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Editorial

Exercise Testing and Motivation

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Abstract: Exercise testing has important applications for sport, exercise and clinical settings, providing valuable information for exercise prescription and diagnostics for health purposes. Often, exercise testing includes the participant's maximal effort, and the testing score partially depends on whether the maximal effort has been exerted. In this context, motivation in exercise testing, including verbal encouragement and video presentation, plays a vital role in assessing participants. Professionals involved in exercise testing, such as exercise physiologists and sport scientists, should be aware of motivation's role in performance during laboratory or field testing, especially using verbal encouragement. Motivation during exercise testing should be standardized and fully described in testing protocols. In this way, exercise testing would provide valid and reliable results for exercise prescription or other purposes (e.g., sport talent identification, athletes' selection, education, research and rehabilitation).

Keywords: ergometer; exercise physiology; maximal oxygen uptake; physical fitness; sport physiology

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Exercise testing has wide applications in sport, exercise and clinical settings, including physical fitness assessment, exercise prescription, progress monitoring, rehabilitation, education, research and diagnostics [1,2]. Physical fitness is crucial for health and performance; thus, fitness assessment provides information about body composition, aerobic capacity, flexibility, muscle strength and endurance, speed, balance, etc. [3,4]. Exercise testing is also a cornerstone of exercise prescription setting optimal goals and training load [5]. When testing is repeated, it assesses progress, i.e., the effectiveness of an intervention. For rehabilitation purposes, exercise testing aids in identifying weakness (e.g., impaired muscle strength or range of motion after an injury), where an injured limb may be compared to a non-injured limb [6,7]. Testing is commonly used in an educational context, e.g., to teach acute responses and chronic adaptations to exercise in an exercise physiology or biomechanics lab for undergraduate or postgraduate students [8,9]. To obtain valid and reliable data in exercise testing, we must fulfil some prerequisites (e.g., informed consent of the participant, calibration of the equipment and standard environmental conditions), with motivation being one among them; nevertheless, limited research has been conducted so far on this field [10]. In a clinical setting, inadequate motivation may impact misleading prognostic information since biomarkers such as peak or maximal oxygen uptake (VO_2peak and VO_2max, respectively) can be influenced [11,12]. For instance, many patients referred for diagnostic stress testing to detect coronary artery disease cannot achieve an adequate increase in heart rate due to lack of motivation, poor physical condition or medications [13]. Traditionally, the effects of physical training in patients with chronic heart failure are evaluated by changes in VO_2peak, which is highly dependent on the patient's motivation [14].

VO_2peak and VO_2max are recorded at 'peak' effort, and consequently, they largely depend on motivation and the choice of test endpoint [15]. Exercise physiologists can evaluate whether the maximal effort has been exerted using criteria of VO_2max achievement (plateau in VO_2, respiratory exchange ratio, blood lactate, attainment of maximal heart rate and perceived exertion) [16,17]. The non-achievement of VO_2max is undesired since the data cannot be further used as maximal values. In this context, motivation may help reduce the non-achievement rates and produce more meaningful data for monitoring or research purposes.

A graded exercise test (GXT) is a popular approach to assess aerobic capacity and includes an exercise of incremental intensity until exhaustion in the maximal testing protocol. Participants should be motivated to elicit maximal end values (e.g., VO_2max, maximal heart rate, HRmax) [10]; otherwise, less motivated participants may stop exercising before maximal values are reached [18]. Testing procedures include the verbal encouragement (which is positively perceived) of participants to maintain or increase effort [10] and the presentation of a video [19] (Figure 1). Verbal encouragement results in an 8–18% increase in time to exhaustion during a GXT [10]. Such encouragement has been suggested to deliver every 20 s or 60 s instead of longer intervals (e.g., 180 s) [10]. Particularly, a verbal encouragement every 20 s or 60 s resulted in higher VO_2max, exercise time, blood lactate, RPE and RER than when no encouragement is given or when the encouragement is infrequent (i.e., every 180 s) [20]. With regards to the video presentation, comparative research between the video of the walking group (showing amateur runners and giving the patients the impression of exercising with them) and static images of flowers showed that the video group achieved a higher percentage of age-predicted exercise intensity (metabolic equivalents) and longer exercise duration and rated higher level of comfort and closeness to physical limits [19].

There is limited evidence that the effect of a motivation intervention may present inter-individual variation depending on personality type (e.g., Type A—more competitive—vs. Type B—more relaxed—on the Jenkins Activity Survey) [21]. For instance, compared with a non-encouragement trial, verbal encouragement led to greater treadmill time, VO_2, and respiratory exchange ratio for Type B but not for Type A [21]. In addition, type A ran longer without encouragement than Type B; however, when encouragement was provided, treadmill time for Type A and Type B did not differ [21]. These differences are attributed to motivation and rating of perceived exertion [22]. Therefore, it has been recommended that personality types be considered before deciding on verbal encouragement [23].

Halperin et al. [23] reviewed the role of volume and frequency of verbal encouragement in exercise testing. They concluded a lack of control of verbal comments' frequency or pitch during exercise testing. In addition, the effect of verbal encouragement has been examined in field and laboratory tests [24,25]. For instance, Sahli et al. [25] examined the effect of verbal encouragement and compliment on repeated sprint ability with a change of direction (COD; 6 × 20 m with 25 s active recovery with 100°COD every 4 m) in high school students. They observed that performance was better and perceived exertion was higher in the verbal encouragement group, followed by the compliment and control group. Furthermore, Karaba-Jakovljevic et al. [24] studied the role of verbal encouragement on Wingate anaerobic test performance in medicine students. They showed that performance improved when verbal encouragement was provided.

Professionals involved in exercise testing, such as exercise physiologists and sport scientists, should be aware of the role of motivation, especially using verbal encouragement, on performance. Therefore, motivation during exercise testing should be standardized and fully described in testing protocols. In this way, exercise testing would provide valid and reliable results for exercise prescription or other purposes (e.g., sport talent identification, athletes' selection, education, research and rehabilitation).

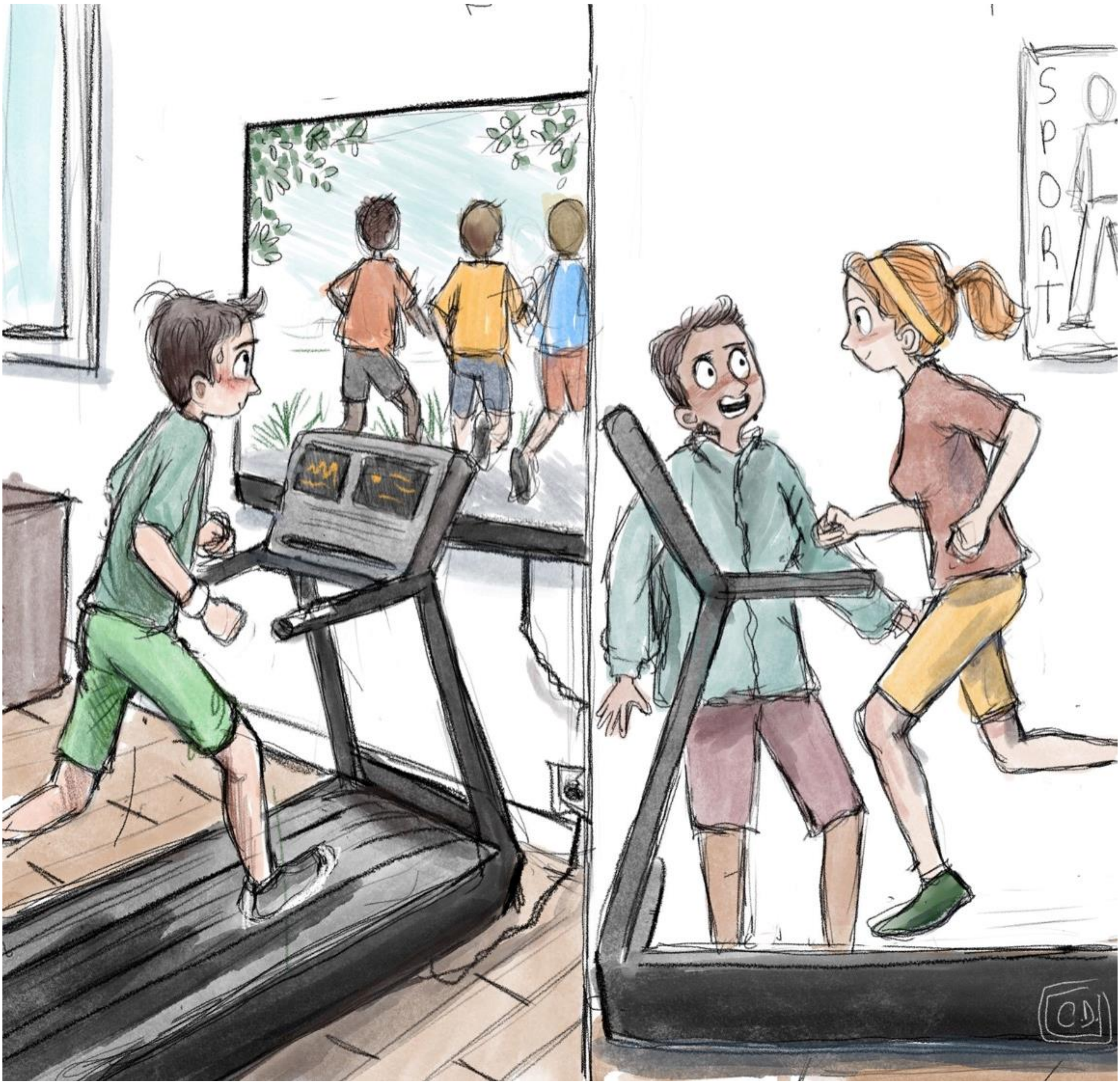

Figure 1. Presentation of video and verbal encouragement as means to motivate participants.

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