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ABOUT THE ACCURACY OF IDENTIFYING ENERGY EXPENDITURE WITH THE WEARABLE ACTIVITY TRACKER POLAR

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Annotation. An important factor in the training of an athlete is the preparation of a diet. Many athletes use chest straps to measure heart rate for the calculation of energy expenditure. The aim of the study was to compare exercise energy expenditure calculated using a Polar chest heart rate monitor with energy expenditure calculated by a metabolograph. On average, energy expenditure during exercise, according to the Polar chest strap, was 120±20 kcal. The average energy expenditure during exercise, according to the data of the metabolograph, was 108±20 kcal. The average difference was 12%, the difference ranged from 6% to 33%.

Keywords: sports, heart rate monitoring, wearable activity trackers, indirect calorimetry, nutrition.

Introduction Worldwide, lack of physical activity is a pressing public health problem. A recent World Health Organization (WHO) report showed that about 23% of adults and 81% of schoolchildren do not follow recommendations for physical activity [1].

Wearables hold great promise, especially as data collection tools for cutting-edge healthcare research, and demand has grown significantly over the past few years [2]. Consumer-grade non-invasive wearable devices are typically less expensive than gold standard research devices, comfortable to wear, and affordable for consumers [3-4]. In recent years, the quality and accuracy of wearable devices have improved, resulting in more clinically approved certifications [5].

In a recent review, Bunn et al noted the tendency of wearable devices to underestimate energy expenditure (EE), heart rate (HR), and step count [6]. Fitbit wearables were highly correlated with step count criteria during lab evaluation and had consistently high inter-device reliability for both step counting and EE [7]. However, some devices tend to underestimate EE, which is consistent with a separate Fitbit accuracy review [8] indicating that Fitbit wearables only provide accurate measurements in limited circumstances.

Calculating EE from heart rate is quite common among chest straps such as Polar, Garmin, etc. Athletes and fitness enthusiasts often use this method to calculate EE for a workout to adjust their diet.

Commercial wearable devices could allow populations to measure physical activity and large-scale behavioral changes. However, questions remain regarding their reliability and validity**.**

The aim of the study: to compare EE calculated with a chest heart rate sensor with indirect calorimetry.

Methods and organization. The study involved 6 men (average age 23±3), training experience – at least 2 years. All participants were instructed to abstain from exercise for 48 hours prior to the study, and for 12 hours to avoid taking any stimulants (caffeine, taurine, etc.). All participants also received dietary recommendations for food intake 3 hours before the start of the study. The subjects performed a stepwise test on a bicycle ergometer (the first stage was 80 W, the load increased by 15 W every minute), the criterion for stopping the test was the Borg scale: level 19. The subjects of the study recorded calorie consumption using the Polar H7 chest sensor (Finland) and the Polar beat app (Polar electro, Finland) every minute of the

test, and real expenditure was identified with the COSMED-QWARK metabolograph (Italy).

Results and discussion. All study participants successfully completed the loading protocol. The average EE during exercise, according to the Polar chest strap, was 120±20 kcal. The average EE during exercise, according to the data of the metabolograph, was 108±20 kcal. The average difference was 12%, the difference ranged from 6% to 33%.

As a result of the study, the Polar chest heart rate monitor increased EE from the actual by an average of 12%, ranging from 6% to 33%. We assume that this depends, on the one hand, on the training of the subject, and on the other hand, on the pulse cost of the session, which has yet to be determined in future works. Such discrepancies can mislead users of these devices and lead to inaccurate calculation of the daily EE for both athletes and other physically active people. Further research should be aimed at developing predictive equations in order to avoid the error of determining the consumption of EE and the error of calculating the caloric content of the diet.

Conclusion. In this work, we have determined that users who use a Polar chest heart rate monitor to measure energy expenditure may significantly overestimate their diet in terms of kilocalories, which can adversely affect body composition. In the future, more research is required on the influence of various devices, the purpose of which is to calculate energy expenditure.

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