

ORIGINAL ARTICLE

Weight varying effects of carrying schoolbags on electromyographic changes of trunk muscles in twelve-year old male students

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ABSTRACT

Aim of the study

The purpose of this study was to investigate the effect of bag carrying with different loads (10, 15 and 20 percent of body weight) on electromyography changes of rectus abdominis (RA), erector spinae (ES), upper pectoralis major (UP) and upper trapezius (UT) muscles.

Material and Methods

A hundred of male students, twelve years-old, from a secondary school in Ahvaz, Iran, were chosen for this research. From this group, twelve right-handed and healthy boys were selected randomly (height: 146.83 ± 11.3 ; body mass: 40.91 ± 7.7 ; age: 12.58 ± 1.4 years, right-handed). Apparatuses which were used in this study, included electromyography and telemetric systems. This research proposal was semi experimental and applied one.

Results

By using paired sample T-test results it has been shown that there is significant difference among the electromyographic (EMG) changes of RA, ES, UP and UT muscles during carrying bag with different loads. If the bag load increases, the trunk muscles' activity level will increase subsequently. The left to right asymmetry in carrying loads was shown to be related with significant EMG changes in the trunk muscles.

Conclusions

These findings suggest that the physical stresses associated with carrying backpacks with different loads can be minimized by reducing of the load and by changing of design system of

school bags. Asymmetry in muscle activity may indicate a failure of trunk stabilization and contribute to the development of back pain and neck pain.

Keywords: *Electromyography, muscle fatigue, skeletal muscles, students, spinal injuries.*

INTRODUCTION

Surface electromyography (EMG), a non-invasive method for the neuromuscular system investigation, is commonly used in ergonomic research to study the appearance of local muscle fatigue.^{1,2} A significant linear relationship was found between external load increments and EMG signal increments.³ Some studies have shown that more than 75 percent of junior students in the elementary and secondary schools of Italy and France are carrying their schoolbags in excess of 10% of their body mass (BM).^{4,5} A general guideline of a limit of 10% BM in carrying loads was initially proposed by Voll and Klimt in 1977, in order to avoid muscular injuries.⁷

Inapplicable equipments as well as over weight in maturation age may lead to spinal disorders. If school students experience a backache in childhood, they will be exposed to worse consequences in adulthood.⁸⁻¹⁰

Imbalance of the shoulder that has been affected by carrying an over-loaded bag due to the weakness of the upper trapezium (UT) muscle is a common cause of these disorders.⁸ Sharifah et al (2009) showed that carrying a heavy load of 15% and 20% of BM would cause a significant increase in the trunk inclination angle.¹¹

Many studies have shown that chest flexion, decrease in action of erector spine muscle, increase in activation of RA muscle and tachycardia may be caused as result of carrying over-loaded backpacks.¹² Furthermore, prolonged reputa-

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