

ORIGINAL RESEARCH

Medicine Science 2017;6(4):710-6

Assessment of postural conditions of children at early adolescence period

Fadime Ustuner Top¹, Dilek Konuk Sener²

¹ Giresun University Faculty of Health Sciences, Giresun, Turkey

² Düzce University School of Health, Düzce, Turkey

Received 17 March 2017; Accepted 30 May 2017

Available online 12.06.2017 with doi: 10.5455/medscience.2017.06.8647

Abstract

This study was performed in order to measure the level of knowledge of primary school students about postural disorders, to determine its effects on their lives and to provide proper posture techniques. The study was planned and performed in the order of pre test-post test in one group from pre-experimental designs. A questionnaire was used as the data collection tool. Students and their families were trained after pre-test phase. It was determined that students used correct position while sleeping ($p=0.00$) and writing ($p=0.03$), and they paid attention to body mechanics while carrying objects (on the arms $p=0.00$, on the back $p=0.00$) and lifting objects from the ground ($p=0.00$) after the training. As a result of this study, it was decided that training that was prepared for the adolescents and their parents to prevent postural disorders, is effective and applicable.

Keywords: Posture, adolescent, parents, education

Introduction

Posture means stance and is defined as the relationship of different parts of body with each other and gravity line. Fundamental condition for healthy development is the proper postural habits that were gained during childhood. Proper and balanced alignment of head, chest, arms and legs with respect to each other during various activities such as standing, sitting and walking is necessary for a good posture. Having a proper posture is important as much as a balanced diet, exercise and regular sleep [1,2].

A physiologically and biomechanically good posture is the position that provides the highest competence in the body with minimum effort. Besides, a good posture can be defined as a stance with a good body appearance, with a good position and balance, with less strain on the joints, that provides sufficient and proper functioning of the organs and that was taken loosely without burdening oneself. Individuals with a proper posture do all their work by spending less energy and they get less tired. A good posture is the indicator of a proper alignment of the bones and the functioning of joints naturally. In these patients, location of the inner organs with vital functions such as heart and lungs is also proper and these organs may function with full efficiency [1,3]. Physiologically and biomechanically bad posture is considered as a poor posture for the people.

It cannot serve the purpose completely; besides, it causes unnecessary contraction of the muscles. Children generally begin to acquire bad postures during the times that they started to sit on the chairs, and this condition becomes permanent during adolescence period between ten-twenty years old [1,4].

Adolescence is the process of transition from childhood to adulthood. Early adolescence period is the period that is the onset of puberty including nearly 10-13 years; and it is considered as the period during which postural disorders fully begin. During this period, sex-specific symptoms emerge with the development of reproductive organs, growth and bone maturation accelerate and many alterations occur in the proportions and structure of the body [5,6]. Postural disorders during this period may be derived from a habit or an underlying musculoskeletal deformity. Postural disorders that are related to leaning of the shoulders forward are encountered mostly in girls to hide growing breasts during this period. Improper positioning of adolescents during studying at school, long sitting times, increase in computer usage, heavy and improper bag carrying habits, postural habits brought by development age and sedentary living conditions raise postural disorders associated with the spine. Furthermore, intense mental stress during this period may also cause postural disorders [2,7,8].

Detection of postural disorders during early period increases the chance of treatment. Therefore, some regional studies were

*Corresponding Author: Fadime Ustuner Top, Giresun University Faculty of Health Sciences, Giresun, Turkey , E-mail: fadikom@hotmail.com

performed in order to determine the prevalence of postural disorders in our country. In the studies that were performed to

detect the prevalence of scoliosis in Istanbul, Sivas, Izmir and Van, scoliosis was observed in 0.25% in Istanbul, in 0.47% in Sivas, in 0.48% in Izmir and in 0.61% in Van out of the students whose age was between 7-15 years [9-12]. In the study by Ozdemir et al. [13] evaluating 436 students who were studying at high school or an equivalent school in Edirne City Center, prevalence of kyphosis was determined to be 1.68%. Recently, besides early detection of postural disorders, emphasis is given to the studies of prevention for this condition with preventive methods; because it is important for the adolescent to have a different body from his/her peers during adolescence period. A slight disturbance in his/her posture may lead to many physical, psychological and social problems by making the adolescent evaluate him/herself differently. Differences in appearance, limitation of physical activity and abilities and pain in musculoskeletal system may be among negative physical effects. Impairment in body perception, hopelessness, decrease in self-respect, impairment in interpersonal relationships, non-compliance with school and depression are among psycho-social effects. The importance of the training which aims to provide good postural habits to the adolescents to prevent these problems is increasing day by day. In recent studies, positive results were obtained from preventive training that was performed to adolescents for postural disorders [5,14,15].

Objectives

This study was performed in order to measure the level of knowledge of primary school students about postural disorders, to determine its effects on their lives and to provide correct posture techniques.

Material and Methods

Study Design

The study was planned and performed in the order of pre-test-post test in one group from pre-experimental designs [16].

Participants

The universe of the study was composed of the students of 9-12 years old who were studying in elementary schools located in a city center in Black Sea region. Schools in the city centers which constituted universe in order to determine sample, were listed; and an elementary school was determined with simple randomization method by using probability sampling method. All 9-12 year-old students in this elementary school constituted the sample group (113 individuals). The study was completed with 109 students (96%) who voluntarily approved to participate in the study.

The universe of the study was composed of the students studying in primary schools in city during 2015-2016 academic years. Sample included the students between 9-12 years old in 19 Eylül Primary School who were selected by a simple random sampling method. The study was planned for 113 students but performed to 109 students since 4 students did not come to school on the day of the study.

Instruments

A questionnaire form which was prepared by using relevant articles found during literature review was used as the data collection tool. Form was composed of 18 questions including physical characteristics of the adolescents, their postures in daily life and their behaviours while lifting weight. Data were collected by face-

to-face interview method by researchers.

Data Collection and Intervention

Questionnaire form was performed to all students during pretest phase. Visual material in the form of short film that was prepared by researchers was used as the training material. Training was consolidated as question-answer while watching short film and feedback was obtained. Training was completed within one lecture hour (45 minutes) by watching 15-minute video and giving necessary explanations. Classrooms and cinevision hall were used as training places. After the completion of the training, training brochure was distributed to the students and their families. Post test was implemented at one week after the training.

Study Materials

Training video: A training video including proper sitting, appropriate lying, proper type of bag and carrying style, proper studying position and postural disorders that may occur in order to resolve the deficits of the students about postural positions by role-play method. Training brochure: This brochure was prepared in parallel to the training video for the consolidation of training for the students and participation of the families in the training. It includes the definition of postural disorder and skeletal disorders that may occur as a result, the causes of postural disorders in the children and the proper postural positions for the activities in daily life.

Statistical Analyses

Coding of data and statistical assessment were performed by using SPSS version 15.0 statistical program. Mean, percentage and McNemar tests were used in data analysis. Coding of data and their statistical assessment were performed online by SPSS statistical package version 15.0. Mean and percentages were used for the assessment of data; chi-square and McNemar tests were used for the assessment of categorical data. Means were given together with standard deviation (SD) (Mean.±SD); and $p < 0.05$ was considered as statistically significant.

Limitations of the study

The universe of the study was composed of the students studying in primary schools in XXXX city. Therefore, it is not possible to generalize the results of the study for all primary schools. Students who were between 9-12 years old and who continued in fourth class were included in the study.

Ethical Issues

A written consent was obtained from Directorate of National Education. Besides, verbal consent was taken from the adolescents by giving them information about the study.

Results

Sex, age distribution and weight-height percentile values of the students and their status of experiencing lower back pain were shown in Table 1. 52.3% of 109 students were female students and 47.7% were males. Mean age of the students was found to be 9.94 ± 0.506 . Mean weight of the students was 32.25 ± 6.552 (20–53), and mean height was determined to be 135.53 ± 6.829 (111–150). When percentile values were examined based on age, it was detected that 32.1% were in 10th percentile and 3.7% were in 97th percentile.

When height percentiles were evaluated, it was found that 27.5% were in 25 th percentile and 6.4% were in 90th percentile.

It was detected that 8.3% of the students have experienced a lower back pain complaint continuously. In addition, it was determined that 39.4% of the students were wearing orthopedic shoes and this ratio has increased up to 67% after the training. 78% of the students who participated in the study had a computer at home. 52.3% of the computers were desktops and 26.6% were laptops. When Table 2 was examined, it was seen that 21.1% of the students who had computer at home were spending less than one hour and 57.8% were spending more than one hour in front of the computer. 21.1% of the students were not spending time since they did not have computer at home. The time spent in front of the computer was decreased at post test measurements and a statistically significant difference was found between them ($p=0.05$).

When television watching distance of the students were examined in Table 2, it was observed that television watching distances were increased at post test measurements and a statistically significant difference was found ($p=0.00$).

Table 1. Descriptive characteristics of the students characteristics of the study group

Variable	Number of students n	Percentage %
Sex		
Female	57	52.3
Male	52	47.7
Weight-Percentile Values		
3rd percentile	8	7.3
10th percentile	35	32.1
25th percentile	33	30.3
50th percentile	13	11.9
75th percentile	11	10.1
90th percentile	5	4.6
97th percentile	4	3.7
Height-Percentile Values		
3rd percentile	11	10.1
10th percentile	27	24.8
25th percentile	30	27.5
50th percentile	19	17.4
75th percentile	15	13.8
90th percentile	7	6.4
Complaint of lower back pain		
Yes	9	8,3
No	100	91,7
Total	109	100

Table 2. Students's status of using computer and watching television

Variable	Pre test		Post test		p
	Number	Percentage	Number	Percentage	
Time spent in front of the computer					
Less than one hour	23	21.1	35	32.1	0.05
One hour and more	63	57.8	52	47.7	
Does not spend time	23	21.1	22	20.2	
Television watching distance					
1 meter	14	12.8	6	5.5	0.00
2 meters	26	23.9	14	12.8	
3 meters	43	39.4	67	61.5	
4 meters	26	23.9	22	20.2	
Total	109	100	109	100	

When Table 3 was examined, it was determined that 99.1% of the students were using backpack while 0.9% were using sleeve bag according to pre test results. No change was observed in this ratio at post test measurements ($p=1.00$).

While 6.4% of these students were carrying all school books in their bags everyday, 93.6% were bringing their books according to daily lesson program.

At post test measurements, the percentage of the students who were bringing books according to daily lesson program became 91.7%, but no statistically significant difference was found between them ($p=0.75$).

When students' status of placing backpack in the classroom were

examined, it was determined that there was a decrease in the ratio of "placing it behind while sitting" after the training and the difference was found to be statistically significant ($p=0.04$).

Postural characteristics which are used by the students in daily life activities were examined in Table 4.

A positive progression occurred in postural characteristics of the students at post test measurements after the training.

When pre test and post test measurements were statistically compared, significant differences were found in the positions for sleeping ($p=0.00$), writing ($p=0.03$), lifting an object from the ground ($p=0.00$), carrying an object on the arms ($p=0.00$) and on the back ($p=0.00$).

Table 3. Students' status of using backpack

Variable	Pre test		Post test		p
	Number	Percentage	Number	Percentage	
Backpack					
Users	108	99.1	108	99.1	1.00
Non-users	1	0.9	1	0.9	
Backpack Weight Status					
Carrying daily books	102	93.6	100	91.7	0.75
Carrying all books	7	6.4	9	8.3	
Status of placing their backpacks in the Classroom					
At behind while sitting on the desk	68	62.4	55	50.5	0.04
Under the desk	1	0.9	3	2.8	
Next to the desk	16	14.7	26	23.9	
On the hanger	24	22.0	25	22.9	
Total	109	100	109	100	

Table 4. Multiple drug use according some health-related characteristics of the study group

Variable	Pre test		Post test		p
	Number	Percentage	Number	Percentage	
Studying positions					
At the table	105	96.3	106	97.2	1.00
By lying on the ground	1	0.9	1	0.9	
By sitting on the ground	3	2.8	2	1.8	
Writing positions					
By bending on the paper	27	24.8	16	14.7	0.03
By sitting upright	82	75.2	93	85.3	
Eating position					
Ground table	11	10.1	10	9.2	1.00
Table	98	89.9	99	90.8	
Television watching positions					
By sitting	82	75.2	86	78.9	0.52
By lying	27	24.8	23	21.1	
Sleeping positions					
Fetus position	39	35.8	69	63.3	0.00
Upright position	13	11.9	8	7.3	
Elderly position	10	9.2	3	2.8	
Soldier position	17	15.6	12	11.0	
Free fall position	19	17.4	13	11.9	
Starfish position	11	10.1	4	3.7	
Style of carrying an object on the arms					
Attached to the body	68	62.4	91	83.5	0.00
Distant from the body	41	37.6	18	16.5	
Style of lifting an object from the ground					
By bending the knees	83	76.1	98	89.9	0.00
By bending the waist	26	23.9	11	10.1	
Style of carrying an object on the back					
By leaning forward	55	50.5	31	28.4	0.00
By standing upright	54	49.5	78	71.6	
Total	109	100	109	100	

Discussion

The study was performed to determine improper postural positions during early adolescence period and to address the lack of knowledge of the adolescents about this subject; thus, to prevent possible musculoskeletal system problems that may occur at advanced ages.

When weight percentile values of the students were examined, it was determined that 32.1% were within 10th percentile; when their height percentiles were assessed, it was found that 27.5% were within 25th percentile (Table 1). The balance between height and weight of the students affects their postures, sitting positions, movements, bone development and health living conditions. These results suggest that the students will not create a problem towards postural disorder in terms of percentile values.

Another finding of the study was that 39.4% of the students were wearing orthopedic shoes before the training and this ratio was determined to be 67% after the training. Connective tissue provides increased balance among primary school children, and extreme mobility of the feet decreases. Ground reaction force based on weight reaches to adult level around eight years old. Shoes having properties like absorbing force that is coming to the feet, begin to gain importance. Again, in these ages, foot shape starts to show differences between girls and boys. Raising the heel part of the shoes slightly compared to the front foot may be preferred due to shock absorbing properties [17]. Since this ratio was not high enough despite the increase in the usage of orthopedic shoes after the training during the study, it is suggested that usage of orthopedic shoes should be more common among the students.

When students' status of carrying backpack was examined, it was determined that 99.1% were using backpacks (Table 3). Backpack is a good choice for use since it divides the load weight equally to both shoulders. This result shows that students are conscious about this matter. However, concerns about the use of wrong and heavy bag packs in providing posture and balance in adolescents, are increasing in recent studies. In a study by Chow et al. [18] that was performed in China, it was determined that carrying a heavy bag causes postural disorders. Maximum bag weight should not exceed 15% of the body weight. In the studies by Hong and Cheung [19] in China and Al-Khabbaz et al. [20] in Japan on students, substantial muscular and postural changes were detected in adolescents whose bag weight constituted 20% of their body weight. Therefore, it is required for the students not to carry unnecessary objects by giving attention to this matter. According to the result of this study, 93.6% of the students were bringing their books according to their daily lesson programs (Table 3). This high ratio obtained in the results shows that students comply with this behavior.

Bad posture is associated with common health problems such as lower back pain [21]. High proportions of adults with lower back pain have reported that their pain has started during their teens and twenties. In recent studies, it was highlighted that a high frequency of lower back pain is observed among school age children [22]. In our study, it was detected that 8.3% were experiencing the complaint of lower back pain (Table 1). In the studies by Olsen et al. [23], Ghandour et al. [24] and Heuscher et al. [25] that were performed in United States of America on adolescents whose ages were varying between 11 and 17 years, it was determined that

30.4%, 23.6% and 29.2% of the students were experiencing lower back pain, respectively. In the study by Cho [2] that was performed on adolescents in China, it was found that 59% of the students were experiencing neck pain, 50% had shoulder and 44% had lower back pain. It is thought that the difference between foreign countries and our country derive from the differences in genetic structure and physical characteristics in these three countries and the weight of the bags they were carrying. Since 93.6% of the students in our study were bringing their books to school according to their daily lesson programs, it is thought that their bag weights were not more than 15% of their body weights (Table 3). In the previous studies, it was determined that there is a positive correlation between the presence of lower back pain complaint in the students and their backpack weights [25-27].

According to the results of this study, it was determined that 62.4% of the students were placing their bags on their behind while they were sitting in the classroom (Table 3). In proper sitting position, head should be upright, jaw should be ahead, load should be equally distributed on both hips and foot soles should be completely contacted with the ground. Back and waist should be leaned on the chair and should be supported if necessary. The weight of the legs should be transferred on the feet and supporting surface. Besides, seat should be high enough and should be sited close to the table. Although promotion of the back during sitting position is desirable, it is considered that backpack is not a suitable supporting tool [3,28]. Sitting positions of the students who are putting their bags on their behind at school, may change. Accordingly, their postures are affected. Therefore, although the postures of the majority of the students may be considered to be affected, it was determined that this ratio was decreased down to 50.5% after the training. This result suggests that the training was effective.

When sitting positions of the students while studying lesson were examined, it was found that 24.8% were writing by bending on the paper and it was determined that this ratio was decreased down to 14.7% after the training (Table 4). Writing by bending on the paper affects body posture since it impairs proper sitting position. In the study by Temur et al. [29] that was performed on 412 students in Kutahya, it was detected that more than half of the students were writing by bending forward. The most striking result of the study was that 15% of the students were standing while writing.

An important factor that provides sitting of the students in a proper position is the desk. Studying lesson in the desk and in the proper sitting position is the recommended style for proper studying [29]. It was observed that 96.3% of the students in our study were studying in the desk by complying with this rule and it was determined that this ratio was 97.2% after the training (Table 4).

Another finding of the study was that 78.9% of the students were using computer. 21.1% of these students were spending less than one hour and 57.8% were spending more than one hour in front of the computer (Table 2). In the study by Deveci et al. [30] that was performed on primary school students in Elazig, it was determined that 59.3% of the students were using computer. Also, in the study by Cho [2] on adolescents, it was found that 43% of the adolescents were using computer and watching television for a longer time. Technologies which become increasingly common such as television, computer and internet have benefits as well as

harms for the children and the adolescents. Since television and computer require long periods of sitting in front of the screen, it may cause damages on musculoskeletal system and postural disorders due to the inaccuracies in sitting position [2,31]. In the study by Durmus and Kaya [32] that was performed on primary school students, it was observed that 91.9% of the students were using computer at home. Moreover, when durations of using computer at home were evaluated for students, it was determined that 67.4% were using for an average of one hour or less, 19.8% were using for 2-3 hours and 4.7% were using for 4-5 hours. This longer duration of computer use in our study and other studies is thought to be derived from the presence of computer at home due to the socio-economic structure.

Spending longer periods in front of the television and computer and operating distance increase the risk of exposure to radiation. By the previous studies, negligible wavelength limits that people were exposed in electromagnetic fields were determined. Again, it is required to use devices such as television and computer from a distance of at least 50 cm for the lowest acceptable electromagnetic measurements. Students' duration for watching television and using computer, their distances to these devices and especially their unnecessary use will increase their exposure to electromagnetic field. While 12.8% of the students in our study were watching television from a distance of 1 meter before the training, it was determined that 5.5% of them were watching from the same distance after the training (Table 2). In the study by Deveci et al. [30] that was performed in Elazığ, mean distance for watching television was found to be 206.62 ± 135.55 cm for the students.

Watching television in a sitting position is important for the development of proper posture. When the results of the students were examined, it was determined that 75.2% of them were watching television in a sitting position complying with this behavior (Table 4). Since sitting in front of the television increases spent sedentary times, it may cause health problems. The risk for lower back pain increases due to stretching of the ligaments and muscles for a long time and smoothing of lumbar vertebra during long-term sitting periods. Therefore, it is thought that orientation of the students to sport activities instead of watching television is appropriate [22].

When the positions that the students are using in daily life activities were examined, it was observed that 76.1% of the students were bending their knees while taking an object from the ground before the training and this ratio was increased up to 89.9% after the training (Table 4). Object's center of gravity should be approximate to the lifting person's center of gravity in order to use body mechanics properly while lifting an object from the ground. Thus, the distance between both centers of gravity shortens and the object is lifted more comfortably. Transfer of the weight to the large muscles by the reduction of the body surface and expansion of the bottom surface facilitates to lift the object. Therefore, body should not be bended from the waist while lifting an object from the ground; hips should be approximated to supporting area by keeping the body upright and bending the knees. Thus, the load will be distributed to large and strong muscle groups [28,33].

In situations where carrying an object on the arms is necessary, object to be carried should not be very heavy and it should be

aligned with the arms as much as possible. The object should be embraced by arms and held close to the body [33]. Based on the results of this study, while 62.4% of the students were carrying the object on their arms as attached to the body, this ratio was determined to be 83.5% after the training (Table 4).

Somnolence is a natural requirement of all people and it covers almost a quarter of our lives. There are some positions that each person feels comfortable during sleeping. Therefore, the position of the spine during this long period of unconsciousness may cause lower back pain. In the study performed by Kocaogullar et al. [34], the rate of hernia was found to be higher in the people who were sleeping by crossing their feet. When the results of our study were examined, it was observed that 51.4% of the students were sleeping in the proper position (fetus and soldier position) and this ratio was increased up to 74.3% after the training (Table 4).

Conclusion

Since the training in our study was including families, it was observed that students gained correct habits for the posture. There are many reasons in daily life that prevents to maintain proper posture. Necessary precautions should be taken during childhood in order to provide and maintain proper posture. There are very different prevention methods in this matter. One of these methods is the training for achieving proper posture. Since families play an important role in creating behavioral change in children from early ages, it is extremely important to give this training not only to the children also to the parents.

It was found that the duration spent by the students in front of the computer was decreased and majority of them gained the habit of watching television from the correct distance after the training. It was determined that there was an increase in sleeping positions such as fetus position and soldier position that were recommended sleeping positions in the training, compared to pre test results. According to post test results, it was detected that most of the students have gained the habits of using orthopedic shoes and proper writing. It was understood that students were more careful while lifting an object from the ground and carrying an object on the arms and on the back, and they were using proper positions. It was determined that majority of the adolescents were using backpack and bringing their books to the school according to daily lesson programs. Furthermore, a reduction was seen in the ratio of the habit of placing their bags on behind on the desk that may cause postural disorders in the students after the training.

Acknowledgments: No external funding sources were used in this study.

Conflict of interest: The authors have no conflicts of interest to declare.

References

1. Celik-Kayapınar F. The investigation effects of sample pilot study program on anthropometric, postur and physical fitness levels of preschool children (thesis). Institute of Health Sciences Department of Sport-Sports Health: Marmara Univ; 2007.
2. Cho C. Survey of faulty postures and associated factors among Chinese adolescent. *J Manipulative Physiol Ther.* 2008;31:224-9.

3. Ecerkale Ö. Posture analysis in the evaluation of results orthoröntgenogra with symmetrigrat (thesis). Okmeydanı Training and Research Hospital: Physical Therapy and Rehabilitation Clinic; 2006.
4. Karakuş S, Kılınç F. Posture and sporting performance. *Kastamonu Education Journal*. 2006;14:309–22.
5. Ekşi A. I'm not sick. Psychosocial aspects of child health and illness. 2nd ed. Istanbul: Nobel Publications. 2011;109-33.
6. Osborn LM, Dewitt TG, First LR, Zenel JA. *Pediatrics: Adolescent Care*. Translation Editor: Murat Yurdakök. Sun Publications. 2011;1494-641.
7. Neyzi O, Ertuğrul T. *Pediatrics*. Istanbul: Nobel Bookstore. 1993;793.
8. Parlak-Demir Y, Çırak Y, Dalkılıç M, Yılmaz GD, Uraş I, Kömürçü M. The habits of carrying bag, computer use and posture in primary school children. *Ankara Medical Journal*. 2012;12:182–7.
9. Adak B, Onen MŞ, Tekeoğlu I, Arslan A. Van scoliosis screening centers in primary schools Turkey. *J Phys Med Rehabil*. 1999;2:22–32.
10. Cilli K. Scoliosis screening in center province of Sivas, primary school student. Specialist Thesis, Cumhuriyet Uni; Department of Orthopedics and Traumatology, 2007.
11. Uğraş AA, Yılmaz M, Sungur I, Kaya I, Koyuncu Y, Cetinus ME. Prevalence of scoliosis and cost-effectiveness of screening in schools in Turkey. *J Back Musculoskelet Rehabil*. 2010;23(1):45–8.
12. Ibişoğlu YU, Atamaz-Çalış F, Yağız-On A. Prevalence of scoliosis among primary school children aged 12-14 years living in a town in western Turkey. *Turk J Phys Med Rehab*. 2012;58(2):109–13.
13. Ozdemir F, Kokino S, Uzunca K, Taştekin N, Ekuklu G, Avcı S. Posture analysis in high school students. *Turk J Phys Med Rehab*. 2002;48(1):3–7.
14. Korooshfard N, Ramezanzade H, Arabnarmi B. Relationship of selfesteem with forward head posture and round shoulder. *Procedia Social and Behavioral Sciences*. 2011;15:3698–702.
15. Choi JH, Kim HS, Kim GS, Lee H, Jeon HS, Chung KM. Posture management program based on theory of planned behavior for adolescents with mild idiopathic scoliosis. *Asian Nursing Research*. 2013;7(3):120-7.
16. Emiroğlu ON. Experimental Designs. In: Erefe I, editor. *Nursing Research Principles, Process and Methods*. Ankara: Focus Offset. 2002;98-9.
17. Marangoz S, Aksoy MC. Features of appropriate footwear in children. *Hacettepe Journal of Medicine*. 2009;40:199–204.
18. Chow DHK, Kwok MLY, Cheng JCY, Lao MLM, Holmes AD, Au-Yang A. The effect of backpack weight on the standing posture and balance of school-girls with adolescent idiopathic scoliosis and normal controls. *Gait Posture*. 2006;24(2):173–81.
19. Hong Y, Cheung CK. Gait and posture responses to backpack load during level walking in children. *Gait and Posture*. 2003;17(1):28–33.
20. Al-Khabbaz YSSM, Shimada T, Hasegawa M. The effect of backpack heaviness on trunk-lower extremity muscle activities and trunk posture. *Gait Posture*. 2008;28(2):297–302.
21. Paušić, J, Pedišić Ž, Dizdār D. Reliability of a photographic method for assessing standing posture of elementary school students. *J Manipulative Physiol Ther*. 2010;33(6):425–31.
22. Açık E. The effects of school furniture on posture in primary school students (thesis). Institute of Health Sciences Occupational Therapy Program: Hacettepe Univ. 2007.
23. Olsen TL, Anderson RL, Dearwater SR, Kriska AM, Cauley JA, Aaron DJ et al. The epidemiology of low back pain in an adolescent population. *Am J Public Health*. 1992;82(4):606–8.
24. Ghandour RM, Overpeck MD, Huang ZJ, Kogan MD, Scheidt PC. Headache, stomachache, backache, and morning fatigue among adolescent girls in the United States: Associations with behavioral, sociodemographic, and environmental factors. *Arch Pediatr Adolesc Med*. 2004;158(8):797–803.
25. Heuscher Z, Gilkey DP, Peel JL, Kennedy CA. The association of self-reported backpack use and backpack weight with low back pain among college students. *J Manipulative Physiol Ther*. 2010;33(6):432–7.
26. Geraldine SN, Richard K, Tariq R, Lisa J, Jennifer P. The association of backpack use and back pain in adolescents. *Health Services Research*. 2003;28:922–30.
27. Siambanes D, Martinez J, Butler E, Haider T. Influence of school backpacks on adolescent back pain. *J Pediatr Orthop*. 2004;24(2):211-7.
28. Sabuncu N, Babadağ K, Taşocak G, Atabek T. *Fundamentals of Nursing: Unit 6 Body Mechanics and Motion*, TC Anadolu University Press. 1996;74-90.
29. Temur T, Aksoy CC, Tabak H. An evaluation of the first-grade elementary student's writing speed and errors with regard to pencil gripping point, sitting posture and paper position. *Journal of Education and Social Sciences*. 2011;191:24–37.
30. Deveci SE, Açık Y, Gülbayrak C, Demir AF, Karadağ M, Koçdemir E. Investigation of frequency of mobile phone, computer and television like electromagnetic field-producing equipment use among primary school students. *Firat Medical Journal*. 2007;12:279-83.
31. Senol S. Child and youth mental health. Ankara: HYB Publications. 2006;105-6.
32. Durmuş A, Kaya S. To determine the correlation between the computer usage practice of the primary school students and their parents' computer usage practice. 8th International Educational Technology Conference; 2008 May 6-9; Anadolu University, Eskişehir, Turkey.
33. Akça-Ay F. *Basic Nursing: Concepts, Principles and Applications*. Istanbul; Istanbul Medical Publishing, 2nd edition. 2008;518–9.
34. Kocaoğullar Y, Erkan-Ustün M, Güney O. Habits in the etiology of lumbar disc herniation role of sleeping position. *Selcuk Journal of Medicine*. 2009;25:191–3.