Effectiveness of Les Mills BODYPUMP® exercise classes in training technique to improve shoulder biomechanics

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Introduction

New Zealand's Accident Compensation Corporation (ACC) paid $35 million in 2019 for gym and fitness related injury claims. These were the second highest number of claims within the sport and recreation category in 2019 but increased in 2020 to surpass the number of rugby claims [1].

Injury prevention interventions such as the ACC SportSmart suite of programmes have proven effective in helping to reduce incidence, severity and cost of injuries and their rehabilitation for sports. However, no injury prevention programme for gym-based injuries exists.

We anticipate that if no intervention is made, the number of gym injuries is likely to increase further, due to a global increase in gym-based activity [2,3,4].

ACC injury epidemiology

Our retrospective analysis of 345,254 minor and moderate to serious gym and fitness activity injury ACC claims between July 2011 and June 2020 [5] showed:

- **21 to 30 years** old most frequently injured
- 96% **soft tissue injuries**
- **Lifting/carrying/strain** resulted in **lower back/spine** and **shoulder** soft tissue injuries
- **Squat**, **bench press** and **deadlift** most frequently performed at injury time

Strength training technique perceptions and behaviours survey

Our online survey gained an understanding of 58 gym staff *'Knowledge Attitudes and Behaviours'* towards strength training technique and musculoskeletal injury. Building on the ACC injury claims analysis we questioned gym staff on what specific strength training exercises they perceived could cause lower back and shoulder injuries. Staff were asked what strength training exercises they typically observed in the gym being performed with poor technique.

- **Deadlifts, squats, cleans/clean & press, push ups** and **chest press** were commonly named as those being performed with poor technique [6].

Les Mills BODYPUMP®

Group exercise classes are an efficient and effective way to train groups. Les Mills BODYPUMP® classes are of interest as they are pre-choreographed and distributed to over 20,000 gyms globally. A typical BODYPUMP® class is 55 minutes in duration and has 10 "tracks" of 4-6 minutes each focussing on a different muscle group [7]. Les Mills BODYPUMP® instructors must follow the choreography and compulsory coaching cues to ensure consistency and quality [8]. New gym members who are novice to strength training can join BODYPUMP® classes to receive coaching on how to perform exercises during the classes.

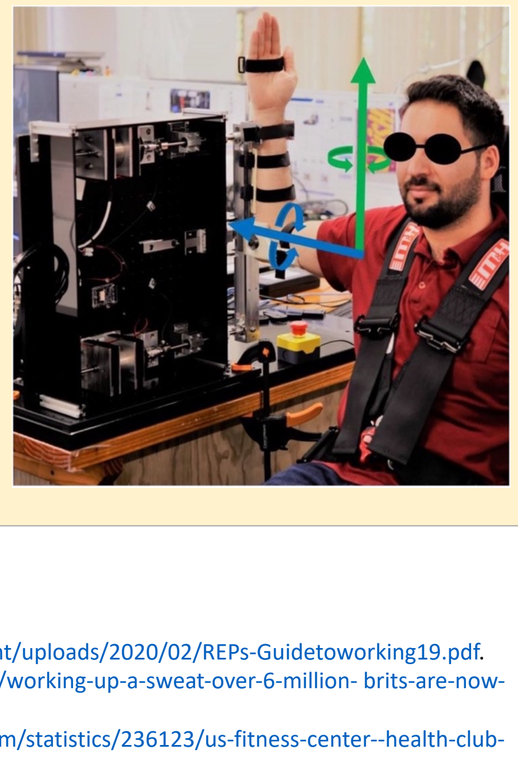
Rationale

Exercises performed in BODYPUMP® class are aimed at strengthening the shoulder muscles, particularly the rotator cuff muscles which play a key role in stabilising the glenohumeral joint during functional tasks. Strengthening programs have proven effective in improving anterior glenohumeral stability and passive anterior joint stiffness [9], although it is not known how strength training influences active or rotational stiffness.

Our next intervention study aims to understand whether BODYPUMP® can train technique in novice strength training participants and increase active and passive glenohumeral joint stiffness.

Intervention study

- **12-week study** of 30 novice strength training participants. Measures of change in shoulder biomechanics for three movements (bench press, shoulder press and Romanian deadlift).
- **Participant technique** kinematic measurements will be taken in the lab using 3D motion capture, focussing on calculating joint angles of the shoulder, hip and knee, range of motion, and barbell trajectory analysed using OpenSIM.
- **Active and passive shoulder joint stiffness** will be estimated using a system identification approach, applying joint torques and measuring angular displacements of the shoulder joint using a perturbation robot [10, 11]. Measurements will be taken in 90° external rotation and 90° shoulder abduction.
- **Strength** will be measured by one repetition max (1RM) for the bench press and shoulder press using a Smith machine repetition to failure protocol [12].



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