FATIGABILITY OF TRUNK MUSCLES WHEN SIMULATING PUSHING MOVEMENT DURING TREADMILL WALKING

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INTRODUCTION: Pushing is a common movement in moving objects, and it also related to about 9% to 20% low back injuries occurrence (Hoozemans et al., 1998). The purpose of the present study was to examine the effect of fatigue on trunk muscle activity during treadmill walking with and without a pushing movement.

METHODS: Twenty healthy young adults were asked to walk with and without a simulated pushing movement. Volunteers first performed walking with simulating pushing by their maximum pushing force. Stopping criterion was reaching subjective assessment of trunk muscle fatigue by Borg CR-10 Scale, and return to carry out walking without pushing movement one week later. The electromyography signal of erector spinea (ES), multifidus (MF), rectus abdominis (RA) and external oblique (EO) muscles at both sides were collected by surface electrodes. Median frequency (MDF) and root-mean-square (RMS) which provide information of muscle fatigability and activity were calculated in the initial, middle and final periods of both walking with and without pushing movements. Repeated measure ANOVA was used to compare the differences of MDF and RMS between the two conditions in three periods. Tukey HSD post hoc analysis was performed on all appropriate statistically significant main effects and interactions. Two-side significance was defined as $p<0.05$.

RESULTS: The mean time of walking with pushing was 19 min 32 sec ± 8 min 32 sec. MDF of ES, MF and RA decreased in both walking with and without pushing conditions, but only significant in without pushing condition (table 1). Normalized RMS of ES and, MF increased (range: 0.21-0.53) in walking with pushing condition, but decreased (range: 0.17-0.34) in walking without pushing condition. However, normalized RMS increased in both with and without pushing conditions.

Table 1 MDF change in with pushing and without pushing conditions during treadmill walking

MDF change (Hz)	Dominate/ Non-dominate	Erector spinae	Multifidus	Rectus abdominis	External oblique
With pushing	initial–middle	-3.5/ -2.1	-2.7/ -2.4	1.6/ -0.7	0.4/ 1.9
	initial–final	-7.5/ -4.0	-6.7/ -6.6	-1.8/ -0.1	1.8/ 3.8
Without pushing	initial–middle	-10.9*/-9.3*	-7.7*/ -15.3*	-11.7*/ -9.4	0.1/0.9
	initial–final	-7.6/ -7.9*	-11.1*/-13.59*	-8.9/ -2.5	8.9*/ 7.4*

* Significant difference of MDF change (Tukey HSD post hoc analysis)

DISCUSSION: MDF change had similar trends in both walking with and without pushing conditions. However, RMS change of back muscles increased in walking with pushing but decreased in walking without pushing. In these two different walking conditions, increased activity of back muscles may result in less fatigue in walking with pushing than without pushing.

CONCLUSION: More fatigability of back muscles was showed in walking without pushing than with pushing condition. Future research should investigate trunk muscle fatigability in subjects with LBP during pushing movement and treadmill walking compare to healthy subjects.

REFERENCE: Hoozemans, M. J & van der Beek, A. J. (1998). *Ergonomics*, *41*, 757-81.
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