

Inclinometer-assessed sitting, standing, physical activity, and energy expenditure before and during Back App ergonomic products usage in office workers

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Introduction: Low energy expenditure during sitting is a risk factor for metabolic disorders (1). Changing physical environment, like office furniture, is a potential way to increase daily energy expenditure.

Objective: This study assessed whether active furniture, a Back App chair and balance board, increase objectively measured physical activity, energy expenditure and decrease sitting time during the product usage periods and during the whole day.

Methods: The volunteers were 12 office workers (women n=10, 42,5±7,6 years, 170±6,7cm, 76,1±14,9kg) who wore an inclinometer (Fibion Inc, Finland, **Fig. 1a**) on thigh in a leg strap for seven days on baseline and a testing period. For the testing period the volunteers received a Back App chair (no back rest, an unstable seat, **Fig. 1b**) and a Back App balance board (designed for dynamic standing, **Fig. 1c**). The volunteers reported in a log diary the periods when they used their regular chairs or the Back App products. Sitting, standing, physical activity, and energy expenditure were compared between different product usage periods (during the testing period) and between the whole days at baseline and the testing period with paired samples t-test.

Results: During the testing period volunteers were self-reportedly using their regular chair 545±389 min, using their Back App chair 868±484 min, standing 312 ± 237 min and standing on Back App balance board 247±226 min on a total of 4,6±0,7 days. As compared to sitting on a regular chair (1,50±0,29 kcal/min), sitting on Back App chair (+6,1%; 1,59±0,31 kcal/min, P=0,016), standing (10,9%; 1,67±0,11 kcal/min, P<0,001) and standing on Back App balance board (16,2%; 1,75±0,38 kcal/min, P=0,007) increased energy expenditure, with no difference between standing conditions or the whole day results.

Conclusions: As compared to sitting on a regular chair, sitting on Back App chair and standing on Back App balance board increase energy expenditure. However, no differences in whole day sitting, physical activity or energy expenditure were observed, suggesting that additional interventions are needed, like counseling to increase the Back App product usage.

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References: 1) Hamilton et al. 2007. Diabetes. Nov;56(11):2655-67, 2) Ellegast et al. 2012 Appl Ergon. Mar;43(2):296-307.



Figure 1a. Fibion device is worn in a leg strap or front pocket of trousers. Fibion differentiates sitting, standing, physical activity types, and estimates energy expenditure based on those activity types.



Figure 1b. Back App chair has an unstable seat and no back rest.

Figure 1c. Back App balance board facilitates dynamic standing.



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