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RESEARCH ARTICLE

The Effect of a Workplace Exercise and Nutrition Intervention on Work Ability, Self-Efficacy, and Self-Rated Health

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Abstract

Background: Resistance exercise is one of the most effective ways to enhance physical and mental health and improve performance. When combined with proper nutrition, the benefits are even greater. The workplace is an opportune environment to foster these lifestyle behaviors.

Aim: This study aimed to evaluate the effects of a workplace resistance exercise and nutrition intervention on work ability, self-efficacy and self-rated health.

Methods: Sixteen university employees participated in a ten-week supervised resistance exercise and nutrition intervention. An 8-item composite survey was distributed to participants to measure work ability, self-efficacy, and self-rated health at the initiation and conclusion of the intervention. Paired T-tests were used to evaluate treatment effects and determine if there was a statistical difference between the pre-intervention and post-intervention scores.

Results: There was a statistically significant improvement between pre-intervention and post-intervention scores for self-efficacy, self-rated health, and likelihood to adopt lifestyle change. Although dietary habits improved, the differences were not statistically significant. Likewise, there were no statistical differences in participants' work ability before and after the intervention.

Conclusions: The RENU intervention was found to be effective in improving self-efficacy and self-rated health, potentially fostering lifestyle change. These findings provide valuable insights for the design of workplace health interventions.

Keywords: Resistance Exercise, Nutrition, Workplace health, Self-efficacy.

1. Introduction

The health benefits of resistance exercise are extensive and well-documented. Research indicates that resistance exercise can increase muscle mass, strength, and power and improve muscle quality in adults of all ages. It can also improve balance and flexibility, increase bone mineral density, raise resting energy expenditure, and, in turn, improve body composition and help maintain a healthy weight (Shailendra et al., 2022; Philips, Ma, & Rawson, 2023). In addition to these well-recognized benefits, resistance exercise confers positive effects on cardiometabolic health, such as lower resting blood pressure, healthier blood profiles, and improved glucose control, making it especially beneficial for the prevention and management of type-2 diabetes (Tyler & Thanos, 2023; Philips, Ma, & Rawson, 2023).

Less well-known is that resistance exercise can enhance aerobic capacity to a degree comparable to moderate-intensity aerobic training (Izquierdo et al., 2021). In addition, it has been linked to improvements in mental health and cognition, potentially lowering the risk of dementia and Alzheimer's and promoting psychological well-being by alleviating anxiety, stress, and depression (Izquierdo et al., 2021; Tyler & Thanos, 2023).

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Moreover, evidence suggests that resistance exercise can extend life expectancy. As few as 60 minutes of weekly resistance exercise reduced all-cause mortality by 27% (Shailendra et al., 2022). Due to this wide range of benefits, leading health organizations such as the World Health Organization (WHO), the Centers for Disease Control (CDC), and the American College of Sports Medicine (ACSM) all recommend that adults engage in resistance exercise two or more days per week.

1.1 Resistance Exercise and Nutrition at the Workplace

The workplace is considered an ideal environment to introduce lifestyle interventions such as nutrition education and regular exercise. The Centers for Disease Control and Prevention describes the workplace as a favorable environment to influence health behaviors since many individuals working full-time spend nearly one-third of their waking hours at work (CDC, 2019). Moreover, interventions delivered at the worksite not only offer convenience but also have the potential to promote social support and interaction among colleagues which contribute to sustained health behaviors (Leman, Mora, & Rahayu, 2021).

Resistance exercise interventions delivered in various work environments have been shown to yield favorable outcomes for employees, including reduced musculoskeletal pain, increased muscle strength, lower resting blood pressure, preserved work ability, and better overall physical fitness (Kenny et al., 2016; Jakobsen et al., 2015; Zavanela et al., 2012). Additionally, some studies have found that as little as 10-minute sessions performed twice per week can confer significant benefits, which highlights the time efficiency of these programs (Jakobsen et al., 2015; Vilela et al., 2015).

The benefits of resistance exercise may be even more profound when coupled with proper nutrition (Ho, Qualls, & Villareal 2022). Workplace nutrition interventions can be an effective way to improve the dietary habits of employees. Nutrition counseling is a particularly promising intervention. A recent systematic review highlighted the wide range of health benefits of nutrition education programs delivered at the workplace, including improvements in participants' body mass index, fasting blood glucose, and blood lipid profiles (Rachmah et al., 2022). The positive impacts extend to health behavior patterns as participants have also demonstrated improved nutritional knowledge and healthier dietary habits (Hassani et al., 2020). Meanwhile, employers may benefit through increased work efficiency, lower absenteeism, and lower healthcare costs (Hochart & Lang, 2011).

1.2 Self-efficacy as a Determinant of Health Behavior

Despite the well-documented benefits of resistance exercise, most US adults fail to meet the WHO, CDC, and ACSM recommendations (Elgaddal, Kramarow, & Reuben, 2020), and only a small proportion adhere to the US federal nutrition dietary guidelines (Haack & Byker, 2014). This low adherence represents a critical challenge in the field of health promotion.

The number one factor influencing the motivation to change health behaviors is the perception of barriers (Jones et al., 2015). This means individuals don't adopt a behavior as a regular habit because they perceive the barriers make it too difficult. According to Social Cognitive Theory (Bandura, 1999), self-efficacy refers to an individual's confidence in their ability to adopt a specific behavior. In the realm of health-related processes, self-efficacy is viewed as a strong predictor of positive health behavior change. For example, individuals with stronger self-efficacy for exercise or healthy eating are more likely to engage in those behaviors, dedicate effort to them, and sustain them long-term (Bandura, 1999).

A workplace intervention that combines resistance exercise and nutrition counseling could be an effective way to foster healthy lifestyle behaviors, enhance self-efficacy, and evoke a positive impact on employee health and work performance. Therefore, the purpose of this study was to evaluate the effects of a combined resistance exercise and nutrition intervention at the workplace on work ability, self-efficacy, and self-rated health. The results are intended to inform program improvements and modifications.

2. Methods

2.1 Setting and Population

The setting is a major research university with an accompanying academic medical system located in the Southeastern United States. The university employs 18,000 faculty and staff members who are eligible to participate in the university's employee well-being program. The Resistance Exercise and Nutrition (RENU) intervention is offered as part of the employee well-being program. RENU is comprised of ten weeks of supervised resistance exercise and nutrition counseling. The resistance exercise component is

designed for beginners and consists of two 30-minute sessions per week, including body weight, resistance band, and free weight exercises. The training protocol is based on the American College of Sports Medicine (ASCM) resistance exercise guidelines for healthy adults (American College of Sports Medicine, 2009). For the nutrition component, each participant receives five one-hour virtual group nutrition counseling sessions, which are delivered by registered dietitians bi-weekly. Sessions are initiated with 10 minutes for reflection on content from the previous class and reviewing how participants applied what they learned over the previous two weeks. Forty minutes are dedicated to teaching the topic of the day, and 10 minutes are allotted for teach-back and questions to conclude each session.

A mass email was disseminated to all eligible employees, advertising RENU as a 10-week introductory resistance exercise and healthy lifestyle program. Twenty-three employees applied for participation. Applicants were screened for previous resistance exercise experience. Those who indicated they regularly engage in resistance exercise training were eliminated, and sixteen previously untrained applicants were accepted into the program. Before commencing the exercise program, each participant underwent a thorough fitness assessment to determine their physical readiness, identify physical limitations, and ensure an appropriate exercise prescription.

2.2 Instrumentation

An eight-item composite survey was distributed to all participants to assess work ability, self-efficacy, and quality of life at the initiation and conclusion of the intervention. The first question assesses how many days per week the participant eats less than three meals per day. The second question is intended to assess participant's confidence in making healthy meals. Survey questions three through five were derived and adapted from the Weight Efficacy Lifestyle (WEL) Questionnaire Short Form (Ames et al., 2012) to measure confidence in performing resistance exercises. Responses to questions two through five are based on a five-point Likert scale where 1 = not confident to 5 = very confident. Question six is intended to understand the participant's confidence in implementing and sustaining lifestyle changes. Secondly, this question also gives insight into the participant's readiness and willingness to adopt healthier behaviors after the program's conclusion. Responses are based on a 10-point scale where 1= very unlikely to 10 = very likely. Question seven is derived from the SF-36 questionnaire, which is a commonly used instrument for evaluating health-related quality of life (Lins & Carvalho, 2016). Responses are based on a 10-point scale where 1= very unhealthy to 10= very healthy. Question eight originated from question one of the Work Ability Index, created by the Finnish Institute of Occupational Health (FIOH). The question is worded: "Assume that your work ability at its best has a value of 10 points. How many points would you give your current work ability? (zero means that you cannot currently work at all)." Several researchers have used this question to assess work ability during health examinations and workplace performance assessments (Adel, Akbar, & Ehsan 2019; Mänttäri et al., 2021).

2.3 Data Analysis

The data analysis was generated using SAS software (Version 9.4 of the SAS System for Windows. Copyright © 2016 SAS Institute Inc. SAS and all other SAS Institute Inc. product or service names are registered trademarks of SAS Institute Inc., Cary, NC, USA). Descriptive statistics, paired t-tests, and Rao-Scott chi-square testing were performed to examine the differences between the average of the pre-test scores and post-test scores and the relationship between variables. A 95% confidence interval was used, and p-values less than 0.05 were considered significant. We followed common practices for the responsible use of data and made no efforts to identify participants. This study was considered quality improvement and not research and was exempt from institutional review board review.

3. Results

After completing RENU, participants, on average, ate three daily meals more regularly, were more confident in their ability to make healthy meals, and were more confident in their ability to perform resistance exercises. Through RENU, participants, on average, increased their confidence in implementing these lifestyle changes at the completion of the intervention and reported better self-rated health. The average work ability score decreased slightly after the intervention (Table 1).

There was a statistically significant improvement in confidence for performing resistance exercise (overall: $t = -4.18$, p-value < 0.001), increased likelihood of implementing healthy lifestyle changes ($t = -2.48$, p-value $= 0.027$), and better self-rated health ($t = -3.20$, p-value $= 0.006$) between pre and post-intervention means.

Table 1. *Pre and Post-RENU Intervention Survey Question Means*

Survey Question	Pre Intervention Mean (SD) (n=15)	Post Intervention Mean (SD) (n=16)
1. In the past week, how many days did you eat less than 3 meals per day? ***	2.79 (2.83)	2.33 (2.38)
2. How confident do you feel in building a balanced meal? *	3.33 (1.11)	3.88 (0.72)
3. How confident do you feel in your ability to perform resistance exercises without a trainer's supervision? *	2.87 (1.06)	4.13 (0.81)
4. How confident do you feel in your ability to perform upper body exercises without a trainer's supervision? *	2.87 (0.99)	4.06 (0.85)
5. How confident do you feel in your ability to perform lower body exercises without a trainer's supervision? *	2.87 (0.99)	4.13 (0.89)
6. How likely would you be to implement these lifestyle changes (improve nutrition habits and resistance exercise) outside of the RENU program? **	6.80 (1.93)	8.13 (1.59)
7. How would you rate your current state of health? **	4.67 (1.23)	6.38 (1.36)
8. Work ability refers to your ability to manage the physical and mental demands of your work. Assume that your work ability at its best has a value of 10 points. How many points would you give your current work ability? (0 means that you cannot currently work at all) **	9.00 (0.85)	8.94 (0.93)

* Indicates this question used a Likert scale with intervals from 1 (not confident) to 5 (very confident)

** Indicates this question used a 1 to 10

*** One less participant answered this question; sample sizes were reduced to n =14 for pre-intervention and n=15 for post-intervention

Although habits regarding diet (Questions one and two) improved, the differences were not statistically significant. Similarly, there was no statistical difference in a participant's work ability before and after the intervention (Table 2). Furthermore, the intervention strengthened associations between health behaviors and health outcomes. A Chi-square analysis revealed that, most notably, the post-intervention association between questions 2:8 (Chi-sq: 13.1, p-value: 0.0008), 6:8 (Chi-sq:20.6, p-value:<.0001), and 7:8 (Chi-sq: 13.4, p-value: 0.0001) were significantly stronger and more statistically significant than pre-intervention values (Table 3). This is to say that the intervention increased the positive relationship between confidence in building a healthy meal, confidence in implementing a positive lifestyle change, and overall self-rated health and work ability.

Table 2. *Paired t-tests between Pre and Post Intervention Mean Scores*

Survey Question	Mean (95% Confidence Intervals)	t	p-value
1	0.79 (-1.39 - 2.96)	0.78	0.45
2	-0.60 (-1.35 - 0.15)	-1.72	0.11
3	-1.33 (-2.02 - -0.65)	-4.18	<0.001*
4	-1.27 (-1.91 - -0.62)	-4.22	<0.001*
5	-1.33 (-1.95 - -0.72)	-4.64	<0.001*

6	-1.47 (-2.74 - -0.16)	-2.48	0.027*
7	-1.80 (-3.01 - -0.59)	-3.20	0.006*
8	0.00 (-0.69 - 0.69)	0.00	1.00

* Indicates the difference between pre-intervention and post-intervention is statistically significant at alpha = 0.05

Table 3. *Intervention Scores*

	Pre-Survey Results		Post-Survey Results	
Survey Question	**Rao-Scott Chi-square**	**p-value**	**Rao-Scott Chi-square**	**p-value**
2:8	7.39	0.0024*	13.1	0.0008*
3:8	18.5	0.0002*	6.4	0.012*
4:8	10.3	0.0027*	4.63	0.01*
5:7	10.8	0.0018*	10.1	0.0025*
6:8	12.5	0.0005*	20.6	<0.0001*
7:8	11.4	0.0006*	13.4	0.0001*

*Indicates the difference between pre-intervention and post-intervention is statistically significant at alpha = 0.05

4. Discussion

Bandura (1999) asserts that the actual performance of a skill is partly dependent on the individual's perceived ability to undertake and persist in achieving that skill. This assertion was supported by our results, which showed that participation in RENU improved self-efficacy for performing resistance exercises. This is an important finding since adherence to similar workplace initiatives has been known to increase physical activity outside the workplace (Vilela et al., 2015). Ostensibly, if the intervention encourages a more active lifestyle, it may lead to a better quality of life and increased professional, personal, and physical performance (Marquez, 2020). Likewise, RENU proved to be effective in enhancing participants' perceptions of their health status as, on average, they reported significantly higher self-rated health following the intervention.

In addition, RENU had a favorable impact on self-efficacy for incorporating positive nutrition habits. These findings align with existing literature, indicating that workplace interventions involving counseling and on-site group activities positively impact eating and physical activity behaviors (Grimani, Aboagye, & Kwak, 2019). However, it is important to note, the effects on nutrition habits were small and not as significant as the effects of resistance exercise. This suggests that the nutrition counseling component of RENU may benefit from program modifications. Recent research suggests that virtual delivery of educational materials may not be as effective as in-person curriculum delivery (Gross et al., 2023). Thus, it is plausible that the virtual delivery of nutrition counseling sessions was less effective than an in-person format, and therefore, a hybrid delivery model warrants consideration. Additionally, future RENU cohorts may require each participant to attend one nutrition counseling visit with a registered dietitian. This session would be conducted using motivational interviewing (Miller, 2015) and incorporate the Transtheoretical Model of behavior change (Prochaska, & Velicer, 1997). The session would provide individualized nutrition counseling and recommendations.

Overall, RENU participants improved the likelihood of sustaining positive health behaviors. This is an especially promising outcome, given that adherence to exercise and healthy nutrition is a key challenge in promoting health and preventing chronic disease.

Lastly, the results of our study indicated that the average work ability score remained consistent. This outcome was anticipated and can be attributed to the participants' baseline work ability scores, which were categorized as "good." Consequently, this minimized the potential for improvements. Moreover, deterioration of work ability has been shown to be associated with older age and more physically or psychologically demanding work (Adel, Akbar, & Ehsan, 2019; Unsgaard-Tøndel & Nordstoga, 2022). In that context, preserved work ability could be considered a favorable outcome.

5. Conclusion

In addition to being time efficient and convenient, RENU was effective in producing favorable outcomes related to positive lifestyle change. RENU is a promising workplace intervention that is worthy of scalability and ongoing access for employees who are interested in developing healthier exercise and nutrition patterns. Future inquiry should be performed to improve the program's components and format of delivery.

Author Contributions

Victor Tringali conceived the study design and led the manuscript writing. Hayes Miller and Idhaya Vasu analyzed the data and assisted with interpreting the data.

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