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Research paper

The effect of a horse riding simulator on energy expenditure, enjoyment, and task difficulty in the elderly

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ABSTRACT

Introduction: Energy expenditure, enjoyment, and task difficulty were compared for exercise with a horse riding simulator (HRS) and real horseback riding (RHR), and analyzed according to riding speed and participant age.

Methods: The HRS and RHR groups comprised 19 and 18 young adults and 21 and 10 elderly subjects, respectively. A visual analog scale was used to measure perceived enjoyment and task difficulty, and pulmonary gas exchange was used to calculate oxygen uptake and metabolic equivalents (METs). Participants either rode the simulator on a treadmill or a real horse on a treadmill at various speeds for 15 min.

Results: Participants reported greater enjoyment from riding a real horse. There were no significant differences between groups in task difficulty, oxygen uptake, or METs. When the speed increased, the gait pattern elicited faster and more complex coordination, and significantly improved energy expenditure, enjoyment, and task difficulty. The elderly showed greater enjoyment and less task difficulty than young adults.

Conclusions: HRS and RHR provide low-level exercise intensity. The elderly reported greater enjoyment and less task difficulty than young adults for both HRS and RHR exercise. These results indicate that HRS might be a feasible substitute for RHR for the elderly, with comparable exercise effects at low intensity. Low-intensity exercise provided by HRS could also be a safe and appealing intervention for the elderly.

1. Introduction

Real horseback riding (RHR) exercise is used to promote physical and mental health [1,2]. RHR has been reported to improve posture, balance, gross motor function, energy expenditure, and health state [2–10,11–13]. Most published studies have focused on children with cerebral palsy, autism, and Downs syndrome [4,7–9,14–17]. A few studies involving adults have focused on multiple sclerosis and stroke, but not healthy populations [18–20]. Most RHR studies have been conducted to identify therapeutic effects for the elderly, patients, and the disabled. RHR has positive effects on motor coordination and fitness among both healthy and unhealthy individuals although only limited results have been reported [11,13,20,29–36].

The elderly experience declining muscle strength, postural control, gait speed, and psychological state with increasing age [21–27]. Functional movement and psychological state are important in the elderly to prevent declining fitness and socioeconomic aspects of independent living [42]. A few RHR research studies involving healthy elderly adults have been conducted. RHR is associated with improvements in static balance and locomotion, and is effective in increasing gait speed and muscle strength compared to traditional exercise such as walking [1,23,28]. However, there is no concrete evidence to support their application to healthy elderly people, who need to maintain psychological and physiological functioning. RHR has also shown positive effects on psychological state in patients [11,13], but these have not been demonstrated in the healthy elderly. Despite the therapeutic benefit of RHR, its use for the elderly has been limited due to cost, accessibility, and safety issues [29,30].

Simulators have been used as substitutes for sports, medical, or aerospace training, and to provide an accessible, safe, economical, and enjoyable alternative to exercise or training [31]. Horse riding

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simulators (HRS) were developed as a substitute for RHR. Most previous investigations have focused on the therapeutic effects in patients using HRS as an alternative to RHR. Recently, HRS showed a low-intensity effect on aerobic exercise in healthy adults and children [35,36]. HRS has also shown therapeutic benefits related to postural control and muscle strength, with relatively low cost, and a high degree of safety and accessibility [20,32,33,34,35] [20,32–35,47], but these studies did not demonstrate improvement in psychological state.

There has been limited information with respect to the direct application of HRS in the elderly, and no studies have compared energy expenditure, enjoyment, and task difficulty for HRS and RHR. The present research aimed to investigate differences in these parameters with respect to the two riding types (RHR/HRS), speed (walk/slow trot/fast trot) and age (young adult/the elderly) of participants, and to determine if HRS could be an effective substitute for RHR in the healthy elderly.

2. Materials and methods

2.1. Participants

Thirty-seven young adults and 31 older adults participated voluntarily and were informed of all procedures. All community-based volunteers were recruited from 2 cities, the Seongbuk borough in Seoul and Jeju Island, South Korea. Participants were divided into 2 groups according to the riding type by means of a random numbers table. The HRS group comprised 19 young adults (26.4 ± 4.2 years old) and 21 older adults (68.8 ± 5.5 years old); the RHR group comprised 18 young adults (20.3 ± 3.6 years old) and 10 older adults (59.0 ± 3.0 years old). Eight participants (5 in the HRS group and 3 in the RHR group) dropped out due to side effects of the exercise (Fig. 1). The final analysis included 35 h and 25 RHR participants. The participant baseline characteristics are summarized in Table 1. Inclusion criteria were as follows: (a) healthy older adults and young adults, and (b) those that had no experience with RHR or HRS. Exclusion criteria were as follows: (a) those who had any neuromuscular impairments or chronic back pain that prevented them from riding a real horse or the simulator, (b) subjects with any cardiovascular or psychological disease, (c) those who had undergone surgery or experienced trauma within the previous 3 months, and (d) drinking alcohol within 24 h or smoking within 3 h of the experiment. The experimental procedure was approved by the Ethics Committee of Korea University. All participants provided written informed consent after an explanation of the study design and purpose.

2.2. Sample size

We calculated sample size based on a previous study [44]. The size was calculated to yield 80% power for detection of a 20% difference at 5% significance. The minimum sample size was 10 participants per group.

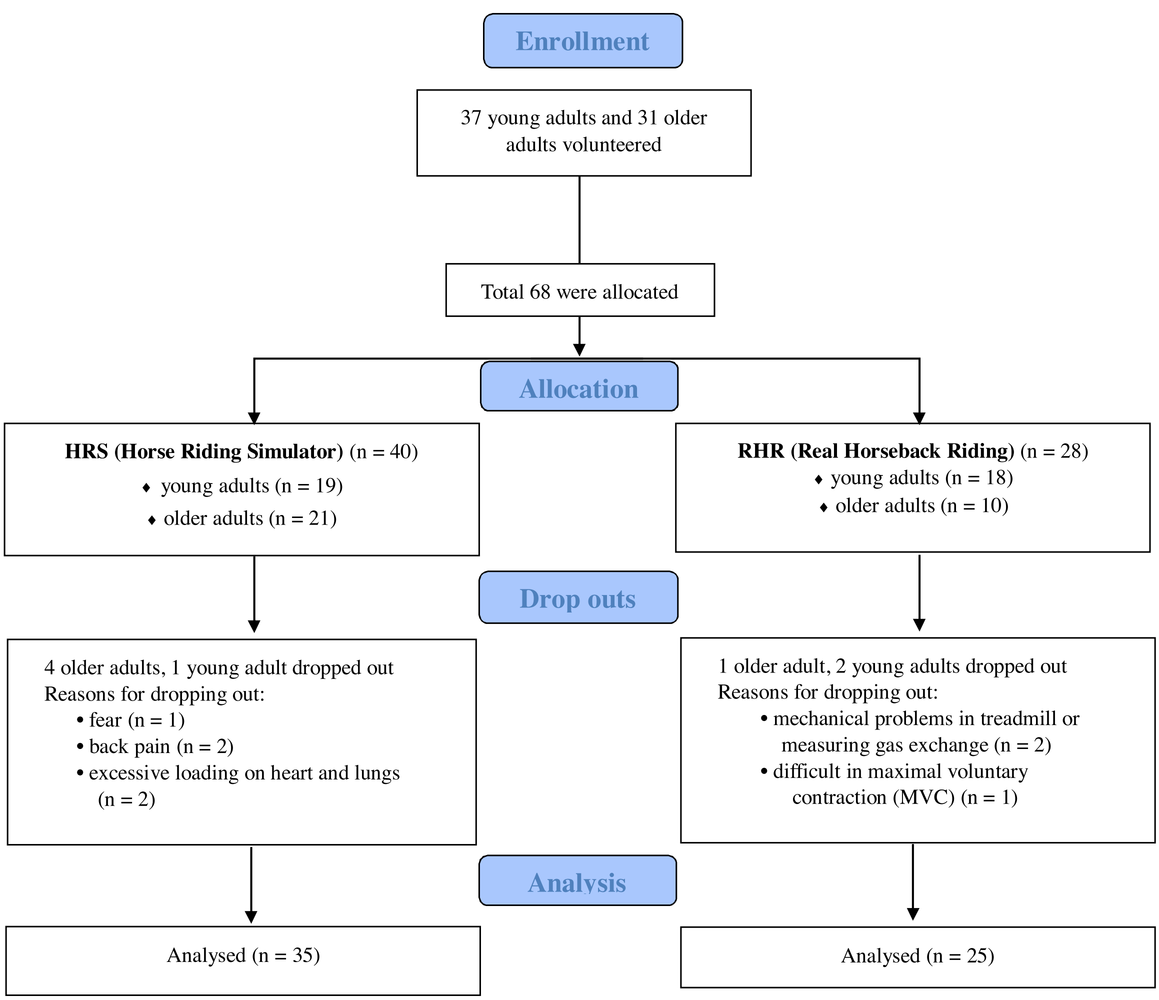

Fig. 1. Flow chart for experimental procedure.