

THE BODY AND MOVEMENT IN THE ELDERLY: TOWARDS A LIFELONG LEARNING APPROACH

IL CORPO E IL MOVIMENTO NEGLI ANZIANI: VERSO UN APPROCCIO LIFELONG

Alessandro Cudicio^{a,b}, Agnese Graticola^a, Valeria Agosti^{a1}

^a Department of Clinical and Experimental Science, University of Brescia, Italy
alessandro.cudicio@unibs.it

^b Department of Human and Social Sciences, University of Bergamo, Italy
agnese.graticola@guest.unibg.it; valeria.agosti@unibg.it

Abstract

It is widely shown that physical activity is effective in preventing motor and cognitive decline in the elderly. Aerobic exercise, like walking, and balance, strength, and joint mobility exercises are suggested by WHO but still proposed as individual activities and in a segmental way of execution. However, scientific evidence suggests that group activities are the best way to perform exercise in a context that promotes both health and sociality, the latter as crucial element in elderly wellbeing and for minimizing dropout. In addition, the control of walking intensity is essential to maximize the effects of the exercise without incurring into fatigue, so as the control of the global movement is crucial in order to recall higher cortical functions and, consequently, to foster motor learning in a lifelong perspective. The purpose of our study was to identify the best methods to proposing and project exercises for the elderly also by means a smartphone App. In this direction, we suggested the Talk test and the OMNI scale as a self-assessment tool to detect effort and fatigue, and a set of exercises where the methodology helps elderly to self-build the movement starting from the perception of the body; the PACES scale was identified and adapted as a means to self-evaluate the satisfaction for the proposed activities.

È ampiamente dimostrato che l'attività fisica è efficace nel prevenire il declino motorio e cognitivo negli anziani. L'esercizio aerobico, come la camminata, e gli esercizi per l'equilibrio, la forza e la mobilità articolare sono suggeriti dalla WHO ma sono ancora proposti come attività individuali e con modalità di esecuzione segmentate. Le evidenze scientifiche sugge-



Copyright: © 2023 by the authors.
Submitted for possible open access
publication under the terms and
conditions of the Creative Commons
Attribution (CC BY) license
(<https://creativecommons.org/licenses/by/4.0/>).

¹ Author Contribution

Alessandro Cudicio: conceptualization; investigation; writing (original draft preparation of all paragraphs, review and editing).
Agnese Graticola: writing of the paragraph "Planning for the elderly oriented towards lifelong learning", final revision.
Valeria Agosti: conceptualization; supervision and final review writing.

riscono invece che le attività di gruppo sono il modo migliore per svolgere l'esercizio fisico in un contesto che promuove sia la salute che la socialità, quest'ultima come elemento cruciale per il benessere dell'anziano oltre che per ridurre al minimo l'abbandono. Inoltre, il controllo dell'intensità della camminata è essenziale per massimizzare gli effetti dell'esercizio senza incorrere nella fatica, così come il controllo del movimento globale è fondamentale per richiamare le funzioni corticali superiori e, di conseguenza, per favorire l'apprendimento motorio in una prospettiva lifelong. Lo scopo del nostro studio è stato quello di individuare i metodi migliori per proporre e progettare esercizi per gli anziani anche attraverso una smartphone App. Abbiamo proposto il Talk test e la scala OMNI come strumenti di autovalutazione per rilevare lo sforzo e la fatica, e un insieme di esercizi in cui la metodologia aiuta l'anziano a auto-costruire il movimento partendo dalla percezione del corpo; la scala PACES è stata individuata e adattata come strumento di autovalutazione del gradimento delle attività proposte.

Keywords

Exercise; elderly; lifelong learning; smartphone app.
Esercizio; anziani; lifelong learning; smartphone app.

1. Introduction

Over the past two decades, the correlation between human movement and health or well-being was widely investigated and debated: from physical education at school, to adapted physical activity up to athlete injury prevention (Cardon et al., 2004; Griffin et al., 2020; Rasberry et al., 2011; Woods et al., 2007). In recent years, great emphasis was given to the motor and sports activity proposed to the elderly, both as a primary and secondary prevention factor related to motor and cognitive function (Angevaeren et al., 2008) and as a social intervention (Ciccarelli et al., 2015): walking groups, dancing, or gymnastics classes are just some of the examples of activities that are proposed by both private and public institutions in order to promote the so-called *healthy ageing*: active ageing overcome in a bio-psycho-social context of health (López-López et al., 2020; World Health Organization, 2015), where physical activity (PA) must be considered not only in its amount but also in the modalities in which it is proposed (Dias et al., 2017).

Unfortunately, participation in PA among the older population remains very low and with a high dropout rate (Spiteri et al., 2019). To counteract this trend and to encourage participation and adherence, recent studies have shown that PA practice needs to be set in contexts that promote interaction, socialization, pleasure, and self-efficacy, directly related to activities of daily living. The right course for the prevention by PA in the elderly relying on "enriched" activities that foster the relationship between the individual, his or her behaviours, and the environment in which

he or she lives, involving older people in full autonomy and self-determination, making use of social and educational strategies in a lifelong learning approach (Bredland et al., 2018; Izquierdo et al., 2021; McPhee et al., 2016).

In this context, in which autonomy and participation become the key words (Foster & Walker, 2021), the support of mobile technology or wearable devices turns out to be crucial and can be a valuable support for older people, to encourage autonomous monitoring and management of physiological parameters, to facilitate constant participation, and to encourage activities even in a digital setting (Helbostad et al., 2017; Narushima et al., 2018).

In this line, it is necessary to increase the knowledge regarding methodologies and didactics of activities in order to increase both the health-related output and the appropriate employment of technologies. In the authors' opinion, the fundamental step lies in giving special attention, in the proposal of exercises, not to the mere quantification of execution but to the organization of the body in movement. This idea of exercise cannot be separated from educating the person who moves through intra-corporeal attention stimulating the answer to these questions: how the body moves and why? This last is crucial in the adaptation of the movement, in response to the morphological and physiological body modifications due to senescence.

The aim of this study is to identify the best methods to proposing and projecting exercises also by means a smartphone App.

2. Ageing in a healthy active perspective

Elderly body experiences a deep change both morphological and physiological. Ageing is described as a gradual functional decline that occurs across multiple organ systems, causing a progressive deterioration. This could result in tissue dysfunction that links with human pathology, but our understanding on the ageing process remains limited (McHugh et al., 2018). Studies identified the so-called *hallmarks* associated with ageing, some common cellular and molecular traits that can be classified into three categories (López-Otín et al., 2013): (1) primary, or the causes of age-associated damage; (2) antagonistic, or the responses to the damage; and (3) integrative, or the consequences of the responses and culprits of the ageing phenotype (McHugh et al., 2018). Senescence, defined as the gradual decline of the physiological processes which contributes to the progressive and extreme slowdown of the cell cycle (Bisht & Avarello, 2021) belongs to the antagonistic class.

The senescence process, enhanced by the physical inactivity (Cunningham et al., 2020), is mainly due to the error in DNA duplication and to the reduction of the number of times that the cell can divide. The nervous system incurs a decline of both central and peripheral components: the decline in cognitive abilities (E. R. Kandel,

2001); the death of the α -motor neuron that innervates the muscle fibres (Cogliati et al., 2019). For this reason, elderly, even if they can maintain the same amount of force, become slower and less precise in the movement execution.

The World Health Organization (WHO) (Bull et al., 2020) suggest, to slow down the ageing process and to stay in health, to perform at least 150 min/week. of moderate PA, or 75 min. of vigorous PA, or a combination of both. Moreover, WHO suggests undertaking, two times a week, exercise to increase the strength of the bigger muscle groups and to ameliorate the balance and recommends minimizing sedentary behaviour. Even if these recommendations precisely define the quantity (in terms of min/ week) and the intensity (in terms of METs) of PA, there are no indications related to the quality of the exercise or to the activity administration approach. PA approach is crucial to maintain health in elderly self-efficiency and this is, in turn, the reason why it is important to rethink an exercise proposal presented in a compliant way for elderly people.

3. Walking and feeling

Walking is one of the most practiced PA worldwide, easy, inexpensive, and suitable for everyone (Ham et al., 2009; Tudor-Locke et al., 2018). Furthermore, this activity may be undertaken with different intensities and modalities. People walk with light-intensity ($< 3\text{MET}$) during grocery shopping or when walking the dog. These kinds of walks are characterized by continuing stop and go, that do not cause fatigue resulting to be not so effective from a health point of view. However, during the day, people walk with moderate intensity ($> 3\text{MET} \ \& \ < 6\text{MET}$) on different occasions: moving to take public transportation or reaching the workplace. In these cases, the activity may be protracted for a long time and has a good effect on health, but from time to time, fatigue can occur. Moreover, it is possible to walk at vigorous-intensity ($> 6\text{MET}$) and the most common examples are brisk walking or climbing stairs. Vigorous PA has huge effects on the health status, but it cannot be prolonged for a long time because of fatigue. To obtain the maximum result from this kind of activity, healthy elderly people should walk for a long time. In this light, the proper walking intensity must be kept moderate. The Talk test is a good tool to control the intensity of the walk and self-perceive the intensity of the PA (Reed et al., 2014). Just speaking, it will be possible to regulate the walking intensity. Indeed, it has demonstrated that when the speech is not fluent anymore it means the intensity is vigorous and potentially fatigue may occur. More they can walk, the more effective the exercise is. Additionally, a method to evaluate fatigue indirectly is to propose a questionnaire on the perception of fatigue. One of the most widely used questionnaire is the OMNI scale ideated to evaluate fatigue during exercise on a cycle ergometer (Robertson et al.,

2004), strength training (Robertson et al., 2003), and running or walking (Utter et al., 2004) and validated, also in Italian language, for different ages (Guidetti et al., 2011a, 2011b). This test is easily deliverable, for example, through a smartphone App that, with a notification, asks the elderly the level of fatigue during and at the end of the walk (Cudicio et al., 2022). Finally, the strong relationship between PA and socialization is widely recognized and, in particular, for elderly people (Costello et al., 2011) in fact group activities lead participants to confront each other fighting depression and the feeling of loneliness socialization fights perception of uselessness of oneself and is a strong deterrent to the dropout of PA itself. Walking group is an adequate tool to ameliorate both physical fitness and social and mental health.

4. Perception and enjoyment in exercise

It is widely described that PA proposed in advanced age cannot be limited to aerobics but, to improve health status in elderly people, strengthening, joint mobility and balance exercises must be included. The US National Institute of Health and the US National Institute of Aging (NIH, 2020) suggest specific exercises that we considered eligible also for a proposal by smartphone App. The innovation consists in the modification of the methodological approach, where exercises were planned through commented and interactive images and organized in a sequence where contents, modalities and objectives were well explained. The user will have the opportunity to receive detailed information on the exercise with intra and extra body references, the awareness of movement will be focused on the involved joint area but also to the whole body, that will guide from the preparatory posture to the action (Berthoz, 1997). Furthermore, for each segmental activity, the opportunity of progressing in the execution of the gesture will be given by choosing the level of difficulty, based on individual perception, which will lead to increasingly complex combinations that begins from the segmental and reaches the global movement execution. The idea is to draw attention to the perception of the body in order to *incorporate* strengthening, mobility and balance exercises in a more coordinated gesture. This type of progression will guarantee a reliable construction and consolidation of motor skills characterized by several motor skills. In this regard, when the user has become an expert in performing the individual exercises, he will have the opportunity to build his own routine thanks to a commented and coloured table by type of active city. This modality that favours autonomy has a double purpose: increase the efficiency of the proposal and to limit the phenomenon of dropout by making the activity more interesting. The hypothesis is that a proposal for remote exercises, where the smartphone temporarily substitutes but does not replace, could be a useful support for a lifelong education in

the practice of exercise in the elderly and maintain them active even in conditions of forced isolation or social inability.

Enjoying PA is an element at the basis of participation. The more people enjoy PA the more people practice PA. PACES (Kendzierski et al., 1991) (from the Anglo-Saxon PA Enjoyment Scale) is the most widely used test to evaluate enjoyment. This questionnaire consists of 18 questions which require an answer on a Likert scale (1-5) which allows to identify the level of agreement with the sentence (1 I completely disagree - 2 I disagree - 3 I am uncertain - 4 I agree - 5 I completely agree). To make this type of questionnaire more usable, versions in non-English languages and for different age groups have been validated. The idea is to propose to elderly, through the aid of a smartphone application, a renewed PACES version based on the validated version in Italian (Carraro, 2012) and the one for the elderly with 8 questions (Mullen et al., 2011). This will be an easy to deliver and fast way to evaluate enjoyment and indirectly the quality of the activity proposal.

5. Planning for the elderly oriented towards lifelong learning

Social strategic planning is a useful tool to reflect on future perspectives in lifelong learning ways and to promote PA and sports interventions, suitable for the elderly and combining the virtual and the real dimension. This allows us to focus on some organizational and cultural relevant aspects: a) to reflect to the future in a historical-evolutionary dimension, b) to give the right direction to action and c) to build projects compliant in generating changes. Developing the basic value is a key element in order to focusing the cultural aspects that condition the guideline in PA for elderly people: the PA dropout and a sedentary lifestyle recall people's cultures and habits, a habitus, a social construct that is linked to lifestyles (positively and negatively) and capable of transforming lifestyles into active ones when it is adopted by the person in a lasting way (Bourdieu, 1976; Borgogni, 2020). However, the conditions to develop effective policies towards a lifelong learning approach are quite complex. A complex approach should encompass who is in charge to give advice about the benefit of being active, intermediate actors, and those who are delivering quality activity and exercises in the gyms or in the walking groups. In Italy, only 27.7% of over 64 -year-old people received advice to be active by the general practitioner or health staff (Istituto Superiore di Sanità). Often the offer of courses and activities (i.e., gymnastic, swimming, walking groups) is fragmented and there is not any general system of counselling and advising. One of the reasons is that activities are organized and delivered by different public (health system or municipalities) or private (sport centres) organizations with limited collaboration within them. A basic SWOT (strength, weaknesses, opportuni-

ties, threats) analysis – focussed on the citizens more than on the organizations – could be helpful in highlighting opportunities and critical issues of perspective.

The first threat concern the projects' target: aimed at promoting active ageing, healthy lifestyles and PA, these projects should be designed for people with sedentary behaviour, not compliant to change habits, never ready to participate in PA, nevertheless without these people, the project would have no sense of existing, it would be “un ospedale che cura i sani e respinge i malati” (Milani, 1967) literally translated as “a hospital that treats the healthy and rejects the sick”. The second critical issue concerns devices used to measure physiological parameters relating to PA, in particular the wearable ones, whose aspects risk assuming an organizational and motivational function that cannot be delegated to tools as properly human.

In order to describe opportunities in a strategic planning context, the above mentioned data are fundamental. As a first, smartphone applications can activate involvement processes even in elderly people encouraging participation, sharing, offer availability, enjoyment, evaluation. Moreover, compliance with the WHO indications is suitable for elderly people when it is proposed through daily, regular, and long-lasting exercises and postures, so that exercise is no longer bound to respecting rules or to achieving targets and the activities are embodied (Bourdieu, 1976), adapted to the body in change. In this line, latest ISTAT data allowing us to observe in 2021 an increase in Italian adults playing sports, with a focus on people between 65 and 74 years old and over 75 (respectively +1,9% and +4,3% compared to 2020). Even if these data need further investigations, it is evident that there is a potential audience of active people for whom, an *ad hoc* mobile application could be the link between the body and the world.

6. Conclusions

In this work we focus on a methodological approach in proposing PA in elderly that could be useful in facilitating participation and counteracting burnout, where the use of technological tools may be a good practice in performing and self-monitoring exercise. The main idea account not only the physiological adaptations to the exercise but even the social engagement and the psychological aspects of the elderly: self-modulation and perception, consciousness of the body, self-evaluation of the enjoyment could be the key elements in proposing and projecting PA for a lifelong learning perspective in healthy ageing.

References

- Angevaren, M., Aufdemkampe, G., et al., (2008). Physical activity and enhanced fitness to improve cognitive function in older people without known cognitive impairment. The Cochrane database of systematic reviews, (3), CD005381. <https://doi-org.proxy.unibs.it/10.1002/14651858.CD005381.pub3>
- Berthoz, A. (1997). Le sens du mouvement. In *Kinésithérapie, la Revue* Odile Jacob.
- Bisht, P., & Avarello, M. D. M. (2021). Molecular combing solutions to characterize replication kinetics and genome rearrangements. In *Cytogenomics* (pp. 47-71). Academic Press.
<https://doi.org/10.1016/B978-0-12-823579-9.00005-9>
- Borgogni, A. (2020). *L'intenzionalità educativa degli spazi pubblici*. Edizioni Studium, 54-63
- Bourdieu, P. (1976). Le sens pratique. *Actes de La Recherche En Sciences Sociales*, 2(1), 43–86.
<https://doi.org/10.3406/arss.1976.3383>
- Bredland, E. L., Söderström, S., & Vik, K. (2018). Challenges and motivators to physical activity faced by retired men when ageing: a qualitative study. *BMC Public Health*, 18(1), 627.
<https://doi.org/10.1186/s12889-018-5517-3>
- Bull, F., Saad Al-Ansari, S., et al. (2020). World Health Organization 2020 Guidelines on Physical Activity and Sedentary Behaviour. *British Journal of Sports Medicine*, 1451–1462.
<https://doi.org/10.1136/bjsports-2020-102955>
- Cardon, G., de Clercq, D., et al. (2004). Sitting habits in elementary schoolchildren: A traditional versus a “Moving school.” *Patient Education and Counseling*, 54(2), 133–142.
[https://doi.org/10.1016/S0738-3991\(03\)00215-5](https://doi.org/10.1016/S0738-3991(03)00215-5)
- Carraro, A. (2012). Valutare il piacere nelle attività motorie: il PACES-It. *Italian Journal of Educational Research*, 259-265
- Ciccarelli, M., Borgogni, A., & Capelli, G. (2015). Physical activity, social inclusion and new technology: A smartphone application in favour of active aging. *1st FIEP Afro European Congress Proceedings*
- Cogliati, M., Cudicio, A., et al. (2019). Influence of age on motor control accuracy during static ramp contractions. *Experimental Brain Research*, 237(8), 1889–1897.
<https://doi.org/10.1007/s00221-019-05524-z>
- Costello, E., Kafchinski, et al. (2011). Motivators, barriers, and beliefs regarding physical activity in an older adult population. *Journal of Geriatric Physical Therapy*, 34(3), 138–147.
<https://doi.org/10.1519/JPT.0b013e31820e0e71>
- Cudicio, A., Agosti, V., et al. (2022). Motor Learning for Ageing: An Innovative Digital Approach. *Giornale Italiano di Educazione alla Salute, Sport e Didattica Inclusiva*, 6 (1), 1-9.
<https://doi.org/10.32043/gsd.v6i1.569>
- Cunningham, C., O’ Sullivan, R., et al. (2020). Consequences of physical inactivity in older adults: A systematic review of reviews and meta-analyses. *Scandinavian Journal of Medicine and Science in Sports*, 30(5), 816–827. <https://doi.org/10.1111/sms.13616>

- Dias, G. N. F., Couceiro, M. S., et al., (2017). Physical activity benefits in active ageing. *Active Ageing and Physical Activity: Guidelines, Functional Exercises and Recommendations*, 21-34.
https://doi.org/10.1007/978-3-319-52063-6_2
- Foster, L., & Walker, A. (2021). Active Ageing across the Life Course: Towards a Comprehensive Approach to Prevention. *BioMed Research International*, 6650414. <https://doi.org/10.1155/2021/6650414>
- Griffin, S. A., Perera, N. K. P., et al., (2021). The relationships between rugby union, and health and well-being: a scoping review. *British Journal of Sports Medicine*, 55(6), 319-326.
<https://doi.org/10.1136/bjsports-2020-102085>
- Guidetti, L., Broccatelli, M., et al. (2011a). Validation of the Italian version of the OMNI Scale of Perceived Exertion in a sample of Italian-speaking adults. *Perceptual and Motor Skills*, 112(1), 201–210.
<https://doi.org/10.2466/06.07.13.27.PMS.112.1.201-210>
- Guidetti, L., Sgadari, et al. (2011b). Validation of the OMNI-Cycle Scale of Perceived Exertion in the Elderly. *Journal of Aging and Physical Activity*, 19(3), 214–224. <https://doi.org/10.1123/japa.19.3.214>
- Ham, S. A., Kruger, J., & Tudor-Locke, C. (2009). Participation by US Adults in Sports, Exercise, and Recreational Physical Activities. *Journal of Physical Activity and Health*, 6(1), 6–14.
<https://doi.org/10.1123/jpah.6.1.6>
- Helbostad, J. L., Vereijken, et al. (2017). Mobile Health Applications to Promote Active and Healthy Ageing. *Sensors (Basel, Switzerland)*, 17(3), 1–13. <https://doi.org/10.3390/s17030622>
- Istituto Superiore di Sanità. EpiCentro - L'epidemiologia per la sanità pubblica.
<https://www.epicentro.iss.it/passi-argento/dati/attivita>. Visited on January 2023.
- Izquierdo, M., Merchant, R. A., et al. (2021). International Exercise Recommendations in Older Adults (ICFSR): Expert Consensus Guidelines. *The Journal of Nutrition, Health & Aging*, 25(7), 824–853.
<https://doi.org/10.1007/s12603-021-1665-8>
- Kandel, E. R. (2001). The molecular biology of memory storage: a dialogue between genes and synapses. *Science*, 294(5544), 1030-1038. <https://doi.org/10.1126/science.1067020>
- Kendzierski, D., & DeCarlo, K. J. (1991). Physical Activity Enjoyment Scale: Two Validation Studies. *Journal of Sport and Exercise Psychology*, 13(1), 50–64. <https://doi.org/10.1123/jsep.13.1.50>
- López-López, R., & Sánchez, M. (2020). The Institutional Active Aging Paradigm in Europe (2002–2015). *The Gerontologist*, 60(3), 406–415. <https://doi.org/10.1093/geront/gnz094>
- López-Otín, C., Blasco, M. A., et al. (2013). The hallmarks of aging. *Cell*, 153(6), 1194–1217.
<https://doi.org/10.1016/j.cell.2013.05.039>
- McHugh, D., & Gil, J. (2018). Senescence and aging: Causes, consequences, and therapeutic avenues. *The Journal of Cell Biology*, 217(1), 65–77. <https://doi.org/10.1083/jcb.201708092>
- McPhee, J. S., French, D. P., et al. (2016). Physical activity in older age: perspectives for healthy ageing and frailty. *Biogerontology*, 17(3), 567–580. <https://doi.org/10.1007/s10522-016-9641-0>
- Milani, L. (1967). *Lettera a una professoressa* (Edizioni Mondadori).

- Mullen, S. P., Olson, E. A., et al. (2011). Measuring enjoyment of physical activity in older adults: Invariance of the physical activity enjoyment scale (paces) across groups and time. *International Journal of Behavioral Nutrition and Physical Activity*, 8, 1–9. <https://doi.org/10.1186/1479-5868-8-103>
- Narushima, M., Liu, J., & Diestelkamp, N. (2018). Lifelong learning in active ageing discourse: its conserving effect on wellbeing, health and vulnerability. *Ageing and Society*, 38(4), 651–675. <https://doi.org/10.1017/S0144686X16001136>
- NIH. (2020). *GET FIT FOR LIFE- Exercise & Physical Activity for Healthy Age*.
- Rasberry, C. N., Lee, et al. (2011). The association between school-based physical activity, including physical education, and academic performance: a systematic review of the literature. *Preventive Medicine*, 52 (Suppl 1), S10-20. <https://doi.org/10.1016/j.ypmed.2011.01.027>
- Reed, J. L., & Pipe, A. L. (2014). The talk test: a useful tool for prescribing and monitoring exercise intensity. *Current Opinion in Cardiology*, 29(5), 475–480. <https://doi.org/10.1097/HCO.0000000000000097>
- Robertson, R. J., Goss, F. L., et al. (2004). Validation of the adult OMNI scale of perceived exertion for cycle ergometer exercise. *Medicine and Science in Sports and Exercise*, 36(1), 102–108. <https://doi.org/10.1249/01.MSS.0000106169.35222.8B>
- Robertson, R. J., Goss, F. L., et al. (2003). Concurrent validation of the OMNI perceived exertion scale for resistance exercise. *Medicine and Science in Sports and Exercise*, 35(2), 333–341. <https://doi.org/10.1249/01.MSS.0000048831.15016.2A>
- Spiteri, K., Broom, D., et al. (2019). Barriers and Motivators of Physical Activity Participation in Middle-Aged and Older Adults—A Systematic Review. *Journal of Aging and Physical Activity*, 27(6), 929–944. <https://doi.org/10.1123/JAPA.2018-0343>
- Tudor-Locke, C., Han, H., et al. (2018). How fast is fast enough? Walking cadence (steps/min) as a practical estimate of intensity in adults: A narrative review. *British Journal of Sports Medicine*, 52, (12), 776–788. <https://doi.org/10.1136/bjsports-2017-097628>
- Utter, A. C., Robertson, R. J., et al. (2004). Validation of the adult OMNI Scale of Perceived Exertion for walking/running exercise. *Medicine and Science in Sports and Exercise*, 36(10), 1776–1780. <https://doi.org/10.1249/01.MSS.0000142310.97274.94>
- Woods, K., Bishop, P., & Jones, E. (2007). Warm-Up and Stretching in the Prevention of Muscular Injury. *Sports Medicine*, 37(12), 1089–1099. <https://doi.org/10.2165/00007256-200737120-00006>
- World Health Organization. (2015). *World report on Ageing and Health*.