injury were excluded. The independent and dependent variables of the study are weight of the backpack and cardiorespiratory parameters (BP, pulse rate) respectively. The group allocation was done according to the BMI calculated with the CDC calculator. student with UG BMI (12.5) and student with HG BMI [12.5-25]. With and without backpack baseline readings of BP and PR were taken before and after the six-minute walk test. Participants were asked to walk for six minutes with backpack load of 12-15% of child's body weight.

Data Analysis

Z- test was used to determine the effect of backpack on cardiovascular parameters in middle school children. To examine the sample. All scores from both groups group A and group B were calculated to determine the mean, standard deviation, variance, after findings these values Z test on excel sheet is applied in both intergroup and intragroup variables. The Z-critical value at p = 0.05 is 1.95.

Results

Demographic Data

Hundred students participated in this study in which male: female ratio is (51:49), the mean age of the group were (12 ± 0.98) years, the mean height of the group were (144 ± 10.5), the mean weight of the group were (29.2 ± 8.07), the mean BMI of children was (16.5 ± 12.4). Z- test analysis was done in both intergroup and intragroup to see the effect of backpack on both the groups. The result is shown in the tables 1-6 below.

Table 1: Shows Statistical analysis between with and without backpack of Group A

Blood Pressure	Mean ± SD		Variance		Observation	Z-stats	Significance
	Without backpack	With backpack	Without backpack	With backpack			
Systolic pre	99.74 ± 7.45	109.7 ± 8.14	54.5	56.4	50	0.68	NS
Diastolic pre	59.1 ± 6.83	58.4 ± 5.41	45.7	21.4	50	0.60	NS
Systolic post	109.7 ± 7.59	116.1 ± 7.16	56.4	50.3	50	4.38	S
Diastolic post	67.94 ± 8.59	71.4 ± 8.45	72.3	70	50	2.05	S
PR pre	78.56 ± 9.1	81.04 ± 8.09	81.1	64.1	50	1.45	NS
PR post	85.3 ± 10.8	97.7 ± 13.7	115	184	50	4.46	S

Table 2: Shows Statistical analysis between pre and post of group A

Blood Pressure	Mean ± SD		Variance		Observation	Z- stats	Significance
	Pre	Post	Pre	Post			
Without backpack systolic	99.7 ± 7.45	109.7 ± 7.59	54.5	56.4	50	0.68	NS
Without backpack Diastolic	59.1 ± 6.83	67.9 ± 8.59	45.7	72.3	50	5.75	S
With backpack Systolic	98.7 ± 8.19	116.1 ± 7.16	95.8	50.3	50	11.4	S
With backpack Diastolic	59.1 ± 5.41	71.4 ± 8.45	28.7	70	50	8.75	S
Without backpack PR pre	78.5 ± 9.1	86.3 ± 10.8	81.1	115	50	3.91	S
With backpack PR post	81.6 ± 8.09	97.7 ± 13.7	64.1	184	50	6.63	S

Table 3: Shows Statistical analysis between with and without backpack of Group B

Blood Pressure	Mean± SD		Variance		Observation	Z- stats	Significance
	Without backpack	With backpack	Without backpack	With backpack			
Systolic pre	96.8 ± 10.27	97.4 ± 10.9	29.8	39.2	50	0.51	NS
Diastolic pre	57.8 ± 6.72	58.4 ± 6.94	35.2	21.4	50	0.56	NS
Systolic post	97.4 ± 10	109.8 ± 11.2	39.2	71.5	50	8.38	S
Diastolic post	57.8 ± 10.9	64.5 ± 7.49	35.2	27.3	50	5.99	S
PR pre	79.5 ± 8.21	84.3 ± 9.68	59.5	92.4	50	2.77	S
PR post	92.18 ± 15	103.4 ± 17.7	153	185	50	4.31	S

Table 4: Shows Statistical analysis between Pre and Post of group B

Blood Pressure	Mean± SD		Variance		Observation	Z- stats	Significance
	Pre	Post	Pre	Post			
Without backpack systolic	97.4 ± 10.27	109.8 ± 7.38	39.2	71.5	50	8.38	S
Without backpack Diastolic	57.8 ± 6.72	64.5 ± 10	35.2	27.3	50	5.99	S
With backpack Systolic	96.8 ± 10.9	113.6 ± 11.2	29.8	52	50	13.1	S
With backpack Diastolic	66.6 ± 6.94	58.4 ± 7.49	30.4	21.4	50	8.05	S
Without backpack PR pre	79.54 ± 8.21	92.1 ± 15	59.5	153	50	6.13	S
With backpack PR post	84.38 ± 9.68	103.4 ± 17.7	92.4	185	50	8.07	S

Table 5: Shows Comparison Between Group A and Group B without back pack

Blood Pressure	Mean± SD		Variance		Observation	Z- stats	Significance
	A	B	A	B			
Without backpack Systolic pre	99.7 ± 7.45	97.4 ± 10.27	54.5	39.2	50	1.70	NS
Without backpack Diastolic pre	59.1 ± 6.83	57.8 ± 6.72	45.7	35.2	50	1.02	NS
Without backpack Systolic post	109.7 ± 7.59	109.8 ± 7.38	56.4	71.5	50	0.11	NS
Without backpack Diastolic post	67.9 ± 8.59	64.5 ± 10	72.3	27.3	50	2.43	S
Without backpack PR pre	78.5 ± 9.1	79.5 ± 8.21	81.1	59.5	50	0.58	NS
Without backpack PR post	86.3 ± 10.8	92.8 ± 15	115	153	50	2.53	S

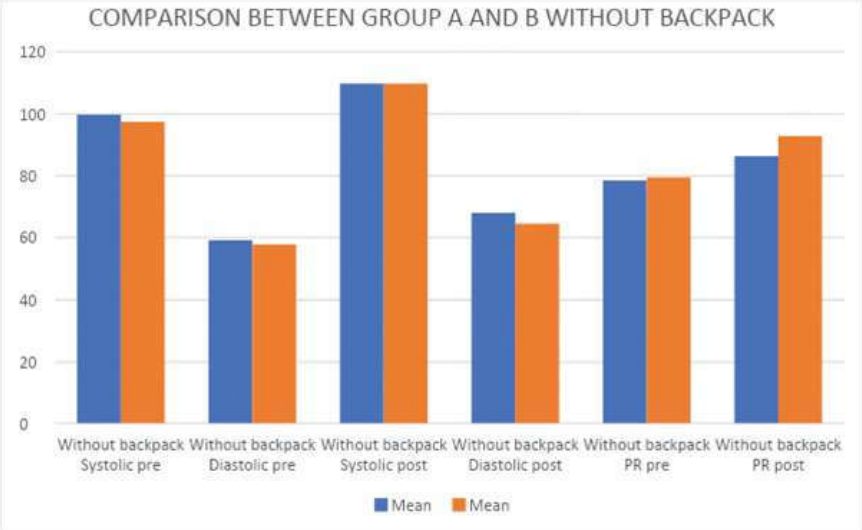

Fig. 1: Showing comparison between group A and B without backpack

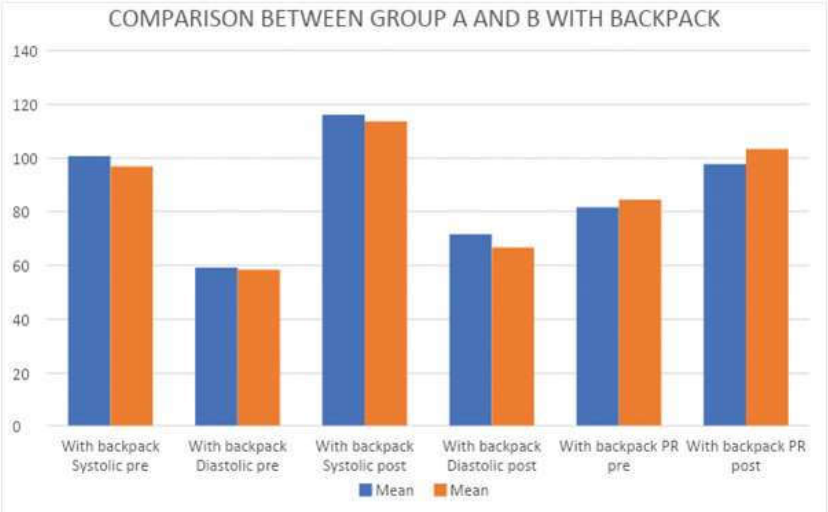

Fig. 2: Showing comparison between group A and B with backpack

Table 6: Shows Comparison between Group A and Group B with backpack

Blood Pressure	Mean± SD		Variance		Observation	Z- stats	Significance
	A	B	A	B			
With backpack Systolic pre	100.7 ± 8.14	96.8 ± 10.9	57	29.8	50	2.95	NS
With backpack Diastolic pre	59.1 ± 5.41	58.4 ± 6.94	28.7	21.4	50	0.69	NS
With backpack Systolic post	116.1 ± 7.16	113.6 ± 11.2	50	52	50	2.75	S
With backpack Diastolic post	71.4 ± 8.45	66.6 ± 7.49	70	30.4	50	3.38	S
With backpack PR pre	81.4 ± 8.09	84.3 ± 9.68	68	92.4	50	1.86	NS
With backpack PR post	97.7 ± 13.7	103.4 ± 17.7	184	185	50	2.09	S

Discussion

On comparison between group A and group B. Without backpack SBP post shows non- significant result while with backpack SBP post shows significant result. This gives the conclusion that the SBP had variations with and without backpack. The reason behind this could be walking tends to put some additional demand on our cardiovascular system because of which our muscles need more oxygen than they do when at rest, so it makes person to breathe more quickly and our heart starts to pump more harder and faster to circulate our blood to deliver oxygen to the muscles , that results in rise in SBP. The result shows more increase in SBP in group A than in group B. The possible reason behind this could be increased weight of the children than normal because of the unhealthy lifestyle. The DBP post both with and without backpack shows non-significant result this concluded that the DBP had no variations with without backpack and with backpack. Researches show that DBP increases more with intensive exercise and high load than moderate exercise and low load the force at which our heart contracts also increase while exercising.

Most of the time it is seen that PR is lower in trained athletes. it increases when person exercise to deliver more amount of blood and oxygen to the working muscles. In UG and HG both systolic and diastolic pre with and without backpack shows non-significant results because the BP is measured when the body is at rest and at rest bp does not show any variations. While both the systolic and diastolic post with and without backpack shows significant results because after 6MWT the force at which person's heart contracts increases that makes to pump more blood with each beat. Because of this effect BP increases after 6MWT. PR pre both with and without backpack shows non-significant results while PR post both with and without backpack shows significant results because the pulse rate of the person increases as person exercise to deliver more amount of blood and oxygen to the working muscles. On comparison of BP and PR pre and post without backpack systolic, diastolic pre and post shows significant result. With backpack systolic, diastolic pre and post shows significant results also pulse rate without backpack with backpack pre post shows significant results. This is because there are some variations of bp and pulse rate on rest without backpack and after six- minute walk with backpack.

Conclusion

Non-significant changes resulted in all the parameters except in systolic blood pressure among the systolic BP, diastolic BP and pulse rate.

Conflict of Interest – Nil

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