



## Development and Psychometric Evaluation of a Health Questionnaire on Backpacks Carrying among Female Students

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### ABSTRACT

**Aims** Despite the high incidence of wrong ways to wear a backpack in students, the relevant musculoskeletal complications, and the effective role of health education in modification of this behavior; there is no standard questionnaire in this regard in Iran. The aim of this study was to assess the psychometric evaluation of a questionnaire on backpack carrying among female high school students.

**Instruments & Methods** The questionnaire on how female high school students carry their backpack in Babolsar, Mazandaran province included 31 items for knowledge (12 items), attitude (10 items), and behavior (9 items) derived from evidenced literature. This questionnaire was evaluated in terms of content and face validity and reliability through internal consistency and stability in 2018. The qualitative and quantitative content validity was evaluated by the panel of experts through Content Validity Index (CVI) and Content Validity Ratio (CVR). Qualitative and quantitative face validity was assessed by the students' views and measuring impact score, respectively. Internal consistency and stability were measured by Cronbach's alpha and Intraclass Correlation Coefficient, respectively. Data were analyzed by SPSS 21.

**Findings** The results of CVI (0.9-1), CVR (0.8-1), and impact score (2.5-3) were acceptable for the whole scale. Qualitative content and face validity was favorable. Cronbach's alpha coefficients were appropriate for the whole scale (0.77) and subscales of knowledge (0.68), attitude (0.8), and behavior (0.77). The interclass correlation coefficient for the whole questionnaire (0.68) and the domains of knowledge (0.61), attitude (0.71), and behavior (0.72) indicated that the questionnaire was acceptable.

**Conclusion** The study showed the validity and reliability of the health questionnaire on carrying backpack among female high school students. However, more researches should be done to verify this questionnaire for measuring knowledge, attitude, and behavior regarding backpack carrying.

**Keywords** Backpack Carrying; Psychometrics; Student; Musculoskeletal Disorder

### CITATION LINKS

[1] Effect of carrying backpacks with different weights on electromyography activity of rectus abdominis and lumbar ... [2] The relationship between weight and the weight of the school bag in ... [3] Use of backpacks in children and adolescents: A potential ... [4] Kinematics effects of carrying the school backpack ... [5] The effect of backpack weight on cardiovascular and respiratory ... [6] Survey of relationship between ergonomic and environmental conditions of ... [7] The association of backpack use and ... [8] Musculoskeletal pain and school bag use: A cross-sectional ... [9] Neck, shoulder and low back pain in secondary schoolchildren in relation to schoolbag carriage: Should the ... [10] Prevalence and characteristics of low back pain in ... [11] Analysis of postural changes in 2nd cycle ... [12] Reported influences of backpack loads on postural deviation ... [13] Poor sitting posture and a heavy schoolbag as contributors to musculoskeletal pain in children: ... [14] The effects of back schools--a meta ... [15] Effect of ergonomic modification training about schoolbag on reduction of musculoskeletal ... [16] Guidelines for schoolbag carriage: An appraisal of safe load ... [17] Awareness of parents about characteristics ... [18] Statistical methods and analyses in health and ... [19] A quantitative approach to content ... [20] Coefficient alpha and the internal structure ... [21] The intraclass correlation coefficient as a measure ... [22] Design and evaluation of measurement tool for sitting ... [23] The development and validation of a low ... [24] Development and psychometric evaluation of a health questionnaire ...

## Introduction

Among the social institutions, the school is one of the most important organized institutions that should be able to flourish the body and mind of the students by providing a healthy environment [1]. Throughout the school year, students are changed physically, emotionally, and socially, and if no proper environment is provided for their development, they face with different growth and developmental disorders and various diseases. Not only does it create important barriers in their learning process and education, but it also forms the basis of many diseases and physical/ psychological disorders in their adulthood [2].

During developmental stages, adolescents carry out a variety of motor activities, among them carrying heavy school bags is the most important example of such activities [3]. The way of carrying, type of the bag, the weight, and the duration of the carriage are issues that have been focused on by the parents, teachers, physical education specialist, and physicians [4].

The use of backpacks and other types of school bags may impose manifest and latent effects and strains on the height and the skeleton of the students and cause certain metabolic, cardiovascular, and respiratory impairments. Musculoskeletal disorders and pain are known as the most important and major pain in students and adolescents [5]. Muscles, ligaments, and bones of adolescents, at the end of puberty, at about 19 years old, still undergo developmental stages and physical growth and between 6 and 14 years old, they are very sensitive and are prone to most lesions and the possible injuries [6]. In Iran, the incidence of neck, shoulder, and waist complaints relevant to carrying school bags and other potential risk factors were examined on 586 students with an age range of 12-14 years. The average student load was 2.8kg. The neck, shoulder, and lower back area complaints by students during 1 month were 35.3%, 26.1%, and 33%, respectively. Sex was one of the independent factors in predicting symptoms of musculoskeletal pain in students, so that girls more than boys complained of pain in the neck, shoulder, and lumbar region.

Furthermore, the results of a study on 5,000 students with an age range of 11-14 in Mazandaran province showed that 15% of them were complaining of back pain during the study. In their lifetime, 40.3% of all students experienced back pain at least once, 19.3% twice, 8.9% three times, and 31.5% several times. The inability to carry the school bag was 21.8% [7-10].

The main reasons for these problems are the lack of appropriate training in educational settings, including schools [11]. Knowing about the proper load and how to carry the backpack is effective in reducing the musculoskeletal complications of the

students [12]. Health education interventions can play a significant role in promoting properly using and carrying backpacks and in preventing the musculoskeletal disorders.

Ergonomic intervention for students in Malaysia by Syazwan *et al.* led to a significant improvement regarding the sitting position in the classroom and reduced weight of the school bag in comparison to control group [13]. The meta-analysis by Maier-Riehle and Härter suggested a positive impact of training proper ways of carrying backpack on the reduction of chronic back pain in students [14]. Implementation of these interventions requires the use of valid and reliable instruments on knowledge, attitudes, and behavior regarding the proper carrying of the backpack. In the country, as far as the researcher knows, the only available questionnaire was relevant to an intervention for school bags conducted by Mirmohammadi *et al.* on the 6<sup>th</sup> grade students in Yazd and it reduced the weight and time of carrying bags in the intervention group [15]. Of course, that questionnaire was based only on the ergonomic characteristics and properties of the bags.

Therefore, considering the prevalence of musculoskeletal pain due to improper carrying of backpacks in female students, in Mazandaran province, and the role of health education interventions in promoting the proper carrying of backpacks for the prevention of musculoskeletal problems in students as one of the most important and vulnerable target groups in the society, as well as lack of standard questionnaire for conducting relevant educational research in the province, this study was conducted with the aim of developing and accessing the psychometric properties of a health questionnaire on carrying a backpack among the female first-grade high school students in Babolsar, Mazandaran.

## Instruments and Methods

**Questionnaire Development:** The questions of the questionnaire on knowledge, attitude, and practice were designed based on the review of several sources regarding carrying the backpack [15-17]. This researcher-made questionnaire consisted of 3 parts; the first part was the knowledge variable, consisting of 12 questions and each item had the options of "yes", "no", and "I do not know". The correct answer gained score 1 and the incorrect answer and "I do not know" option gained score 0. The second part dealt with attitude toward how to carry a backpack, and it consisted of 10 questions based on 5-point Likert scale (strongly agree, agree, undecided, disagree, strongly disagree). The option "strongly agree" scored 5, and "strongly disagree" scored 1. The behavior variable had 9 items and each item had the following options like "true", "somewhat true", and "false". The "true" option of the behavior scored

2 points, "somewhat true" scored 1 point, and the "false" option scored 0 point. The total score of the

questionnaire was computed to be between 10 and 80 (Table 1).

**Table 1)** Items and options in the Health questionnaire on carry backpacks among high school students

Items	Choice alternatives
<p><b>Knowledge</b></p> <p>The backpack is a suitable tool to carry necessary supplies to schools.</p> <p>The weight of the backpack should fit with the student's weight and age.</p> <p>The size of the backpack should fit with the student's height of the spinal cord.</p> <p>Compared to other school bags, backpack consumes less energy.</p> <p>Improper use of backpack may cause irreversible damages to your spinal cord.</p> <p>The backpack should be worn right on the back and it should be stable.</p> <p>The backpack should be placed between the shoulders.</p> <p>To reduce the weight of the backpack, they should buy notebooks with paperbacks.</p> <p>Carrying a backpack for a long time causes musculoskeletal disorders.</p> <p>The heavy weight of backpack causes musculoskeletal disorders.</p> <p>The heavy weight of backpack results in a hollow back.</p> <p>The improper carrying of the backpack causes pain in the back and shoulders.</p>	<p>Yes</p> <p>No</p> <p>I do not know</p>
<p><b>Attitude</b></p> <p>Many spinal cord disorders in the adulthood are the result of injuries in the childhood and adolescence.</p> <p>Following the principles of carrying a backpack is necessary for the spinal cord health.</p> <p>Correct order of arrangement inside the backpack is necessary.</p> <p>When the weight of the backpack fits the student's weight, it maintains the spinal cord health.</p> <p>Carrying a backpack for continuous hours without breaks cause musculoskeletal disorders.</p> <p>After carrying a backpack, physical exercises of the shoulders, shoulder blades, arms, and back muscles are necessary for the spinal cord health.</p> <p>Proper carrying of the backpack makes me less tired.</p> <p>The height of the backpack should fit the height of the spinal cord.</p> <p>It is necessary to fasten the chest and waist straps.</p> <p>Proper carrying of the backpack reduces the probability of musculoskeletal disorders</p>	<p>Strongly agree</p> <p>Agree</p> <p>Undecided</p> <p>Disagree</p> <p>Strongly disagree</p>
<p><b>Behavior</b></p> <p>I consider that the weight of my backpack is about 10% of my body weight</p> <p>I use both straps when I use backpack.</p> <p>When I use backpack I adjust the straps so that it does not sway side to side.</p> <p>When I use backpack I fasten the chest and waist straps.</p> <p>To arrange my school supplies I put heavy ones in the back, the ones with average weight in the middle, and the lighter ones in the front of my backpack.</p> <p>If after the arrangement backpack still weigh is more, I carry the extra supplies in my hand.</p> <p>To wear the backpack, I first place it on a table and put my hands inside the straps.</p> <p>At long distances, I replace the backpack successively.</p> <p>To relieve from the fatigue caused by carrying the backpack, I do the proper exercises.</p>	<p>True</p> <p>Somewhat true</p> <p>False</p>

**Validity Assessment:** The content validity of the questionnaire was evaluated qualitatively and quantitatively. In the qualitative assessment, the researcher requested 10 experts (including health education specialists, physiotherapist, and ergonomics specialists) assess the instrument based on the criteria of grammar, proper word choice (wording), item allocation, and scaling. In the quantitative assessment of the content validity, Content Validity Ratio (CVR) and Content Validity Index (CVI) were used [18]. In CVR, the obtained value was compared with the Lawshe table [19]. In CVI, the acceptance of items was based on a scores more than 0.79 [18]. The face validity of the questionnaire was studied in 15 students similar to the target group. In qualitative method, the level of difficulty, irrelevance, and ambiguity were evaluated. In the quantitative method, the item impact method was used to reduce and eliminate inappropriate items and to determine the

importance of each item. A high impact score of 1.5 was considered acceptable [18].

**Reliability assessment:** To determine the reliability of the questionnaire, internal consistency and stability were evaluated. Internal consistency was investigated among 30 students similar to the target group, using Cronbach's alpha with the acceptable rate of 0.7 and more [20]. The evaluation of stability was performed through a test-re-test and a two-week interval. Then, the scores obtained in these two stages were compared, using the Intra-class Correlation Coefficient (ICC). The coefficient of less than 0.4 was considered poor agreement, 0.41-0.6 average, and 0.61-0.8 as well, and above 0.8 as excellent [21]. Data were analyzed, using SPSS 21 and significance level was considered as less than 0.05.

**Ethical Considerations:** The Ethics Committee of Tarbiat Modarres University of Medical Sciences approved this study. The participants also signed an informed consent form.

## Findings

**Validity:** The results of CVI (0.9-1), CVR (0.8-1), and impact score (2.5-3) were acceptable for the whole scale. Qualitative content validity was favorable. Difficulty, irrelevance, and ambiguity levels were evaluated in proper qualitative face validity.

**Reliability:** Cronbach's alpha coefficients was appropriate for the whole scale and the subscales of knowledge, attitude, and behavior. ICC for the questionnaire and the dimensions of knowledge, attitude, and behavior were at "good" level of evidence (Table 2).

**Table 2)** The results of reliability assessment of the health questionnaire on carrying backpack

Subscale	Cronbach's alpha coefficient	Intra-class correlation coefficient
Knowledge	0.68	0.68
Attitude	0.8	0.61
Behavior	0.77	0.71
Total	0.77	0.72

## Discussion

Considering the increasing prevalence of musculoskeletal disorders due to improper backpacking in students (16), the need for educational interventions using valid and reliable instruments to change this behavior is guaranteed. Since there was no standard questionnaire in this regard in Iran, the present study was designed to assess the validity and reliability of a researcher-made questionnaire on knowledge, attitudes, and behavior regarding carrying backpacks among students.

This study showed the CVR and CVI were acceptable for the whole questionnaire. Qualitative content validity was appropriate in terms of grammar, proper word choice, allocation, and scaling. Furthermore, the impact score of this scale was evaluated in favorable quantitative face validity. Students described the level of difficulty, relevance, and lack of ambiguity in proper qualitative face validity. In fact, providing relevancy, clarity, simplify, and essentiality questions based on reliable sources on how to carry backpacks using expert opinions led to proper item design in terms of content validity.

Moreover, the target group of the study confirmed the questions of scale in terms of difficulty, relevance, and lack of ambiguity. This suggests that the sample questions used in this questionnaire represent the entire community of questions that may be generated from the considered content or subject. Moreover, they appeared to be similar to the subject that they were designed to measure. These results were consistent with the findings of the content and face validity of the 29-item questionnaire on knowledge, attitude, and behavior of how students should sit by Norouzi *et al.* [22]. Furthermore, it was consistent with the results of a study conducted by Simone Maciel *et al.* regarding

the questionnaire on back pain. The content and face validity of the present questionnaire were appropriate, judged by the experts and the target group [23].

The reliability assessment of this scale showed that the questions had a good internal consistency and, in other words, the expressions in the subscales were homogeneous and each subscale measured one single issue. Moreover, the re-test showed that students obtained the same grades at two stages of time. In other words, the modification and revision of the questionnaire in the content and face validity phase led to the design of coherent and stable items. These findings were consistent with the research conducted by Javdivala *et al.*, which showed an acceptable internal consistency for the questionnaire on knowledge of the proper backpack characteristics [17].

Furthermore, these findings were consistent with the study of Simone Maciel *et al.* regarding the reliability assessment of the questionnaire on the knowledge of back pain in patients, which showed an appropriate Spearman correlation coefficient (0.69-0.86) and ICC (0.80-0.94) for the scale [23].

The results of the present study were consistent with the research carried out by Monfort-Pañego *et al.* regarding the psychometric of the questionnaire on the knowledge of back care in daily physical activity in students. In his study, Cronbach's alpha results showed a high internal coherence (0.82). In the stability assessment, the ICC was moderate to excellent (0.54-0.76) [24]. Moreover, the psychometric properties of the questionnaire of how students should sit by Norouzi *et al.* showed an internal consistency (Cronbach's alpha=0.87) and appropriate stability (ICC=0.87, Pearson correlation=0.96) [22].

This research confirmed the validity and reliability of the questionnaire on carrying backpack in female high school students. However, to provide a standard and general instrument, it is necessary to assess the psychometrics of this instrument in further researches among male students and also in other levels of education as well.

## Conclusion

The study showed the validity and reliability the health questionnaire on carrying backpack among female high school students. However, more researches should be done to verify this questionnaire for measuring knowledge, attitude, and behavior regarding backpack carrying.

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**Ethical Permissions:** The case was not found by the authors.

**Conflict of Interests:** The case was not found by the authors.

**Authors' Contribution:** Dadashi Tonkaboni N. (First author), Introduction author/ Original researcher (35%); Tavafian S.S. (Second author), Methodologist/ Discussion author (35%); Gholamnia-Shirvani Z. (Third author), Assistant researcher/ Statistical analyst (30%)

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