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Low-load high-repetition resistance training improves strength and gait speed in middle-aged and older adults

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ABSTRACT

Objectives: To determine the effect of 26 weeks of low-load high-repetition resistance training (BodyPump™) on maximal strength, gait speed, balance and self-reported health status in healthy, active middle-aged and older adults.
Design: Two-group randomised control trial.
Methods: Sixty-eight apparently healthy, active adults aged over 55 years completed either 26 weeks of BodyPump™ training (PUMP) or served as control participants (CON). The BodyPump™ group ($n = 32$, age = 66 ± 4 years) trained twice per week for 26 weeks while the control group ($n = 36$, age = 66 ± 5 years) continued with their normal activities. Leg-press and Smith-machine bench-press one repetition maximum (1RM), gait speed, balance, and self-reported health status were all assessed at baseline and follow-up.
Results: Significant group-by-time interactions in favour of the BodyPump™ group were found for leg-press 1RM (PUMP +13%, CON +3%, $p = 0.007$, partial eta$^2 = 0.11$), Smith-machine bench-press 1RM (PUMP +14%, CON +5%, $p = 0.001$, partial eta$^2 = 0.18$), normal gait speed (PUMP +23%, CON +9%, $p = 0.028$, partial eta$^2 = 0.08$) and single leg balance right (PUMP +24%, CON −7%, $p = 0.006$, partial eta$^2 = 0.12$). There were no group-by-time interactions for health status measures. Three participants in the BodyPump™ group withdrew from training due to injury or fear of injury related to training.
Conclusions: Low-load high-repetition resistance training in the form of BodyPump™ is effective at improving maximal strength, gait speed and some aspects of standing balance in adults over 55 years. The training was well tolerated by the majority of participants.

1. Introduction

The age-related deterioration in measures of strength,[1] balance[2] and gait speed[3] are well established and are typically observable from the fourth and fifth decades of life. Also well recognised is the effectiveness of resistance training at improving these measures in middle-aged and older adults.[4–6] Many resistance training interventions in middle-aged and older adults have successfully utilised high-load[4,6,7] protocols equivalent to ~80% one-repetition maximum (1RM) but less attention has been given to low-load (<40% 1RM) resistance training utilising very high (>60) repetitions.

There are conflicting reports as to whether low-load/high-repetition resistance training is effective at improving maximal strength compared to high-load resistance training in older adults.[8–10] Many of these differences are due to the great variability in the prescribed load and repetition range. Only one study in older adults[10] has utilised a very high-repetition protocol at low-loads similar to that used by Anderson and Kearney (1982) when they identified a repetition training continuum.[11] Significant gains in strength, muscle volume and function were reported after 12 weeks of training in this manner.

Improvements in gait speed and balance performance have been reported following high-[4] and low-load[12] resistance training although there is still only weak evidence that resistance training can be moderately effective at improving balance in older adults.[13] To date, no ideal resistance training load or dose has been identified for the improvement of gait speed and balance. Maintenance of health is a primary motivator for exercise participation in older adults[14] and the use of self-reported tools can provide additional insights into the effect of exercise interventions. Currently the evidence[15,16] suggests that resistance training does not improve self-reported health status in healthy older adults but the effect of low-load/high-repetition resistance training on these measures has yet to be determined.

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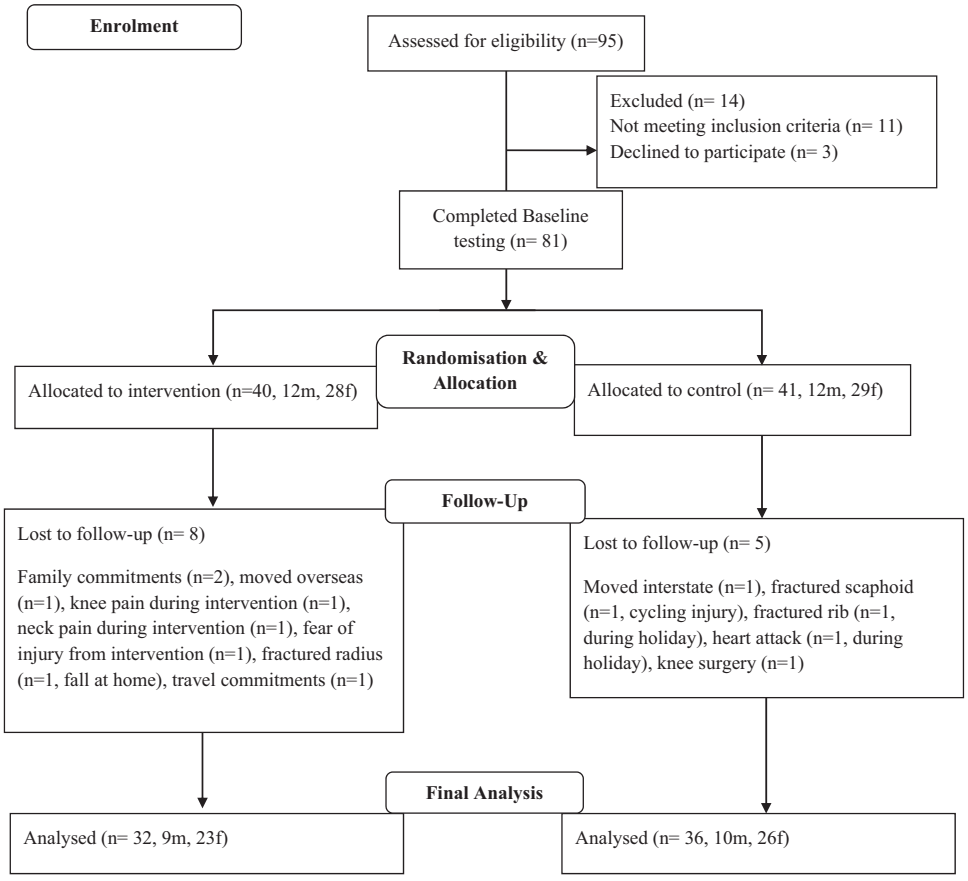

Fig. 1. Project flow chart.

A widely available form of low-load/high-repetition resistance training is BodyPump™ – a pre-choreographed group class that utilises light weights and very high-repetitions (70–100 per body part) in each workout. The class is available in some 14,000 facilities globally and is the most utilised group class produced by Les Mills International.[17] The pre-choreographed nature of the classes provides uniformity between fitness facilities which allows for an easily reproducible resistance training programme. Despite the growing number of older adults undertaking gym based activities[18] and the exposure of such a programme, there has been no peer reviewed research on the effectiveness of BodyPump™ in middle-aged or older adults.

The aim of this study was to determine the effect of 26 weeks of low-load/high-repetition resistance training (in the form of BodyPump™) on measures of maximal strength, gait speed, balance and self-reported health status in active middle-aged and older adults. An age range of 55–75 years was chosen to allow the inclusion of adults in both late middle-age and early old-age. It was hypothesised that 26 weeks of BodyPump™ would increase lower and upper body one-repetition maximum strength; improve static balance and gait speed; and would have no impact on self-reported health status.

2. Methods

A two-group, repeated measures, randomised control trial was used to investigate the effects of 26 weeks of BodyPump™ training on adults aged 55–75 years. Based on results of a pilot study and previous resistance training interventions,[6,10] a priori power calculation with power set at 0.8 and an alpha of 0.05 identified a required sample size of 34 per group. To account for a 20% attrition rate a sample size of 41 per group was required. Due to space and equipment restrictions at the local fitness facility, the sample size for the BodyPump™ group was limited to 40.

Participants were recruited through an adult education facility and via local advertising. Ninety-five participants were initially assessed for eligibility of which 11 did not meet inclusion criteria and a further three declined to participate (Fig. 1). Eighty-one apparently healthy men and women undertook baseline testing after providing informed consent conforming to the Declaration of Helsinki, approved by the Human Research Ethics Committee of the University. Participants were allocated to either the intervention (PUMP) or control group (CON) on a 1:1 ratio using a computer generated random number list (stratified for age and gender) after baseline data collection. All participants were physically active, taking part in regular exercise such as walking, cycling and swimming, but had not been involved in formal resistance training in the previous six months. Exclusion criteria included: acute or terminal illness, myocardial infarction in the past six months, recent low impact fracture, or any condition that would interfere with participation in moderate intensity exercise.

PUMP participants undertook 26 weeks of BodyPump™ classes in total. The first four weeks of the intervention served as an orientation and were used to appropriately teach exercise technique and larger rest periods were included. During this phase participants were able to determine appropriate weights for each exercise. From week five onwards all classes were instructed at a level that one would expect to encounter if they took part in a BodyPump™ class at a local fitness centre. Participants were provided with free access to a local fitness facility and were instructed to attend two out of three available classes per week. All classes were instructed by experienced BodyPump™ instructors who were not associated