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Guest editorial

Exercise and cardiovascular protection: Update and future

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Cardiovascular disease (CVD) is a major cause of mortality and morbidity worldwide. In China, it is estimated that 330 million people are CVD patients. With the rapid aging of populations around the world, the number of CVD patients and death due to CVD are continuously rising.[1] Exercise and physical activity have been recognized as economical and effective ways to enhance cardiovascular health and reduce CVD. Pathways mediating the cardiovascular benefits of exercise are promising therapeutic targets for CVD.[2]

In this special topic of the *Journal of Sport and Health Science* (*JSHS*), 6 leading groups provide insights into cardiorespiratory fitness as it relates to CVD. Topics include pragmatic indices related to fitness such as step count and grip strength as well as fundamental mechanisms including IGF-PI3K signaling and epigenetics and a discussion of animal-exercise models in cardiovascular research.

Dr Antonio García-Hermoso and colleagues investigated the association between cardiorespiratory fitness (CRF) and mortality in patients with CVD. In a systematic review and meta-analysis, they included data from 21 studies and 159,352 CVD patients to demonstrate that high CRF in CVD patients was associated with a 73% reduction in CVD mortality risk and a 58% reduction in all-cause mortality risk. Remarkably, each 1-metabolic equivalent (MET) increase in CRF was associated with a 19% decrease in all-cause mortality risk. That study has important implications for the identification of CVD patients at high risk and promotion of the recommendation for CRF. In another meta-analysis, Dr Jianqian Chao and colleagues examined the relationship between step count and all-cause mortality or cardiovascular events. They found that a 1000-step/day increase in step count was associated with a 23% reduction in all-cause mortality risk. Moreover, 8959 steps/day (the third quartile) were associated with a 37% lower all-cause mortality risk and a 43% lower risk of cardiovascular events in comparison to 4183 steps/day (the first quartile). That study provides a future potential big-data study direction by using novel techniques such as pedometer software to understand the relationship between step count and all-cause mortality or cardiovascular events. Based on the Prospective Urban Rural Epidemiology Study in China, Dr Wei Li and colleagues reported that in hypertensive patients, an elevated risk of all-cause mortality, CVD mortality and CVD incidence was associated with lower muscle strength as indicated by grip strength. Interestingly, that study included participants from high-income (eastern, including Beijing, Jiangsu, Liaoning, and Shandong), middle-income (central, including Inner Mongolia, Jiangxi, and Shanxi), and low-income (western, including Shaanxi, Sichuan, Qinghai, Xinjiang, and Yunnan) areas, which can provide important information to guide both regional and national policy making for primary prevention of CVD.

Two state-of-the-art reviews were provided by international leaders in the field. Dr Julie R. McMullen and colleagues summarized the role of the IGF-1-PI3K pathway as a major regulator of exercise-induced cardiac physiological hypertrophy and how therapies based on PI3K could be a promising approach for improving cardiac function and mediating cardio protection. They also discussed how to use genetically modified mice that had either reduced or elevated cardiac PI3K activity for novel drug-target identification. Dr Feng Gao and colleagues summarized the epigenetic modifications seen in exercise, including noncoding RNAs, histone modification, and DNA/RNA methylation in the heart and other tissues providing indirect cardioprotective effects. They also provided a road map for future investigations of epigenetic modifications in various exercise modules and various tissues.

Finally, a position paper of the Committee on Cardiac Rehabilitation, Chinese Medical Doctors' Association provided valuable information on current knowledge and optimal design for animal exercise studies in cardiovascular research. Animal exercise models that are commonly used in cardiovascular research for model establishment and assessment of exercise, including swimming, voluntary wheel running, treadmill running, and resistance exercise, were summarized. Importantly, the optimal design of animal-exercise studies in cardiovascular research is discussed. Moreover, functional experiments to determine targets identified from exercised hearts are suggested. This study serves as a guide for the establishment of a standard for animal-exercise studies in cardiovascular research and paves the way for identification of novel therapeutic targets for exercise for patients with CVD.

Currently the study of exercise and cardiovascular protection is in its infancy.[3] We hope that this special topic of *JSHS* will inspire more studies in exercise and cardiovascular protection. We believe that exercise can provide a valuable platform for precision drug discovery and the development of novel therapeutic approaches to combat the growing challenge of CVD.

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Competing interests

Both authors declare that they have no competing interests.

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