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The effect of backpack weight on vertebral column deformity of high school girl students

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ABSTRACT

The aim of present study is analysing the effects of students' backpack's weight on deformity of their shoulder and vertebral column. In order to do this examination a group of high school girl studentsin Qazvin city are chosen as the statistical society. The measurement instruments include posture screen, meters, scales and questionnaires. The independent variable is the backpack's weight and the dependent variables are skeletal defects involving unsymmetrical shoulder, scapula asymmetry and deviation of vertebral column. 45 studentscarriedschool backpacks of 10%, 12.5%, 15% and 17.5% bodyweight for 20 minutes. The results show carrying backpacksof 10% bodyweight does not have noticeable effect on progress of dropped shoulder deficiency during the first 5 minutes; however, its destructive impact will appear by passage of time. It is also observed that in the case of heavier backpacksof 12.5%, 15% and 17.5% bodyweight, the harmful effect ofbackpacks loads on the shoulder asymmetry is beingstarted from the first moment.

Keywords: Dropped shoulder, Vertebral column, Unsymmetrical shoulder, Skeletal defects, Backpacks

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INTRODUCTION

Nowadays, with advances of technology and extension of city lives, the amount of people activities have decreased remarkably. This lack of activity follows by obesity, cardiovascular diseases and also skeletal defects [1,2]. There are a lot of people all around the world who suffer from skeletal deficiency and face with muscle weakening, deformity of appearance and even fatigue. Unfortunately, the numbers of these people especially among teenagers and students are increasing sharply. Up to now, a lot of methods have been suggested for solving this common problem of twentieth century. However, physical education and exercise have their own specific placesamongst all of these solutions. Corrective Exercises is one of physical education branch that focuses on skeletal defect and tries to propose some specific activities in order to prevent from the advent and progress of skeletal deficiency [3].

Backpacks are one of the basic stuff that students must carry every day. Unfortunately, in some schools because of wrong curriculum students must usually carry heavy backpacks which can cause serious problems in their shoulder, scapula and even onset of back pain [4-8]. During last decades, a lot of researches have been done about the negative effects of heavy backpacks on students' skeletal defects. In article [9]magnetic resonance imaging (MRI) scanner is used for analysing the effect of backpack loads on the lumber spine in children. Horizontal displacement of numerous parts of body under the action of backpacks loads is investigated in [10,11]. Direct effect of backpack carriage on lumbar lordosis of school boy children is carried out by [12]. In this study, a scoliometer was used for measuring the immediate change of spin curvature and the results were compared for loaded and unloaded cases. Paper[13]examined the correlation between backpacks loads, manner of s and athletic activities for both schoolchildren and adolescent.The shape of lumbar spine of young adult female was studied in [14] where the

results showed significant increase of thoracic surface curvature after 18 minutes. Finally, it is recommended widely that students should not carrybackpacksheavier than 10-15% of their bodyweight (BW) [15,16].

In this work, we are trying to find a relation between the weight of students' backpack and asymmetry of their shoulder and scapula. We also determine which backpack's weight has the most destructive effect on vertebral column deformation. Recent biological tests ascertained bone growth will continue till about twenty years old and the weight of students' backpacks can have negative impact on its natural process. Given that fact, the results of our research can be very useful for prevention of these skeletal deficiency in next generation.

MATERIALS AND METHODS

Statistical society of this study is freshman and sophomore high school girl students in Qazvin city. 45 students between 14-16 years old were chosen voluntary among 9180 students. There were 7 questions in questionnaire including the height, weight, body type, age, the distance between their homes and school and the their dominant hands that they carry backpack with it. For testing the students' abdominal muscle strength and their body flexibility the sit-ups and sit and reach tests were used. If the students could do these tests easily, they were categorized in normal condition.

2.1The assessment of body condition

In each session, after weighting the student, she carried a backpack of 10%, 12.5%, 15% and 17.5% her bodyweight once a time. The student musts carry the backpacks with their dominant hands (right hand in this work) about 20 minutes and measurement is done every 5 minutes. The measurements include calculating the symmetry of shoulders, the scapula asymmetry, the distance of fingers and knee for both right and left side and also the distance between fingers and ground.

2.2 Instruments and methods of measuring

1- A posture screen is a steel frame. There is a vertical line in the middle of this frame and it is graded meticulously each 5 centimeters in both vertical and horizontal sides. We used from this tool for determining the skeletal deformation.

2- The students' height were measured by a meter. Moreover, during the test, the distance between hand fingers and both knee and ground is measured by this instrument.

3- For determining the students' weight and the weight of backpacks samples one simple scale is utilized.

4- The shoulder asymmetry is measured by a long ruler.

2.3 Variables

a) In this study, the dependent variable is skeletal defects including unsymmetrical shoulder, scapula asymmetrical and deviation of vertebral column.

b) The weight of students' backpack is considered as the independent variable.

2.4 The statistical method

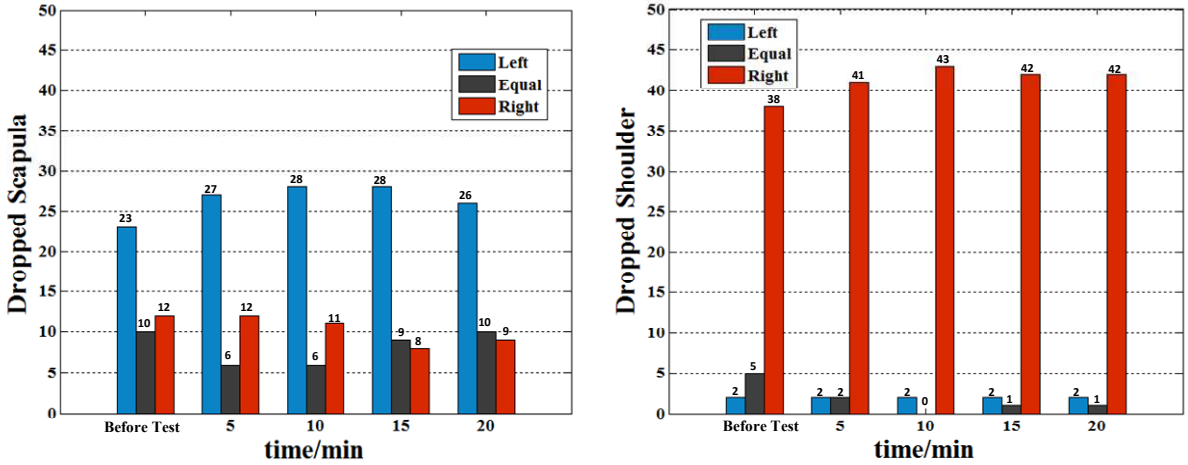
Regarding to the fact that in the current study the results were obtained by semi experimental tests, the average, percent of data and the correlation between variables are calculated by descriptive and inferential (t-test and k square) statistics respectively.

RESULTS

The following figures and tables show the dropped scapula and shoulder problem distribution among high school girl students. Before doing the test the existed dropped problem in each left and right side of shoulder and scapula were measured. After that each student carried a backpack of 10%, 12.5%, 15% and 17.5% her bodyweight for 20 minutes. Each 5 minutes, the student stopped and the variation of her shoulder and scapula positions were measured. It is worth mentioning that in this study, all students carried their backpacks with right hands and the scale of data is centimeter.

Table 1. Dropped scapula and shoulderdistribution in carrying backpacks of 10% bodyweight for times=5, 10, 15 and 20

	Before Test	5 minutes	10 minutes	15 minutes	20 minutes	Total
Dropped left scapula	23	27	28	28	26	109
Dropped left shoulder	2	2	2	2	2	8
Equal scapula	10	6	6	9	10	31
Equal shoulder	5	2	0	1	1	4
Dropped right scapula	12	12	11	8	9	40
Dropped right shoulder	38	41	43	42	42	168

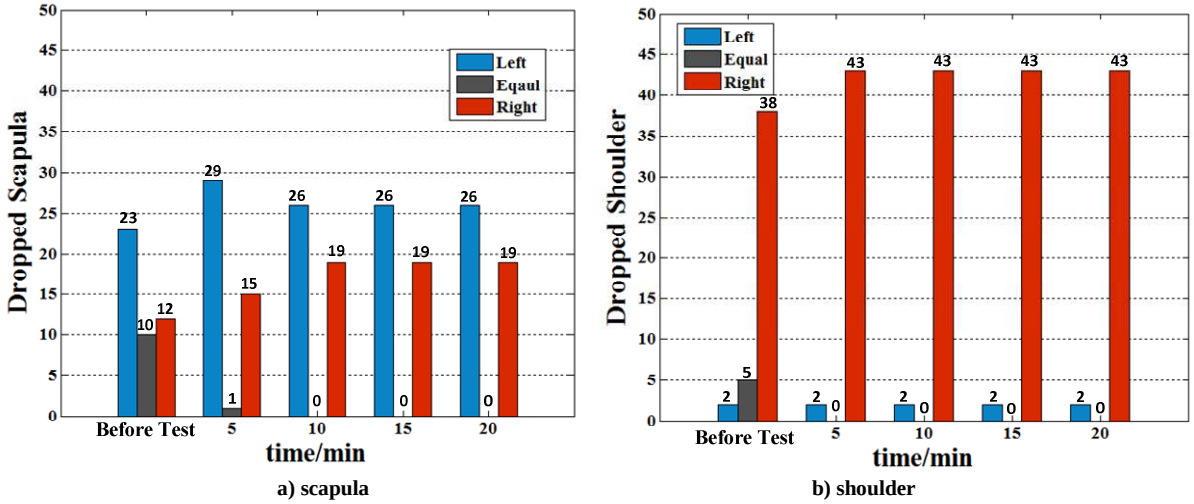


a) scapulab) b) shoulder

Figure 1. Comparison of dropped a) scapula, b) shoulder for each side in carrying backpack of 10% students' bodyweight for time=5, 10, 15 and 20 minutes

Table 2. Dropped scapula and shoulder distribution in carrying backpacks of 12.5% bodyweight for times=5, 10, 15 and 20

	Before Test	5 minutes	10 minutes	15 minutes	20 minutes	Total
Dropped left scapula	23	29	26	26	26	107
Dropped left shoulder	2	2	2	2	2	8
Equal scapula	10	1	0	0	0	1
Equal shoulder	5	0	0	0	0	0
Dropped right scapula	12	15	19	19	19	72
Dropped right shoulder	38	43	43	43	43	172

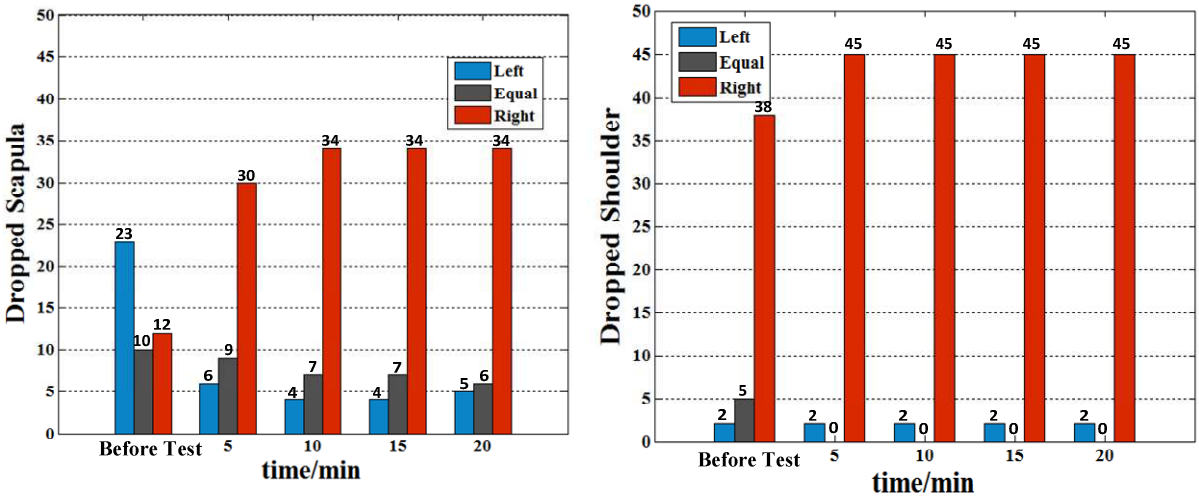


a) scapula b) shoulder

Figure 2.Comparison of dropped a) scapula, b) shoulder for each side in carrying backpack of 12.5% of students' weight for time=5, 10, 15 and 20 minutes

Table 3. Dropped scapula and shoulder distribution in carrying backpacks of 15% of bodyweight for time=5, 10, 15 and 20

	Before Test	5 minutes	10 minutes	15 minutes	20 minutes	Total
Dropped left scapula	23	6	4	4	5	19
Dropped left shoulder	2	2	2	2	2	8
Equal scapula	10	9	7	7	6	29
Equal shoulder	5	0	0	0	0	0
Dropped right scapula	12	30	34	34	34	132
Dropped right shoulder	38	45	45	45	45	180

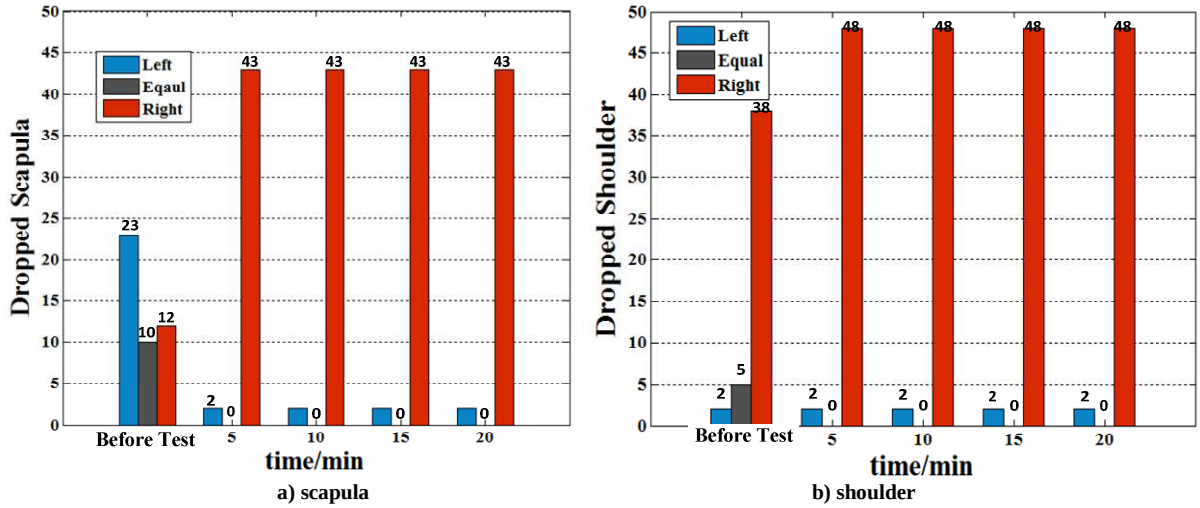


a) scapula **b) shoulder**

Figure 3. Comparison of dropped a) scapula, b) shoulder for each side in carrying backpack of 15% of students' bodyweight for time=5, 10, 15 and 20 minutes

Table 4. Dropped scapula and shoulder distribution in carrying backpacks of 17.5% bodyweight for time=5, 10,15 and 20

	Before Test	5 minutes	10 minutes	15 minutes	20 minutes	Total
Dropped left scapula	23	2	2	2	2	8
Dropped left shoulder	2	2	2	2	2	8
Equal scapula	10	0	0	0	0	0
Equal shoulder	5	0	0	0	0	0
Dropped right scapula	12	43	43	43	43	172
Dropped right shoulder	38	48	48	48	48	192



a) scapula **b) shoulder**

Figure 4. Comparison of dropped a) scapula, b) shoulder for each side in carrying backpack of 17.5% students' bodyweight for time=5, 10, 15 and 20 minutes

After statistical analyzing data, the results can be summarized as following:

- Meaningful relation is observed between dropped scapula and carrying backpacks of 10%,12.5%,15% and 17.5% students' bodyweight (sig=0.000).
- Meaningful relation is observed between dropped scapula and carrying backpacks of 10% students' bodyweight at time= 10, 15 and 20 minutes (sig= 0.012, 0.007 and 0.0005 respectively). However, there is not a meaningful relation between dropped scapula and carrying backpacks of 10% students' bodyweight at time=5 minutes (sig=0.062).
- There is not a meaningful relation between dropped scapula and carrying backpacks of 12.5% students' bodyweight at time=5, 10 and 20 minutes (sig=0.065, sig=0.381 and sig=0.154 respectively). However, a meaningful relation is observed between dropped scapula and carrying backpacks of 12.5% students' bodyweight at time=15 (sig=0.028).
- There is not a meaningful relation between dropped scapula and carrying backpacks of 15% students' bodyweight at time=5, 10, 15 and 20 minutes (sig=0.451, sig=0.183, sig=369 and sig=0.213respectively).
- There is not a meaningful relation between dropped scapula and carrying backpacks of 17.5% students' bodyweight at time=5, 10, 15 and 20 minutes (for all sig=0.368).
- Meaningful relation is observed between dropped scapula, carrying backpacks of 10%, 12.5%, 15% and 17.5% students' bodyweight and position before test (for all sig= 0.00).
- There is not a meaningful relation between dropped shoulder and carrying backpacks of 10%,12.5%,15% and 17.5% students' bodyweight (sig=0.060).
- Meaningful relation is observed between dropped shoulder and carrying backpacks of 10% students' bodyweight at time= 5, 10, 15 and 20 minutes (for all sig= 0.000).
- Meaningful relation is observed between dropped shoulder and carrying backpacks of 12.5% students' bodyweight at time= 5, 10, 15 and 20 minutes (for all sig= 0.000).
- Meaningful relation is observed between dropped shoulder and carrying backpacks of 15% students' bodyweight at time= 5, 10, 15 and 20 minutes (for all sig= 0.000).
- Meaningful relation is observed between dropped shoulder and carrying backpacks of 17.5% students' bodyweight at time= 5, 10, 15 and 20 minutes (for all sig= 0.000).
- Meaningful relation is observed between dropped shoulder, carrying backpacks of 10%, 12.5%, 15% and 17.5% students' bodyweight and position before test (for all sig= 0.00).

In Table 5, the distance between right hand fingers and ground for different backpack weight and times is are archived. The default distance before doing the test is measured 60.6667.

Table 5. The distance between right hand fingers and ground for different backpack weights and time=5,10,15 and 20 minutes

The percent weight of backpack	Time (minutes)			
	5	10	15	20
10%	60.5533	60.3778	60.6333	60.5000
12.5%	60.4661	60.5778	60.7556	60.5560
15%	60.4500	60.2444	60.2833	60.1500
17.5%	60.5111	60.3667	60.1500	60.4000

According to Table 5it is concluded that:

- There is not a meaningful relation between the distance of right hand fingers and ground with or without carriage a backpack of 10% bodyweight at times=5, 10, 15 and 20 (sig=0.6500, 0.2260, 0.9260 and 0.544 respectively).
- There is not a meaningful relation between the distance of right hand fingers and ground with or without carriage a backpack of 12.5% bodyweight at times=5, 10, 15 and 20 (sig=0.478, 0.753, 0.846 and 0.282 respectively).
- There is not a meaningful relation between the distance of right hand fingers and ground with or without carriage a backpack of 15% bodyweight at times=5, 10, 15 and 20 (sig=0.478, 0.167, 0.227 and 0.098 respectively).
- There is not a meaningful relation between the distance of right hand fingers and ground with or without carriage a backpack of 17.5% bodyweight at times=5, 10, 15 and 20 (sig=0.590, 0.354, 0.099 and 0.461 respectively).

DICUSSION AND CONCLUSION

Carrying backpacks especially heavy ones can change the shape of body gradually. Students are the main group of people who must carry backpacks every day and expose to lumbar arthritis. According to the fact that bone growth will continue to the age of twenty, the strongest and most destructive effects of carrying backpacks will be on the children and teenager. In this article, 45 high school girl students between 14-16 years old were examined for analyzing their vertebral column deformity, particularly their shoulder and scapula parts, due to carrying different weight of backpacks about 20 minutes. The study showed that generally there is a meaningful relation between dropped shoulder or scapula and backpacks carriage. It is found that carrying light backpack, 10% and 12.5% of

students' bodyweight, in short period 5 or at most 10 minutes does not have strong effect on progress of dropped scapula problem. Because, in short time the muscles stand strongly and muscles fatigue probably will not happen. However, by passage of time the hands' muscles lose their potential and shoulders drop. Interestingly in heavy backpacks case including 15% and 17.5% of students' bodyweight, it is observed that in all minutes there is not a meaningful relation between carrying backpack and dropped shoulder defect since the muscles react to the heaviness hardly and prevent from dropping shoulder and scapula articulation. Moreover, the obtained results showed that there is not a meaningful relation between carrying backpacks and the distance of right hand fingers to the ground because students usually bended their elbow for avoiding the muscle tension and keeping their balance. Regarding to above results, we can suggest that students should not carry backpack heavier that 10% of their bod weight. They also should carry the backpacks with both hands and do not bear them for long distances.

REFERENCES

[1] H. Alimohamadi, M. Imani, *International Journal for Computational Methods in Engineering Science and Mechanics*, **2014**, 15:390-400.
[2]H. Alimohamadi, M. Imani, M. Shojaee-Zadeh, *Advances in Applied Science Research Journal*, **2013**, 5: 1-8.
[3] M. Sinaki, M. Pfeifer, E. Preisinge, E.Itoi, R. Rizzoli, S. Boonen , et al.,*Current osteoporosis reports*, **2010**, 8:138-144.
[4] K. Grimmer, M. Williams, *Applied Ergonomics*, **2000,** 31: 343-360.
[5] M. S. R. Iyer, *The Indian Journal of Pediatrics*, **2001**, 68: 937-941.
[6] S. R. Iyer, *Journal of School Health*, **2002,** 72:270-271.
[7] S. Negrini, R. Carabalona, *Spine*,**2002**, 27: 187-195.
[8] G. I. Sheir-Neiss, R. W. Kruse, T. Rahman, L. P. Jacobson, J. A. Pelli, *Spine*, **2003**, 28: 922-930.
[9] T. B. Neuschwander, J. Cutrone, B. R. Macias, S. Cutrone, G. Murthy, H. Chambers, et al., *Spine*,**2010**, 35: 83-88.
[10] K. Grimmer, B. Dansie, S. Milanese, U. Pirunsan, P. Trott, *BMC Musculoskeletal Disorders*, **2002**, 3, 10.
[11]E. Frank, J. M. Stevenson, P. Stothart, *Medicine & Science in Sports & Exercise*,**2003**, 35, S21.
[12] P. Korovessis, G. Koureas, S. Zacharatos, Z. Papazisis, *Spine*,**2005**, 30: 247-255.
[13] P. Korovessis, G. Koureas, Z. Papazisis,*Journal of spinal disorders & techniques*, **2004**, 17: 33-40.
[14] H. A. Orloff, C. M. Rapp, *Spine*,**2004**, 29: 1325-1329.
[15] H. M. Brackley, J. M. Stevenson, *Spine*, **2004**, 29: 2184-2190.
[16] Y. Hong, J. X. Li, D. T. P. Fong, *Journal of Electromyography and Kinesiology*, **2008**, 18: 990-996.