

Usability Assessment of a Bluetooth-Enabled Resistance Exercise Band among Young Adults

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Abstract : Background: Resistance-based exercises effectively enhance muscle strength, which is especially important in older populations as it reduces the risk of disability. Our group developed a Bluetooth-enabled handle for resistance exercise bands that wirelessly transmits relative force data through low-energy Bluetooth to a local smartphone or similar device. The system has the potential to measure home-based exercise interventions, allowing health professionals to monitor compliance. Its feasibility has already been demonstrated in both clinical and field-based settings, but it remained unclear whether the system's usability persisted upon repeated use. The current study sought to assess the usability of this system and its users' satisfaction with repeated use by deploying the device among younger adults to gather formative information that can ultimately improve the device's design for older adults. Methods: A usability study was conducted in which 32 participants used the above system. Participants executed 10 repetitions of four commonly performed exercises: bicep flexion, shoulder abduction, elbow extension, and triceps extension. Each completed three exercise sessions, separated by at least 24 hours to minimize muscle fatigue. At its conclusion, subjects completed an adapted version of the usefulness, satisfaction, and ease (USE) questionnaire - assessing the system across four domains: usability, satisfaction, ease of use, and ease of learning. The 20-item questionnaire examined how strongly a participant agrees with positive statements about the device on a seven-point Likert scale, with one representing 'strongly disagree' and seven representing 'strongly agree.' Participants' data were aggregated to calculate mean response values for each question and domain, effectively assessing the device's performance across different facets of the user experience. Summary force data were visualized using a custom web application. Finally, an optional prompt at the end of the questionnaire allowed for written comments and feedback from participants to elicit qualitative indicators of usability. Results: Of the n=32 participants, 13 (41%) were female; their mean age was 32.4 ± 11.8 years, and no participants had a physical impairment. No usability questions received a mean score < 5 of seven. The four domains' mean scores were: usefulness 5.66 ± 0.35 ; satisfaction 6.23 ± 0.06 ; ease of use 6.25 ± 0.43 ; and ease of learning 6.50 ± 0.19 . Representative quotes of the open-ended feedback include: 'A non-rigid strap-style handle might be useful for some exercises,' and, 'Would need different bands for each exercise as they use different muscle groups with different strength levels.' General impressions were favorable, supporting the expectation that the device would be a useful tool in exercise interventions. Conclusions: A simple usability assessment of a Bluetooth-enabled resistance exercise band supports a consistent and positive user experience among young adults. This study provides adequate formative data, assuring the next steps can be taken to continue testing and development for the target population of older adults.

Keywords : Bluetooth, exercise, mobile health, mHealth, usability

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