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Relationship between Cognitive Factors and Healthy Spine-related Behavior among Pupils

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ABSTRACT

Aims: Back pain is one of the most important public health problems. It is on the rise among the adolescent and pupil population. This study aimed to assess the relationship between cognitive factors (skills, knowledge, self-efficacy, and expectation beliefs) and back care behavior among pupils.

Method and Materials: A cross-sectional study was conducted on a random sample of students attending public elementary schools in Tehran, Iran, from October 2018 to March 2019. They completed a questionnaire containing items on cognitive abilities and a checklist to assess their skills in back care behaviors. Stepwise multiple regression analysis was performed to find out the contribution of cognitive factors to the outcome.

Findings: In all, 204 students were entered into the study. The results revealed that 95.3% of the variance in the back behavior was explained by self-efficacy (β=0.586, t=12.08, P<0.001), expectation beliefs (β=0.232, t=5.08, P<0.001), and skills (β=0.181, t=4.46, P<0.001).

Conclusion: These results showed that the pupils who had more confidence, skills, and expectation beliefs were more likely to exhibit proper behavior. In this regard, school-based back pain prevention interventions should be addressed using key cognitive factors that consider the potential change strategies.

Keywords: Cognitive Factors, Spine-related Behavior, Pupils

Introduction

Back pain is one of the most important public health problems, and nearly 540 million people suffer from it [1]. It is on the rise among the adolescent and pupil population, and the prevalence varies between 11% and 52.1%, and is associated with back pain in adulthood [2–5]. Behavioral risk factors for back pain in children are, among others, prolonged improper backpack loading during the childhood years, carrying the bag on one side of the body [1,5–7], physical inactivity [1,8], and improper posture during daily activity [7,9]. Thus, it is argued that to prevent or reduce the burden of back pain in pupils, theory-based back care educational programs for this population are of prime importance [10].

One such theory that might help to enrich these programs and make them effective is the Social Cognitive Theory (SCT). The Social Cognitive Theory was originated from the Social Learning Theory (SLT), according to the theory, three main psychological determinants that predict any behavior changes are: behavioral capability (knowledge and skills to perform a given behavior); Self-Efficacy (SE); and outcome expectation beliefs (behavioral beliefs) [11,12].

The applications of SCT in many health education/promotion programs are well documented [13–17]. For instance, a review of the literature on Physical Activity (PA) and diet behavior among cancer survivors reported that SCT-based interventions demonstrated promising results [17]. Similarly, a review on the explanatory power of SCT to explain PA among adolescents showed that the model explained a greater proportion of variance for intention compared to behavior [16]. Hall et al. [14] developed and validated

SCT-based survey instrument that focused on knowledge, behavior, and SE for fifth-grade students to assess the relationships between knowledge, behavior, and SE for healthy eating. They have demonstrated that SE and behaviors were positively correlated (r = 0.40, P = 0.0001), but knowledge was not associated with SE or behavior. However, we could not locate any studies that use this theory for back care education. Most existing studies on the topic usually did not apply any theoretical models and only implemented interventions that they thought could work to change or modify pupils' back care behaviors.

Spence et al. [18] and Sheldon et al. [19] for the first time presented a healthy back behavior education. They determined the effects of verbal presentation, demonstration, and guided discovery teaching methods on children's proper lifting techniques, and in the end, they could not show that any behavior change occurred. Cardon et al. [20] tested the practical performance and back care knowledge through the back care education program, among fourth- and fifth-grade elementary school children. The results showed that behavioral changes need further evaluation to optimize back care prevention programs for elementary school children. Recently, Dullien et al. [1] conducted a cluster-randomized controlled study and examined whether teacher-led intervention programs could improve back-care knowledge and back-friendly behavior. The results showed that back care knowledge and parts of back-friendly behavior could be significantly improved. As reported by Geldof et al. [21], intensive back posture education through the elementary school curriculum is effective till adolescence. It was shown that school-based back education programs did not change spinal care behavior or self-efficacy [22]. Santos et al. [23] argued that no statistically significant difference was found between post-test and follow-up about theoretical knowledge and posture during activities of daily living. A key limitation of these investigations is that they do not address cognitive factors causing back behavior, and this issue has been scarcely investigated from a theoretical point of view.

However, to the best of our knowledge, as mentioned earlier, this theory has not been used in any back pain prevention programs in elementary schools, and we are not aware of a quantitative study that explores cognitive factors causing back behavior. Therefore, we were interested in investigating the extent to which the SCT could explain back care behavior among schoolchildren. It was hoped that the findings from this study could help to design and implement an appropriate intervention for pupil populations attending elementary schools.

Materials and Methods

This study used a cross-sectional design among 5th-grade students attending elementary schools in Tehran, Iran, from October 2018 to March 2019. The independent variables were the constructs of the SCT (self-efficacy, knowledge, skills, and outcome expectation beliefs). The dependent variable was the back behavior (Fig.1).

The study sample consisted of female students aged 11 years. They were selected from two (out of 8) randomly selected elementary schools in the northwest of Tehran, Iran. The district has a population of a variety of socio-economic backgrounds. To explore the predictive factor, the previous study [1] was referred to determine the required sample size. According to this study [1], to conduct a study with a power of 80%, and a standard deviation of 14.5 for a performance score with a minimum precision of 2 at a 5% significance level, a sample of 202 pupils would be required. However, since in school-based studies, selection is almost impossible, the whole classes were selected and 204 fifth-grade students were recruited. We obtained permission from school principals, and all parents completed written informed consent.

Data collection was done as follows: Information on pupils' parents' jobs and level of education, and a question about the presence of back pain during the last week among pupils (Yes, No). To measure the main independent variables, the Cardon et al. questionnaire was used [20]. The questionnaire contained 43 items, including the following sections:

Back care knowledge consists of 10 multiple-choice items on general back care knowledge. For each item, respondents could choose a correct answer from a list of statements. The correct answers received 1 point, and if they responded incorrectly, they received zero points for that item. The score on this construct ranged from zero to 10, where the higher scores indicated higher knowledge.

Back care skills, which contained a checklist for practical assessment of skills, for back care principles. The checklist consisted of 23 items tapping into seven tasks (sitting at a table, picking up the crate, carrying the crate, setting the crate down on the table, picking up a pencil, moving the crate, and a book bag). Each item is rated on a 5-point scale ranging from 1 (very poor) to 5 (excellent), giving scores ranging from 23 to 115, where higher scores indicate better fulfillment of tasks.

Self-efficacy contained 4 questions asking how easy or difficult the following were: participation in daily physical activity and sports, attaining a natural curvature of the spine, minimal loading of the book bag, and paying attention to ergonomic postures. Each item is rated on a five-point scale (from difficult to easy), giving scores ranging from 4 to 20, where the higher scores indicate higher self-efficacy.

Outcome expectation beliefs (behavioral beliefs) contained 6 items asking whether sitting, swimming, running, participating in physical education, cycling, and lifting heavy objects are 'dangerous' when having a backache. Each item is rated on a five-point scale (strongly disagree to strongly agree), giving a score ranging from 6 to 30, where a higher score indicates stronger beliefs.

3. Back care behavior as outcome measure contained six questions regarding daily activities on checking the weight of the book bag; carrying the bag with 2 straps; knee position when putting on shoes; doing exercises every day; and postural behavior while lifting and carrying objects. Each question is rated on a five-point scale (never = 1 to ever = 5), giving a score ranging from 6 to 30, where higher scores indicate better preventive behavior.

Before data collection, we explained the aim of this study to the principal, class teacher, and pupils of the two schools. After obtaining permission from them, we distributed the questionnaire. There were two independent research assistants to help in this study, who rated students' skills based on the checklist. Since the analysis of the relationship between the variables is worthy of attention. We are looking to identify the relationships between variables that are extracted from the theory are confirmed by the data collected from the sample.

Descriptive statistics were used to explore the data. In addition, we used stepwise multiple regression analysis to assess the relationship between back care behavior (outcome variable) and independent variables, including knowledge, skills, SE, and expectation beliefs. The level of significance was set at $p < .05$. The data were analyzed using the SPSS V_{24} software to test the correlation between study variables.

Findings

In all, 204 pupils aged 11 years participated in the study. Of these, 22.5% (n = 46) reported back pain during the last week. The common characteristics of the students are presented in Table 1.

Table 1) The sample characteristics (n = 204)

Variables		N (%)
Father's job		
	Employed	181 (88.8)
	Unemployed	4 (2.0)
	Retired	11 (5.4)
Mother's job		
	Employed	40 (19.6)
	Housewife	160 (78.4)

Variables		N (%)
Father's level of education		
	Illiterate/primary	3 (9.9)
	Secondary	87 (42.6)
	Higher	69 (33.8)
Mother's level of education		
	Illiterate/primary	34 (16.7)
	Secondary	94 (46.1)
	Higher	55 (27.0)
Presence of back pain		
	Yes	46 (22.5)
	No	154 (75.5)

In general, the students' scores on knowledge were reasonable (mean = 4.71). The means and standard deviations of independent and dependent variables are demonstrated in Table 2.

Table 2) Descriptive statistics for the study variables (n= 204).

Variables	Mean	SD	Score range
Knowledge	4.71	1.40	0-10
Skills	65.84	16.16	23-115
Self-efficacy	13.89	4.44	4-20
Expectation belief	20.48	6.44	6-30
Back care behavior	20.94	6.65	6-30

The results obtained from stepwise multiple regression analysis to predict the back care behavior are shown in Table 3. The analysis revealed that 95.3% of the variance in the back care behavior was explained by skills (β = 0.181, P<0.001), expectation beliefs (β = 0.232, P<0.001), and self-efficacy (β = 0.586, P<0.001). F (3, 200) = 1332.519, P< 0.001, R^2 (Adjusted R^2) = 0.976 (0.953)

Table 3) Parameter estimates on stepwise regression analysis to predict back care behavior (n= 204).

Variables	B	SE_B	β	t	95% CI for B	P value
Self-efficacy	0.878	0.073	0.586	12.077	0.735-1.022	<0.001
Expectation belief	0.239	0.047	0.232	5.084	0.146-0.332	<0.001
Skills	0.075	0.017	0.181	4.463	0.042-0.108	<0.001

B = unstandardized coefficient; **SE_B**= standard error of the coefficient; **CI** = Confidence Interval; **β** = standardized coefficient

Discussion

This study was carried out to predict healthy spine-related behavior among pupils using the SCT in elementary school children. The results revealed that SE, skills, and expectation beliefs were important mediators of Back-care Behavior (BB). Of these, SE was the strongest predictor for BB. Studies have shown that SE affects both the initiation and continuance of BB [22, 25]. The relationship between SE and behavior is well documented in previous studies, where it has been reported that interventions should improve students' SE towards proper BB. Indeed, it has been suggested that back pain prevention programs should implement modeling, feedback, and reattribution sufficiently since these factors are important to improve SE in health-related behavior [22, 25].

A positive value for the expectation beliefs' coefficient (β = 0.232, P<0.001) gives the sense that stronger beliefs about the dangers of back pain will result in improved behaviors. Similarly, Gross et al. reported that one of the most basic assumptions about human behavior is the fact that what people believe guides what they do [25]. Therefore, to enhance proper back behavior, we need to reinforce

the proper beliefs and active approach toward the dangers of pain and limitations that might exceed. Belief change is much easier at a younger age, so appropriate actions should be considered in educational programs to correct any misunderstandings and misbeliefs at this stage. As such, the findings from the current study indicate that promoting expectation beliefs could be an appropriate strategy for back care interventions.

We found a significant and positive relationship between skills and BB ($P<0.001$) that has not been indicated previously. This, however, indicates that by improving students' skills, we might be able to promote their proper behavior. As suggested in educational initiatives, we need to target children's skills toward BB during key constructive years when maladaptive beliefs, habits, and attitudes about the condition are being shaped [25].

The knowledge of back principles did not show any significant association with BB. Studies have shown that although knowledge might improve after back care interventions, the association between knowledge and proper back Behavior was not established. For instance, Dullien et al. reported that back care knowledge and parts of BB significantly improved from pre- to post-test, but an increase in the intervention group's knowledge did not significantly affect their behavior [1]. Santos et al. also reported that there was no statistically significant difference between the post-test and follow-up concerning back care knowledge and posture during activities of daily living, although the performance of students was higher in the post-test and follow-up when compared with the pretest [23]. Perhaps this is because people usually do not act on what they know, and the fact that education alone is unlikely to promote positive and persisting behavioral change without coincident strategies [25].

There were some limitations to this study. First, we used a cross-sectional design, and data were collected through self-reported measures and raters' assessments; thus, the findings cannot provide evidence for cause-and-effect relationships. Longitudinal data and experimental studies are needed to confirm the results observed in this study. Secondly, although we explored the main cognitive factors of behavior, we acknowledge that there were other factors based on the SCT (environmental determinants of behavior) that were not adequately addressed. Finally, one should notice that we only collected data from girls who were attending public elementary school; therefore, this limits the generalizability of the results to the entire population of pupils.

Conclusion

This study was the first SCT to predict healthy spine-related behavior among pupils. The findings suggest that SCT-based back care education programs should focus more on expectation beliefs, self-efficacy, and skills when designing interventional programs for pupils. Indeed, assessing the utility of the main cognitive determinants of SCT deserves further investigation.

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Authors' contribution

ZAC was the main investigator, collected and analyzed the data, and wrote the first draft. SST supervised the study and contributed to all aspects of the study. AM was the study

advisor and contributed to the analysis, interpretation, and writing process. All authors read and approved the final manuscript.

Conflict of Interest

Not applicable. The authors declare that they have no competing interests.

Ethics Approval

The study was registered by the ethics committee of Tarbiat Modares University under the code IR.TMU.REC.1396.727 and was by the Helsinki Declaration. We invited all of the parents and informed them about the research design, aim, and objectives, as well as voluntariness, confidentiality, and their rights. They then agreed to participate in the study by completing and returning the questionnaire. The parents completed the written consent form.

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