Effects of a postural program for children and adolescents eight months after its end

Efeitos de um programa de educação postural para crianças e adolescentes após oito meses de seu término

Efectos de un programa de educación postural para niños y adolescentes ocho meses después de su conclusión

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ABSTRACT

Objective: To evaluate the effects of a Postural Education Program (PEP) for children and adolescents eight months after its completion.

Methods: 34 subjects were assigned to a Control Group (CG) or to an Experimental Group (EG). Only the EG participated in the PEP, but all the subjects were evaluated before, during and eight months after finishing the PEP. The assessment used three procedures: (1) static posture by photography; (2) dynamic posture by recording the execution of everyday activities (EAs); and (3) answering a questionnaire designed to evaluate the theoretical knowledge about the spine. In order to verify the differences between CG and EG and between the three studied periods the following tests were used: Mann-Whitney and Wilcoxon for comparing the scores of EAs and questionnaire, and chi-square to analyze the frequency of postural changes in CG and EG.

Results: When evaluated immediately after its completion, the PEP had a positive effect on the posture of EAs and on the knowledge about the spine. The positive effect of the PEP was reduced eight months after its completion.

Conclusions: It can be speculated that the awareness of the importance of good posture during EAs was not effectively incorporated into the habits of the studied group.

Key-words: posture; students; health education.

RESUMO

Objetivo: Avaliar os efeitos de um Programa de Educação Postural (PEP) para crianças e adolescentes oito meses após seu término.

Métodos: Estudo experimental com 34 participantes divididos em Grupo Controle (GC) e Grupo Experimental (GE). Somente os integrantes do GE participaram do PEP. Os 34 participantes foram submetidos – no início, no término e oito meses após o término do PEP – a três procedimentos de avaliação: (1) postura estática por meio de fotografia; (2) postura dinâmica, por filmagem da execução de atividades da vida diária (AVDs); e (3) questionário sobre os conhecimentos teóricos da coluna vertebral. Para verificar as diferenças entre o GC e o GE e entre as etapas de avaliação, foram utilizados os testes de Mann-Whitney e de Wilcoxon para os escores das AVDs e do questionário e o qui-quadrado para comparar a frequência de alterações posturais.

Resultados: O PEP, quando avaliado imediatamente após seu término, promoveu efeito positivo apenas no conhecimento teórico e na postura das AVDs. Entretanto, o efeito positivo do PEP não foi estendido ao período de *follow-up*, após oito meses do término do programa.

Conclusões: Especula-se que o conhecimento da importância da boa postura durante as AVDs não foi efetivamente incorporado aos hábitos das crianças e dos adolescentes.

Palavras-chave: postura; estudantes; educação em saúde.

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RESUMEN

Objetivo: Evaluar los defectos de un Programa de Educación Postural (PEP) para niños y adolescentes, ocho meses después de su conclusión.

Métodos: Estudio experimental, formado por 34 participantes. Los participantes fueron divididos en grupo control (GC) y grupo experimental (GE). Solamente los integrantes del GE participaron del PEP, pero fueron realizados con todos los 34 participantes, en el inicio y término del PEP y ocho meses después del término del PEP, tres procedimientos de evaluación: (1) Postura Estática, mediante fotografía; (2) Postura Dinámica, mediante filmación de la ejecución de actividades de la vida diaria (AVD); y (3) Cuestionario informativo sobre los conocimientos teóricos de la columna vertebral. Para verificar las diferencias entre los grupos GC y GE, y entre las etapas de evaluación (pre y post experimento; pre experimento y follow-up; y post experimento y follow-up) se utilizaron las pruebas no paramétricas de Mann-Whitney y de Wilcoxon (para los escores de las AVD y del cuestionario) y el Chi-cuadrado (frecuencia de alteraciones posturales).

Resultados: El PEP, cuando evaluado inmediatamente después de su conclusión, promovió efecto positivo solamente en el conocimiento teórico y en la postura de las actividades de la vida diaria. Sin embargo, los resultados también demostraron que el efecto positivo del PEP no se extendió al periodo de follow-up, ocho meses después de la conclusión del programa.

Conclusiones: Se especula que el conocimiento de la importancia de la buena postura durante las actividades de la vida diaria no fue efectivamente incorporado a los hábitos de los niños y adolescentes.

Palabras clave: postura; estudiantes; educación en salud.

Introduction

Healthcare professionals have long sought ways of attenuating issues associated with poor posture, which not uncommonly causes pain and limitation of physical and psychological abilities. Over the past few decades, one alternative that has arisen the world over[1-9] as a means of mitigating posture issues is the use of postural education or "back education" programs, which, regardless of their theoretical framework, are designed to modify everyday attitudes that lead to spinal damage[3,10]. Postural education can thus be provided to a variety of demographics, including senior citizens, children, adolescents, and young adults[1,4-8,11-14], as long as the theoretical and practical content of educational programs is adapted to the distinct needs of each.

The literature has shown that individuals who take part in postural education programs, regardless of age, tend to effect positive modifications on posture during activities of daily living (ADLs), and tend to exhibit improved theoretical knowledge of the spine[6-8,10,15-18]. However, few reports have focused on the issue of whether postural teachings are actually incorporated into the daily habits of participants of these programs and maintained later on. We believe more studies are required to assess whether the effects of postural education programs persist outside the context of programs themselves, and to ascertain the effects of these programs in distinct demographics, such as children and adolescents.

Taking into account that elementary education and social projects geared to children and adolescents play a major role in health promotion[8,12-15,17] and assuming that children and adolescents who acquire healthy posture habits during the development stage tend to maintain these habits throughout the life course, the aim of the present study was to assess the effects of a postural education program (PEP), as a subprogram of a social project for children and adolescents, 8 months after its completion. We speculated that, 8 months after completion of the program, children and adolescents would be able to recognize and identify the spine, its parts, and its functions, and maintain the natural curves of the spine in static posture and during ADLs.

Method

The minimum sample size was calculated as 28 for a 5% level of significance and an 80% sampling power for between-score differences of 4 points, assuming a standard deviation of 3.5. The sample comprised 34 male and female participants of the Projeto Escolinhas Integradas Ayrton Senna (PEI), a social and educational project with ties to Universidade do Vale do Rio dos Sinos. Participants were divided into two groups: a control group (CG) of 7 children and 10 adolescents and an experimental group (EG) also of 7 children and 10 adolescents. Mean age was 10.5±0.8 years in children and 13.2±1.0 years in adolescents. Study participants were randomly allocated to the control (morning) and experimental (afternoon) groups.

The criteria for inclusion in the study were before- or after-school participation in the PEI project, fitness for physical activity, and random allocation to the group corresponding to the opposite of one's school. The criteria for exclusion were presence of fractures or orthotic devices (crutches). Participation in the study was voluntary, and dependent on the provision of informed consent by parents or legal guardians. The study was approved by the UFRGS Research Ethics Committee and was conducted in accordance with National Health Council Resolution 196/96.

Three assessments – of static posture, dynamic posture, and theoretical knowledge of the spine – were carried out at baseline, after the experiment, and at 8-month follow-up. The total duration of the PEP was 45 days. Study outcomes were assessed at three different points in time: at baseline, immediately post-intervention, and 8 months post-intervention.

The PEP consisted of a back education program adapted from Souza[19] in terms of the choice of ADLs and the language used for communication with children and adolescents. For instance, in lesson 3, which focused on the "seated position," emphasis was placed on sitting at school and at the computer. In lesson 5, which focused on "standing and walking properly," emphasis was placed on carrying school supplies. Table 1 presents an overview of the stages of the experiment and describes the themes, objectives, and ADLs addressed in each class. Classes lasted 1 hour each and were held twice weekly, only for participants in the EG. Children in the CG did not receive any information and had no contact whatsoever with the Program. This was only made possible by the fact that the children in each group attended PEI activities in different periods (morning and afternoon).

For static postural assessment, children and adolescents were evaluated individually, viewed from the right side while standing and wearing appropriate clothing, using a posture grid and a plumb line. Students were placed against the posture grid and the plumb line was positioned as recommended by Kendall *et al*[20]. Students were then asked to assume whatever posture they believed to be proper, and were photographed after doing so.

For static posture analysis, photographs obtained from participants in both groups (CG and EG) at baseline, after the intervention, and at 8-month follow-up were jumbled and submitted to an independent posture specialist – who had no contact with the study participants – for evaluation. This procedure was judged to be required to avoid bias. The expert was asked to assess the images and note the course of the plumb line (focusing on the shoulder and earlobe) in relation to standard posture, which enabled assessment of shoulder posture (protracted, retracted, normal) and head position (forward, axial extension; normal). Posture was considered altered when the shoulder was "protracted" or "retracted" and when the head was in the "forward" position or in "axial extension". For the purposes of this study, the results of static posture analysis were counted merely as the total number of cases of any postural change, regardless of whether the change affected the shoulder or head and of whether it occurred at baseline, after the experiment, or at 8-month follow-up.

Table 1 - Stages of the experiment and topics addressed in each lesson of the Adapted Postural Education Program (PEP)

Lesson	Topics
1	Introduction and pre-intervention assessment (baseline photo and administration of questionnaire)
2	Pre-intervention assessment (videotaping)
3	The objectives of postural education The curves of the spine The sitting position
4	Postural compensation mechanisms Standing and walking properly
5	Structure and function of the intervertebral discs Sitting and standing up properly
6	Spinal overload: the onset of disc herniation Squatting, picking up, and lifting objects properly
7	Spinal overload: painful slipped discs Rotation and bending of the spine
8	The ideal position for sleep and pillow height Lying down and getting up properly
9	The muscles and posture – the erector spinae muscles, abdominal muscles, and hip flexors
10	Theoretical review – a review of the content of the PEP
11	Post-intervention assessment (photo and administration of questionnaire)
12	Post-intervention assessment (videotaping)
8 months later	Follow-up (photo, administration of questionnaire, videotaping)

For dynamic postural assessment, subjects were filmed individually while performing a variety of ADLs[21]: (1) sitting on a stool, (2) remaining in sitting position, (3) picking up one heavy object and one lightweight object from the ground, (4) carrying these objects to a table, (5) replacing them on the ground, and (6) writing while sitting at a desk.

Dynamic posture analysis was performed according to the process recommended by Rocha and Souza[22], on the same day of filming, by two study authors, each of whom was blinded to the other's assessment to prevent bias. There was inter-rater agreement on all observations, making independent analysis by a third investigator unnecessary. Scores for each station ranged from four points (proper posture) to zero points (completely incorrect posture), for a maximum total score of 24 points. The maximum total score of each participant was used for analysis.

The educational questionnaire sought to evaluate theoretical knowledge of the spine[8]. A specific score was assigned to each question, with the maximum total score for the whole questionnaire being 18 points (the higher the score, the higher the level of theoretical knowledge). The maximum score of each participant was used for analysis.

The following nonparametric tests were used: (1) the Mann-Whitney U, to test for differences between the control and experiment groups at baseline, separately for children and adolescents; (2) the Wilcoxon signed-rank test (W_S), to evaluate differences between baseline and post-intervention, baseline and follow-up, and post-intervention and follow-up, separately for children and adolescents. These tests were applied to the following study variables: maximum total score on the ADL circuit and maximum questionnaire score. The chi-square test (χ^2) was used to investigate the presence or absence of postural changes (frequency of postural changes) between baseline and post-intervention, baseline and follow-up, and post-intervention and follow-up, separately for children and adolescents. The significance level was set at 0.05.

Results

At baseline, static posture was similar both in the CG and in the EG, both among children (χ^2; p=0.85) and among adolescents (χ^2; p=0.69).

Among controls, comparison of static posture analysis findings showed no significant differences between (1) baseline and post-intervention, both in children (χ^2; p=0.85) and in adolescents (χ^2; p=0.67); (2) baseline and follow-up, both in children (χ^2; p=0.94) and in adolescents (χ^2; p=0.91); and (3) post-intervention and follow-up, both in children (χ^2; p=0.71) and in adolescents (χ^2; p=0.83). Therefore, participants in CG had postural issues at baseline and continued to exhibit these issues at 8-month follow-up (Table 2).

Likewise, comparison of static posture analysis findings among EG participants showed no significant differences in the number of cases with some postural change between (1) baseline and post-intervention, both in children (χ^2; p=0.13) and in adolescents (χ^2; p=0.07); (2) baseline and follow-up, both in children (χ^2; p=0.30) and in adolescents (χ^2; p=0.20); and (3) post-intervention and follow-up, both in children (χ^2; p=0.47) and in adolescents (χ^2; p=0.32). Although there were no significant changes from baseline to the post-intervention period were found in the experiment group, a decline in the number of cases of postural changes did occur, that is, some PEP participants did show improvement in postural alignment (Table 2). Eight months after completion of the PEP, however, the number of cases of postural changes in the EG had increased (Table 2).

There were no significant differences between controls and experimental participants in dynamic posture at baseline, neither in children (U; p=0.08) nor in adolescents (U; p=0.66).

Comparison of dynamic posture assessment findings in the CG revealed no significant differences between baseline and post-intervention (W_S; p=0.22 and p=0.06 for children and adolescents respectively); baseline and follow-up (W_S; p=0.14 and p=0.11 for children and adolescents respectively); or post-intervention and follow-up (W_S; p=0.63 and p=0.26 for children and adolescents respectively). Therefore, CG participants continued to carry out their ADLs as they did at baseline (Table 3).

Conversely, comparison of dynamic posture assessment findings in the EG revealed differences between baseline

Table 2 - Number of cases of postural changes observed during static postural assessment of PEP participants in the control and experimental groups, at baseline, post-intervention, and follow-up

Group	Children			Adolescents		
	Baseline	Post	Follow-up	Baseline	Post	Follow-up
Control (n=17)	15	14	16	12	10	11
Experimental (n=17)	14	7	10	14	6	10

Table 3 - Means and standard deviations of the theoretical questionnaire scores of PEP participants in the control and experimental groups, at baseline, post-intervention, and follow-up

Group	Children			Adolescents		
	Baseline	Post	Follow-up	Baseline	Post	Follow-up
Control	4.8±3.1	5.2±2.1	5.0±1.7	6.5±1.7	6.6±1.9	6.8±1.8
Experimental	4.7±2.7	10.9±1.6	8.0±1.9	6.6±1.8	12.4±3.3	10.1±2.0

and the post-experiment period (W_S; p=0.001 and p<0.001 for children and adolescents respectively) in how subjects carried out their ADLs. Similar differences were also found between baseline and follow-up (W_S; p=0.013 and p=0.021 for children and adolescents respectively) or between post-intervention and follow-up (W_S; p=0.008 and p=0.002 for children and adolescents respectively). In the experimental group, all differences in performance of ADLs at 8-month follow-up (that is, 8 months after conclusion of the PEP) were in the sense of returning to baseline postural inadequacies (Table 3).

Pre-PEP theoretical knowledge of the spine was similar in CG and EG participants, both children (U; p=0.32) and adolescents (U; p=0.85).

Among controls, theoretical knowledge of the spine did not change significantly between baseline and post-intervention (W_S; p=0.06 and p=0.43 for children and adolescents respectively); baseline and follow-up (W_S; p=0.12 and p=0.08 for children and adolescents respectively); or post-intervention and follow-up (W_S; p=0.26 and p=0.23 for children and adolescents respectively), showing that CG participants had the same theoretical knowledge of the spine throughout the study period, as was to be expected (Table 4).

Among participants who took part in the PEP, however, theoretical knowledge of the spine changed significantly between baseline and post-intervention (W_S; p=0.001 and p=0.001 for children and adolescents respectively); baseline and follow-up (W_S; p=0.045 and p=0.041 for children and adolescents respectively); or post-intervention and follow-up (W_S; p=0.038 and p=0.042 for children and adolescents respectively). In the experimental group, all differences in theoretical knowledge at 8-month follow-up (that is, 8 months after conclusion of the PEP) represented reductions in questionnaire score – meaning that participants returned to their initial level of knowledge on the spine, its parts, and its functions (Table 4).

Discussion

Pre-PEP static posture assessments showed that nearly all children and adolescents in the sample had some sort of postural change. This finding is consistent with those of Rosa Neto[21] and Detsch *et al*[23], who reported high prevalence rates of lateral and anteroposterior postural deviations in student populations.

However, qualitative observation of the results in Table 2 shows that, from baseline to the immediate post-intervention period, there appears to have been a decline in head and shoulder deviation from the plumb line, which suggests that the PEP effected a "positive postural change" among EG participants, because results were obtained immediately after completion of the program, when self-perceptions of posture and understanding of the new concepts addressed in class were still fresh in participants' minds. Conversely, comparison between baseline and 8-month follow-up and between the immediate post-intervention period and 8-month follow-up showed a "postural change" in the opposite direction – that is, the positive effects detected immediately after completion of the program had faded, and participants had returned to their incorrect pre-PEP postures (Table 2). Nevertheless, these results were not supported by statistical analysis, which showed no statistically significant difference between the frequency of postural changes at each of the three stages of the study.

Bearing in mind that the growth period may have affected the results of static postural assessment, the present study was subject to one major limitation: no specific tests other than chronological age were used to control for puberty. Hence, some children in the study might have already reached puberty, whereas some adolescents might have not. However, any potential effects of this limitation are mitigated by the finding that results were similar among children and adolescents.

In addition to the growth process, motivation is another factor that is likely to have influenced the results of the PEP as measures by static posture assessment in the post-intervention stage and at 8-month follow-up. Tresca and De Rose[24] and Scalon *et al*[25] stress that motivation is a driver of learning, helping learners channel perceived information

Table 4 - Means and standard deviations of scores of postural assessment of videotaped performance of PEP participants in the control and experimental groups during an ADL circuit, at baseline, post-intervention, and follow-up.

Group	Children			Adolescents		
	Baseline	Post	Follow-up	Baseline	Post	Follow-up
Control	11.8±3.3	12.2±2.6	12.0±3.7	10.5±3.7	10.6±2.9	10.8±3.8
Experimental	10.7±2.7	19.9±0.6	15.0±2.6	10.6±1.8	18.6±2.4	14.3±3.5

into behavior and leading humans to action or inertia – in other words, motivation is the reason why one chooses to do something or maintain one's current state. Hence, motivation played an essential role in implementation and execution of the PEP, as it is a decisive factor in the learning process: motivation is responsible for inertia or action in every activity of life.

It is important to stress that at no point did the PEP attempt to correct existing postural changes: its sole objective was to teach proper posture for performance of ADLs and the importance of following the slogan "tug on the plumb line and smile" as a means of maintaining natural spine curvature during ADLs. Therefore, static posture assessment was performed only to evaluate whether subjects in the experimental group, after taking part in the PEP, would try to keep their static posture realigned in response to changes in the content addressed in class.

Unlike the results of statistic posture assessment, the differences in dynamic posture assessment from baseline to the post-intervention period suggest that the positive changes in ADL performance detected immediately after completion of the PEP were indeed due to the effects of postural education, as expected. Méndez and Gómez-Conesa[6] evaluated the effect of a postural education program on 106 schoolchildren aged 9 years and concluded that participation in the program improved theoretical knowledge and performance of ADLs at school. In Brazil, Ritter[18] led a back education program for 61 students with a mean age of 15 years. For assessment of ADL performance and comparison between baseline and the post-experiment stage, the author used the protocol developed by Rocha and Souza[22] (as did the present study); PEP participants showed significant improvement in all ADLs, whereas controls did not change their patterns of carrying out ADLs.

Although it is well established in the literature that back education programs tend to effect positive behavioral changes in terms of adoption of proper posture during ADLs immediately after completion of such programs, few studies have attempted to identify whether these positive changes are permanent. In the present study, differences in dynamic posture from baseline to follow-up and between the immediate post-intervention period and follow-up (Table 3) are due to the reduction in ADL test scores, which shows that an 8-month period of no guidance on or reinforcement of newly learned activities, which could have helped ensure real assimilation of good postural habits by participants, probably had a negative impact on the long-term effects of the program. Therefore, the fact that PEP effects were "transient" in this study may have been a limitation of this method. On the other hand, the findings of Cardon *et al*[13], who reported medium-term positive influence of a postural educational program in fourth- and fifth-graders, encourage further studies of this nature.

In light of these distinct realities, one suggestion for fostering use of PEPs and possibly minimizing delayed negative effects would be implementation of regular "refresher" events – that is, after having taken part in a PEP, participants would be invited to return periodically (before 8 months) and experience again, perhaps in a single session, the body and posture activities experienced during the PEP. Weineck[26] notes that breaks in regular exercise practice lead to a slow extinction of motor patterns, even after a short time. Therefore, long periods spent with no follow-up or no practice or experience of the activities taught would lead to a progressive loss of motor patterns. Unless renewed periodically, automatic movements are soon lost from a mechanical, physiological and conditioned reflex standpoint, which would account for the decline in knowledge acquired during the PEP when participants were assessed at 8-month follow-up.

The fact that participants in the EG had the highest number of right answers on the study questionnaire on comparison between baseline and the post-intervention period (vs. baseline to follow-up or post-intervention to follow up) (Table 4) also provides evidence of the positive effects of the PEP immediately after its conclusion. Similar findings were reported by Candotti *et al*[8] and Cardon *et al*[15], who found that children who attended a PEP learned to understand and identify the spine, its parts, and its functions. However, in the present study, 8 months after completion of the PEP and with no attempts at reinforcing teachings during this period, participants got fewer answers right when administered the assessment instrument again, which reveals a need for "refresher" classes and other learning aids.

Faced with these findings, we believe it is important that Postural Education Programs continue to be implemented, and their effects studied, including long-term assessment, so as to ascertain the persistence of the knowledge acquired by participants of these programs. It would be interesting for new PEPs for children and adolescents to be held; however, after the completion of these programs, regular reinforcement of new knowledge, by means of monthly activities such as lectures or postural workshops, is required Such activities might have ensured learning and assimilation of the contents of the PEP.

In short, our results suggest that, immediately after its conclusion, the PEP had a positive effect on theoretical knowledge and on the posture adopted while carrying out ADLs. However, at least in the present study, this effect did not extend to the follow-up period. Therefore, 8 months after conclusion of the PEP, its participants showed: (1) no knowledge of and inability to identify the spine, its parts, and its functions; and (2) inability to maintain the natural curves of the spine, whether in static posture or during ADLs. These findings suggest that the theoretical content of the program and knowledge of the importance of maintaining good posture during ADLs were not truly incorporated into the habits of children and adolescents; in other words, 8 months after completion of the program, children and adolescents had not assimilated the new knowledge it was meant to provide.

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