The effect of backpacking load carriage on ground reaction forces in children

ABSTRACT

Carrying heavy loads over unpredictable terrain for long distances is a requirement common to military personnel, various types of workers and recreational hikers, as well as school children. Backpacks share the load between the shoulders and the hips, they restrict the free movement of shoulders and hips and they always cause a forward lean with a corresponding pulling back force on the shoulders. It is suggested that backpack loads for children should be restricted to no more than 15% body weight for walks of up to 20 min duration to avoid muscle fatigue (Hong et ai, 2008). Liu and Chou (2004) also compared three carriage modalities (backpack, satchel and handbag) and found that backpack carriage of loads equivalent to 10% body weight incurred the lowest physiological cost while walking at 6.4 km/h. Previous biomechanical studies have generally been restricted to loads of 20% and 40% of bodyweight in adults, usually carried in the backpack alone. Sixteen Iranian male children (age = 9 years, mass = 31.7 ± 3.2 kg height = 130.0 ± 6.5 cm,) performed 20-min walking trials on platform with different backpack loads (0%, 100/0, 15% and 20% body weight). Results showed that only load added from 15% to 20% body weight increments elicited a proportional increase in vertical and anteroposterior ground reaction force (GRF) parameters. These effects may be the result of changes to the vertical and horizontal position of the body's centre of mass, caused by the restriction of natural arm swing patterns. Increased GRFs, particularly in the vertical axis, have been positively linked to overuse injuries. Therefore, the biomechanical analysis of load carriage is important in aiding our understanding of injuries associated with backpacking load carriage in children.

Keyword: Ground reaction force; Load carriage; Backpacking load