

UDC 615.8

EFFECTS OF AEROBIC, RESISTANCE, AND COMBINED EXERCISE PROGRAMS ON ARTHRITIS RELATED SYMPTOMS

Scott Jamieson¹, Katherine DeVivo¹, Kailyn Horn¹, Jessica Moxley¹, Christine Pellegrini¹

¹The University of South Carolina, Department of Exercise Science, Columbia, South Carolina, United States; stj7@email.sc.edu

<https://doi.org/10.29038/2220-7481-2023-04-104-108>

Abstracts

Physical activity is a therapeutic modality in alleviating arthritis-related symptoms, yet most individuals fail to attain recommended guidelines. **The Purpose of the Research** was to briefly summarize the effects of aerobic and resistance exercise on arthritis symptoms, highlight some of the challenges of these programs, and provide future strategies to increase participation in physical activity. **Research Methods.** A brief search of the recent literature on physical activity interventions and health related outcomes in adults with arthritis was performed. **Research Results.** For aerobic activity, improvements in arthritis outcomes including pain, function, and quality of life are common in supervised sessions a minimum of 3 times per week; however, adherence to participation often remains low. Engaging in resistance exercise at least 12 weeks has been shown to promote improvements in arthritis related symptoms with higher intensity not always leading to greater improvements. Prior evidence has suggested mixed exercise to be the least efficacious compared to single exercise programs. **Conclusions.** Future research should explore strategies to increase adherence to aerobic and resistance exercise programs, which could lead to greater reductions in pain and improvements in physical function in adults with arthritis. Alternative delivery modalities over the standard in person, supervised sessions should be considered and may be more appropriate to older adults with arthritis. More research is also needed to understand why multicomponent exercise programs appear less effective than programs focusing only on one activity behavior. Finally, engaging stakeholders in the development and implementation of exercise programs may help to ensure these programs are acceptable for adults with arthritis.

Key words: degenerative joint disease, physical function, quality of life, physical activity, pain.

Скотт Джеймісон, Кетрін ДеВіво, Кейлін Хорн, Джессіка Мокслі, Крістін Пеллегріні. Вплив програм аеробіки, силових та комбінованих вправ на полегшення симптомів артриту. Фізична активність є терапевтичним засобом полегшення симптомів, пов'язаних з артритом, однак більшість людей не дотримуються рекомендацій. **Мета дослідження** полягала у виявленні впливу аеробних та силових вправ на полегшення симптомів ревматоїдного артриту, окресленні основних переваг та недоліків тренувальних програм і визначенні майбутньої стратегії в напрямі посилення фізичної активності. **Методи дослідження.** Було здійснено огляд наукової літератури про вплив фізичної активності на стан хворих на ревматоїдний артрит. **Результати дослідження.** Для аеробної активності характерні, окрім відчуття болю, покращення фізіологічних функцій організму людини та поліпшення якості життя. Кількість осіб, які займаються фізичними вправами з тренером три рази на тиждень, залишається низькою. Доведено, що 12-тижневі заняття фізичними вправами сприяють полегшенню симптомів, пов'язаних з артритом. Однак виявлено, що збільшення інтенсивності фізичних навантажень не завжди приводить до покращення стану. Аналіз дослідження засвідчив, що змішані програми тренувань є не такими ефективними, як заняття за індивідуальними тренувальними програмами. **Висновки.** У майбутніх дослідженнях потрібно звернути увагу на вивчення питання програм аеробних і силових вправ, які можуть полегшити біль та покращити фізичні функції в дорослих із ревматоїдним артритом. Доцільно розглянути альтернативні програми замість стандартних, які є більш ефективними для літніх людей із ревматоїдним артритом. Треба провести додаткові дослідження для виявлення причин низької ефективності тренувальної мультипрограми в порівнянні з виконанням однотипних фізичних вправ. Для цього потрібно залучити ширше коло зацікавлених сторін для розробки й упровадження тренувальних програм, які можуть показати більшу ефективність для дорослих із ревматоїдним артритом.

Ключові слова: дегенеративно-дистрофічні захворювання суглобів, фізична функція, якість життя, фізична активність, фізичний біль.

Introduction. Globally, arthritis affects over 300 million adults and is the leading cause of disability [6; 29]. Arthritis often leads to increased joint pain, stiffness, and swelling resulting in lower levels of physical function and reductions in quality of life. While there are numerous treatment options available for those with arthritis, one of the most common non pharmacological recommendations is engagement in regular exercise [10]. Specifically, participation in aerobic exercise, muscle strengthening, and balance training

activities are encouraged for adults with arthritis [18]. Aerobic activities use the body's large muscles for a continuous time, whereas muscle strengthening involves activities that increase skeletal muscle strength and performance [27]. Despite the strong recommendations for exercise, adults with arthritis are less likely to meet recommendations for physical activity as compared to those without arthritis [14]. In the United States, 36 % of adults with arthritis meet guidelines for aerobic activity, nearly 18 % meet muscle strengthening recommendations, and less than 14 % reach recommended guidelines for both types of exercise [23]. This review briefly summarizes the effects of aerobic and muscle strengthening/resistance exercise on arthritis related symptoms as well as challenges of these exercise programs and highlights future directions and recommendations to increase participation in regular activity in adults with arthritis.

Research Materials and Methods. A brief search on literature focusing on physical activity interventions and health related outcomes in adults with arthritis was conducted between August and September 2023. Search combinations of terms included physical activity, aerobic activity, walking, resistance training, arthritis, pain, physical function, and quality of life. Select randomized controlled trials and review papers published between 2008 and 2023 were included in the review.

Research Results. There are multiple benefits of aerobic exercise for people with arthritis including improvements in arthritis related pain [11; 17; 30], physical function, and quality of life [11]. Recommendations have suggested that results are optimal when exercise sessions are supervised and occur at least 3 times per week [17]; however, attending numerous in person sessions is challenging for many adults with arthritis. Several prior studies which used in person sessions have had low attendance, with participants only attending approximately 63 % of possible sessions [4; 20]. In order to increase the availability of these programs, there has been an increase in self directed aerobic activity programs for adults with arthritis. Interestingly, when given the choice, only between 42–58 % of participants opted to receive a self directed program [5; 20] suggesting that, although there are challenges with attending regular in person sessions, many still prefer the social support and accountability from an in person format.

Resistance training has been shown to help lower arthritis related pain [19; 30; 31] and stiffness [19] in adults with arthritis. Participation in regular resistance training also results in improvements in physical function in this population [31]. In order to see these effects, it has been recommended that these resistance training programs last at least 12 weeks in duration and include 24 sessions [19; 31]. Within types of strength training, non weight bearing strength training exercises appear to have a larger effect on pain reductions as compared to weight bearing activities [30]. More recently, there has also been a comparison between high and low intensity strength training programs in adults with arthritis. To date, results have shown no differences in pain, physical function, or quality of life between the two intensities [15] with long term effects of high intensity strength training appearing negligible compared to control [21]. In the short term, adherence to both low and high intensity training conditions have been high (9; 21); however, over time, adherence to low and high intensity programs drops (69 % and 66 % respectively) resulting in lower adherence as compared to a non resistance exercise control group (80 %) [21]. The lower long term acceptability of resistance training programs among adults with arthritis is likely contributing to the lack of effect on arthritis related symptoms.

There are many programs that combine both aerobic and resistance training exercises; however, the results have not been as straightforward as programs that focus solely on aerobic or resistance training alone. Mixed programs have beneficial effects on arthritis related symptoms, but these combined programs do not appear to be as effective as a program focused on a single type of exercise [11; 17; 32]. The majority of mixed exercise interventions included in previous reviews have been delivered in person, however alternative delivery modalities are being used more frequently. For example, there have been several internet based programs recommending both aerobic and strengthening activities for adults with osteoarthritis [1; 24]. While the results of these programs remain mixed, internet and other technology-based delivery formats may provide a more feasible and less costly alternative to the standard in person supervised aerobic and resistance exercise programs.

Discussion. This paper briefly summarizes the effects of aerobic and resistance exercise on arthritis related symptoms in adults with arthritis. Both aerobic and resistance exercise have beneficial effects for those with arthritis and can help to reduce pain, improve physical function, and increase quality of life; however, mixed programs that recommend both aerobic and resistance exercise do not seem to be as effective as single exercise programs. While physical activity guidelines recommend achieving at least 150 minutes per week of moderate intensity activity and engaging in strength training exercises on at least

2 days per week [3], it is unclear why multicomponent interventions are not as effective as single exercise programs.

One potential explanation for the lack of benefits could be that adults with arthritis face numerous barriers to activity [2; 33] and may have difficulty integrating different types of activity into their day. There has been a lot of research on multiple health behavior change interventions with the results indicating that there does not seem to be a difference in outcomes when behaviors are introduced in a simultaneous or sequential manner [16]; however, physical activity is often considered as one type of behavior instead of examining aerobic and resistance training as two unique behaviors. Given the number of barriers that adults with arthritis face when trying to increase activity, future research should consider introducing aerobic and resistance training in a sequential format. Allowing participants to focus first on one behavior could help to increase self-efficacy and mastery experiences with one type of activity (i.e., aerobic activity) before introducing a second type of activity (i.e., resistance training).

Another challenge with examining the effects of aerobic and resistance training exercise programs is that many of the programs include numerous components. When there are several components to interventions, it makes it difficult to distinguish which intervention strategies are actually contributing to changes observed in the intervention. Further, there is a chance that many components also have no effect on behavior change, potentially leading to increased and unnecessary burden and cost. For example, Nelligan et al. (2021) found that a self-directed web-based exercise program focusing on strengthening exercise and physical activity was effective at improving knee symptoms; however, the intervention included a website that incorporated several behavior change techniques (e.g., education, self-monitoring, goals) and text messages. It is unclear whether both the website and text messages were necessary or if only one of the tools would have been sufficient. Rather than continue to test packaged interventions, future research should consider using the Multiphase Optimization Strategy (MOST) [8] framework to efficiently identify the optimal set of effective intervention components rather than providing costly and burdensome intervention components that may not influence outcomes.

Although benefits are seen from participation in exercise programs, long-term adherence remains a challenge for adults with arthritis. Identifying ways to improve adherence to physical activity recommendations and program sessions could enhance long-term outcomes. The use of technology has substantially increased in older adults [26] which provides new opportunities and alternative ways to deliver evidence-based physical activity programs. Exercise programs using the internet and text messages have been tested in adults with arthritis [1; 24], however, other forms of technology such as smartphone applications and wearable activity monitors show promise for providing supportive accountability [22], improving adherence to physical activity recommendations, and enhancing outcomes in rheumatic and other populations [25; 28]. Using technology also helps to reduce the cost and burden while increasing potential scalability and accessibility to exercise programs.

In addition to trying alternative delivery modalities, another potential way to increase adherence to exercise programs is to engage stakeholders in the development of the programs. Stakeholder engagement could consist of including adults with arthritis and healthcare professionals such as rheumatologists, physical therapists, and primary care physicians during program development and implementation. Incorporating stakeholder input and adapting programs based on their recommendations could help improve program engagement and adherence to aerobic and resistance training recommendations in adults with arthritis [7; 12]. There has been an increase in the use of stakeholder panels and engaging stakeholders in the development of several exercise programs for adults with arthritis [13; 34]; however, more research is needed to determine the full effects of this process.

Conclusions. For adults with arthritis, both aerobic and resistance exercises are beneficial to reduce pain, improve physical function, and increase quality of life. Supervised sessions occurring a minimum of 3 times per week yielded optimal improvements in arthritis-related symptoms following aerobic exercise interventions. Similarly, regular participation in resistance training in either low or high intensity improved arthritis symptom severity and physical function performance. Interventions targeting singular exercise domains are reported to be more effective than those targeting mixed exercise. Multicomponent interventions may consider introducing aerobic and resistance exercises in a sequential format to allow participants to focus on one behavior at a time and increase self-efficacy and mastery experiences.

Physical activity is important for adults with arthritis, yet regular participation remains low. It is crucial to develop and implement feasible programs to increase aerobic activity and resistance exercises among adults with arthritis. The delivery method of programs and adherence warrants future attention. In person,

instructor led interventions are often preferred by participants because of the social support and accountability. However, a fully in person delivery method may limit the impact of the intervention if adherence and attendance rates are low. Using technology may increase the reach of these programs; therefore, a hybrid approach (in person and remotely delivered via technology) may be recommended. These delivery methods need to be further explored to determine not only what types of programs are effective, but also which are realistic, feasible, and scalable for increasing physical activity participation and improving symptoms in adults with arthritis. Stakeholder engagement throughout program development and implementation may be needed to enhance acceptability and adherence to program exercise recommendations.

References

1. Allen, K. D., Arbeeve, L., Callahan, L. F. [et al.] (2018). Physical therapy vs internet-based exercise training for patients with knee osteoarthritis: Results of a randomized controlled trial. *Osteoarthritis and Cartilage*, 26(3), 383–396. <https://doi.org/10.1016/j.joca.2017.12.008> (in English).
2. Brittain, D. R., Gyurcsik, N. C., McElroy, M., & Hillard, S. A. (2011). General and arthritis-specific barriers to moderate physical activity in women with arthritis. *Women's Health Issues*, 21(1), 57–63. <https://doi.org/10.1016/j.whi.2010.07.010> (in English).
3. Bull, F. C., Al-Ansari, S. S., Biddle, S. [et al.] (2020). World Health Organization 2020 guidelines on physical activity and sedentary behaviour. *British Journal of Sports Medicine*, 54(24), 1451–1462. <https://doi.org/10.1136/bjsports-2020-102955> (in English).
4. Callahan, L. F., Cleveland, R. J., Shreffler, J. [et al.] (2014). Evaluation of active living every day in adults with arthritis. *Journal of Physical Activity & Health*, 11(2), 285–295. <https://doi.org/10.1123/jpah.2011-0307> (in English).
5. Callahan, L. F., Shreffler, J. H., Altpeter, M. [et al.] (2011). Evaluation of group and self-directed formats of the Arthritis Foundation's Walk With Ease Program. *Arthritis Care & Research*, 63(8), 1098–1107. <https://doi.org/10.1002/acr.20490> (in English).
6. Centers for Disease Control and Prevention (CDC). (2009). Prevalence and most common causes of disability among adults – United States, 2005. *MMWR. Morbidity and Mortality Weekly Report*, 58(16), 421–426 (in English).
7. Collado-Mateo, D., Lavín-Pérez, A. M., Peñacoba, C. [et al.] (2021). Key factors associated with adherence to physical exercise in patients with chronic diseases and older adults: An umbrella review. *International Journal of Environmental Research and Public Health*, 18(4), Article 4. <https://doi.org/10.3390/ijerph18042023> (in English).
8. Collins, L. M., & Kugler, K. (Eds.). (2018). *Optimization of Behavioral, Biobehavioral, and Biomedical Interventions*. Springer International Publishing. <https://doi.org/10.1007/978-3-319-91776-4> (in English).
9. de Zwart, A. H., Dekker, J., Roorda, L. D. [et al.] (2022). High-intensity versus low-intensity resistance training in patients with knee osteoarthritis: A randomized controlled trial. *Clinical Rehabilitation*, 36(7), 952–967. <https://doi.org/10.1177/02692155211073039> (in English).
10. Fernandes, L., Hagen, K. B., Bijlsma, J. W. J. [et al.] (2013). EULAR recommendations for the non-pharmacological core management of hip and knee osteoarthritis. *Annals of the Rheumatic Diseases*, 72(7), 1125–1135. <https://doi.org/10.1136/annrheumdis-2012-202745> (in English).
11. Goh, S.-L., Persson, M. S. M., Stocks, J. [et al.] (2019). Relative efficacy of different exercises for pain, function, performance and quality of life in knee and hip osteoarthritis: systematic review and network meta-analysis. *Sports Medicine*, 49(5), 743–761. <https://doi.org/10.1007/s40279-019-01082-0> (in English).
12. Goodman, M. S., & Sanders Thompson, V. L. (2017). The science of stakeholder engagement in research: Classification, implementation, and evaluation. *Translational Behavioral Medicine*, 7(3), 486–491. <https://doi.org/10.1007/s13142-017-0495-z> (in English).
13. Griesemer, I., Vu, M. B., Callahan, L. F. [et al.] (2022). Developing a primary care-focused intervention to engage patients with osteoarthritis in physical activity: A stakeholder engagement qualitative study. *Health Promotion Practice*, 23(1), 64–73. <https://doi.org/10.1177/1524839920947690> (in English).
14. Herbolsheimer, F., Schaap, L. A., Edwards, M. H. [et al.] (2016). Physical activity patterns among older adults with and without knee osteoarthritis in six European countries. *Arthritis Care & Research*, 68(2), 228–236. <https://doi.org/10.1002/acr.22669> (in English).
15. Hua, J., Sun, L., & Teng, Y. (2023). Effects of high-intensity strength training in adults with knee osteoarthritis: A systematic review and meta-analysis of randomized controlled trials. *American Journal of Physical Medicine & Rehabilitation*, 102(4), 292. <https://doi.org/10.1097/PHM.0000000000002088> (in English).
16. James, E., Freund, M., Booth, A. [et al.] (2016). Comparative efficacy of simultaneous versus sequential multiple health behavior change interventions among adults: A systematic review of randomised trials. *Preventive Medicine*, 89, 211–223. <https://doi.org/10.1016/j.ypmed.2016.06.012> (in English).

17. Juhl, C., Christensen, R., Roos, E. M., Zhang, W., & Lund, H. (2014). Impact of exercise type and dose on pain and disability in knee osteoarthritis: A systematic review and meta-regression analysis of randomized controlled trials. *Arthritis & Rheumatology*, 66(3), 622–636. <https://doi.org/10.1002/art.38290> (in English).
18. Kolasinski, S. L., Neogi, T., Hochberg, M. C. [et al.] (2020). 2019 American College of rheumatology/arthritis foundation guideline for the management of osteoarthritis of the hand, hip, and knee. *Arthritis & Rheumatology*, 72(2), 220–233. <https://doi.org/10.1002/art.41142> (in English).
19. Li, Y., Su, Y., Chen, S. [et al.] (2016). The effects of resistance exercise in patients with knee osteoarthritis: A systematic review and meta-analysis. *Clinical Rehabilitation*, 30(10), 947–959. <https://doi.org/10.1177/0269215515610039> (in English).
20. Martin, K. R., Stelfox, K., Macfarlane, G. J. [et al.] (2023). Bringing the Walk with Ease Programme to the UK: A mixed- methods study to assess the relevance, acceptability, and feasibility of implementation for people with arthritis and musculoskeletal conditions. *Translational Behavioral Medicine*, ibad032. <https://doi.org/10.1093/tbm/ibad032> (in English).
21. Messier, S. P., Mihalko, S. L., Beavers, D. P. [et al.] (2021). Effect of high-intensity strength training on knee pain and knee joint compressive forces among adults with knee osteoarthritis: The START randomized clinical trial. *JAMA*, 325(7), 646–657. <https://doi.org/10.1001/jama.2021.0411> (in English).
22. Mohr, D. C., Cuijpers, P., & Lehman, K. (2011). Supportive accountability: A model for providing human support to enhance adherence to eHealth interventions. *Journal of Medical Internet Research*, 13(1), e30. <https://doi.org/10.2196/jmir.1602> (in English).
23. Murphy, L. B., Hootman, J. M., Boring, M. A. [et al.] (2017). Leisure time physical activity among U.S. adults with arthritis, 2008–2015. *American Journal of Preventive Medicine*, 53(3), 345–354. <https://doi.org/10.1016/j.amepre.2017.03.017> (in English).
24. Nelligan, R. K., Hinman, R. S., Kasza, J. [et al.] (2021). Effects of a self-directed web-based strengthening exercise and physical activity program supported by automated text messages for people with knee osteoarthritis: A randomized clinical trial. *JAMA Internal Medicine*, 181(6), 776–785. <https://doi.org/10.1001/jamainternmed.2021.0991> (in English).
25. Ocagli, H., Agarinis, R., Azzolina, D. [et al.] (2023). Physical activity assessment with wearable devices in rheumatic diseases: A systematic review and meta-analysis. *Rheumatology*, 62(3), 1031–1046. <https://doi.org/10.1093/rheumatology/keac476> (in English).
26. PEW Research Center. (2021, June). *Mobile Technology and Home Broadband 2021*. <https://www.pew-research.org/internet/2021/06/03/mobile-technology-and-home-broadband-2021/> (in English).
27. Piercy, K. L., Troiano, R. P., Ballard, R. M. [et al.] (2018). The physical activity guidelines for Americans. *JAMA*, 320(19), 2020–2028. <https://doi.org/10.1001/jama.2018.14854> (in English).
28. Romeo, A., Edney, S., Plotnikoff, R. [et al.] (2019). Can smartphone apps increase physical activity? Systematic review and meta-analysis. *Journal of Medical Internet Research*, 21(3), e12053. <https://doi.org/10.2196/12053> (in English).
29. Safiri, S., Kolahi, A.-A., Smith, E. [et al.] (2020). Global, regional and national burden of osteoarthritis 1990–2017: A systematic analysis of the Global Burden of Disease Study 2017. *Annals of the Rheumatic Diseases*, 79(6), 819–828. <https://doi.org/10.1136/annrheumdis-2019-216515> (in English).
30. Tanaka, R., Ozawa, J., Kito, N., & Moriyama, H. (2013). Efficacy of strengthening or aerobic exercise on pain relief in people with knee osteoarthritis: A systematic review and meta-analysis of randomized controlled trials. *Clinical Rehabilitation*, 27(12), 1059–1071. <https://doi.org/10.1177/0269215513488898> (in English).
31. Turner, M. N., Hernandez, D. O., Cade, W. [et al.] (2019). The role of resistance training dosing on pain and physical function in individuals with knee osteoarthritis: A systematic review. *Sports Health*, 12(2), 200–206. <https://doi.org/10.1177/1941738119887183> (in English).
32. Uthman, O. A., Windt, D. A. van der, Jordan, J. L. [et al.] (2013). Exercise for lower limb osteoarthritis: Systematic review incorporating trial sequential analysis and network meta- analysis. *BMJ*, 347, f5555. <https://doi.org/10.1136/bmj.f5555> (in English).
33. Wilcox, S., Der Ananian, C., Abbott, J. [et al.] (2006). Perceived exercise barriers, enablers, and benefits among exercising and nonexercising adults with arthritis: Results from a qualitative study. *Arthritis Care & Research*, 55(4), 616–627. <https://doi.org/10.1002/art.22098> (in English).
34. Williams, Q. I., Gunn, A. H., Beaulieu, J. E. [et al.] (2015). Physical therapy vs. internet-based exercise training (PATH-IN) for patients with knee osteoarthritis: Study protocol of a randomized controlled trial. *BMC Musculoskeletal Disorders*, 16(1), 264. <https://doi.org/10.1186/s12891-015-0725-9> (in English).

Стаття надійшла до редакції 19.02.2024 р.