High-intensity Interval Training for Older Adults: Safety Issues

Shigenori Ito

ABSTRACT

High-intensity interval training (HIIT) has been reported to become an alternative of moderate-intensity continuous training and adapted even in older adults. However, to implement the use of HIIT for older adults, who are very often associated with life-style related and chronic diseases, safety issues should be considered in the first place. However, at present, the evaluation of the safety of HIIT among older adults is compromised by the limited availability of relevant data due to the low proportion of studies reporting adverse events. In this review, update data regarding safety and check-up methods for older adults are described in submaximal HIIT and spring interval training.

Keywords: Aerobic, check-up, high-intensity interval training, older, sprint interval training, safety.

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S. Ito*

Division of Cardiology, Sankuro Hospital, Toyota, Japan.

(e-mail: shigeito918@gmail.com)

**Corresponding Author*

I. INTRODUCTION

Recently, the importance of vigorous exercise to improve maximal oxygen consumption (VO_{2max}) and resultant decrease of mortality and morbidity have been emphasized; the key of exercise protocol is the intensity [1]. Compared with participants with complete lacking of high-intensity training, those performing >50% to 75% of vigorous physical activity to total physical activity showed a 17% lower all-cause mortality, independent of total moderate to vigorous physical activity [1]. If at least a small amount of high-intensity training lacks, the progressive loss of muscle mass and associated function with aging and weight gain will worsen the deleterious course of aging [2], [3]. High-intensity interval training (HIIT) has been reported to become an alternative of moderate-intensity continuous training (MCT) [4] and adapted even in older adults [5]-[8]. However, to optimize the use of HIIT for older adults, who are very often associated with life-style related and chronic diseases, safety issues should be considered in the first place.

II. SAFETY

Healthy older adults without overt comorbidities, such as cardiovascular disease or orthopedic injuries, could be adapted to submaximal HIIT program [5]. However, even submaximal HIIT training may increase catecholamine secretion during exercise at an intensity over anaerobic threshold [9]; therefore cardiovascular risks could increase and meticulous check-up would be necessary in older adults compared with younger target groups. Adaptation of all-out sprint interval training (SIT) for older adults has been reported by only a few studies with a limited number of subjects [6], [10], [11].

There is an understandable concern regarding the safety of HIIT in older adults with known or occult coronary artery disease (CAD) and/or chronic heart failure (CHF). At present, the evaluation of the safety of HIIT among adults with varied health and disease characteristics is compromised by the limited availability of relevant data due to the low proportion of studies reporting adverse events [12]. Limited safety data of HIIT in CR under supervision is available, which can be referred to older adults because of high frequency of older participants in CR. HIIT/MCT can be performed at a relatively low risk [13] in stable and selected patients. Among 4846 patients with CAD [13], one fatal cardiac arrest during MCT (129456 exercise hours) and two non-fatal cardiac arrests during HIIT (46364 exercise hours) have been reported with no myocardial infarctions. These low event rates preclude a definitive quantitative determination of the risk associated with HIIT [14]. More recently, only one major non-fatal cardiovascular event occurred among 547 participants with 17083 completed HIIT sessions in patients with CAD or CHF [15]. No deaths or cardiac events requiring hospitalization was found among 465 HIIT patients and 488 MCT patients within a medically supervised CR setting [16]. Meanwhile, the incidence of acute adverse responses during or within 24 hours post-exercise in a single session of HIIT was approximately 8% in 156 patients with cardiometabolic disease. Therefore, caution must be taken when prescribing HIIT to patients with cardiometabolic disease [16]. Additional long-term studies assessing the safety of HIIT are mandatory before wide adoption in older individuals with known or suspected CAD, particularly in unsupervised, non-medical settings [14], [17].

Data on the safety and risk of injury for SIT are limited [12]. Supra maximal sprints are associated with blood pressure elevation, as well as an increase in blood flow, which could pose a risk of dislodging unstable plaques, potentially

leading to acute myocardial infarction [18], [19]. Redistribution of blood flow (increased flow in muscle followed by decreased flow in visceral organs) may also pose a risk to patients with cardiovascular disease and chronic kidney disease. However, currently SIT has been adopted in healthy young people, irrespective of their athletic or sedentary lifestyle. For these subjects, the cardiovascular risk could be low due to the low incidence of hypertension and/or atherosclerotic disease. For older individuals with lifestyle-related and/or cardiovascular diseases, the potential risk of the SIT protocol has not been evaluated; thus, it should not be adopted for individuals with clinical issues without clearance [20].

III. CHECK-UP METHODS

In my opinion, it is not simple to define a clear and/or unique diagnostic check-up for older adults who want to practice HIIT/ SIT/competitive sports, including all-out exercise; there is currently a relative lack of evidence in the literature on this subject. A guideline by [21] could help judge the adoption of HIIT among participants with clinical problems. This guideline summarizes the clinical considerations for HIIT based on the American College of Sports Medicine and American Heart Association statements, including an initial assessment [3], absolute contraindications to participants [22], [23], monitoring checklist, and indications for avoiding/ceasing HIIT [23]. Medical clearance should be sought for all patients with clinical conditions from medical specialists or general practitioners prior to commencing HIIT [21].

In the check-up to participate in HIIT/SIT programs, the guidelines for sports participation in older adults can be applicable because sports include high-intensity exercise during the entire game or at least transiently depending on the type of sport [24]. Although regular exercise might be useful to lower cardiovascular risk factors, even in those aged >65 years, cardiovascular risks increase with age. Therefore, pre-competition screening is crucial in older populations as well as those with higher cardiovascular risks [25], [26]. The latest recommendations of the European Society of Cardiology (ESC) highlight the importance of defining the cardiovascular profile by means of pre-participation screenings. Indeed, the main pivotal aim of recent guidelines is to minimize the risk of major cardiovascular adverse events, including sudden cardiac arrest/death during physical activity [24]. It is well known that sudden cardiac arrest /death are very often related to myocardial ischemia, which causes acute coronary syndromes, and most likely affect older people. Therefore, discovering subclinical cardiovascular disease, especially CAD, in subjects who are preparing to participate in HIIT training/sports is fundamental [27]. Coronary computed tomography detects occult CAD in almost 20% of asymptomatic sportsmen aged ≥ 45 years after a normal sports medical evaluation that included resting and bicycle exercise electrocardiogram (ECG) [27]. The coronary artery calcium score reveals most of the relevant CAD with limited additional value of contrast-enhanced coronary computed tomography angiography [27]. Meanwhile, very few studies have assessed the prevalence of CAD in older athletes with a low atherosclerotic risk profile. Other silent enemies for the

coronary systems of athletes/HIIT participants may be congenital heart defects, such as the anomalous origin of the coronary arteries and myocardial bridges (MB). The anomalous origin of coronary arteries has a very low prevalence (about 0.44%) in adolescents and very rarely causes sudden cardiac death in the population over 40 years old [28]. Instead, the prevalence of MB is higher; however, in adult/senior individuals, it has been shown that the arterial compression in MB may be directly related to the atherosclerotic burden proximal to the MB. Therefore, the main objective is to discover unknown/silent CAD, as in the MB-free population [29].

The ESC 2020 guidelines on sports and cardiovascular disease have proposed a relatively simplified algorithm for cardiovascular pre-competition assessment in asymptomatic individuals aged >35 years [30]. This tool divides the population into low and high cardiovascular disease risk, based on the number of cardiovascular risk factors or sedentary lifestyle. Based on this algorithm, in older athletes with symptoms, pre-participation cardiovascular examinations should include an exercise ECG test. Functional tests or coronary computed tomography angiography should be considered if the exercise stress test is equivocal or if the ECG is uninterpretable. Stress ECG testing can also cover the diagnosis of exercise-induced arrhythmias, evaluation of blood pressure trends during effort, and quantification of preclinical symptoms such as atypical light tightness and/or initial dyspnea [1]. Finally, in the latest ESC 2020 document, the importance of the exercise testing or cardiopulmonary exercise testing was emphasized to assess cardiovascular risk and measure potential performance for elderly “athletes,” especially if inexperienced in moderate to vigorous physical activity [31].

IV. CONCLUSION

HIIT for older adults, irrespective of the exercise mode (submaximal HIIT or SIT), has been investigated for feasibility and efficacy. However, safety issues cannot be overstressed. Because data is limited, future studies should investigate the safety issues more.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

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