COMBINING HEART RATE AND ACCELEROMETER DATA TO ESTIMATE PHYSICAL FITNESS

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ABSTRACT
Monitoring changes in physical fitness is relevant in many conditions and groups of patients, but its determination demands substantial effort from the person, personnel and equipment. Besides that, present (sub) maximal exercise tests give a momentary fitness score, which depends on many (external) factors. Obtaining a fitness score based on measures gathered during longer periods of time and in natural conditions, like in daily life, would be an attractive alternative for the present methods. We performed an explorative lab-experiment to study the feasibility of fitness estimation during an activity commonly encountered in daily life; walking.

PURPOSE: To investigate the feasibility of physical fitness estimation from combined heart rate and accelerometer data obtained during treadmill walking.

METHODS: Forty-one subjects (23m, 18f) aged between 21 and 29 walked at three speeds on a treadmill (4, 5.5 and 6 kmh−1) wearing a heart rate monitor and a hip mounted 3D accelerometer. The acceleration signal was converted into activity counts [1] per 10 seconds. Stepwise linear regression analysis to estimate VO2max was performed on the slope and intercept of the linear relation between heart rate and activity counts during steady state exercise (> 3min), together with age, gender, weight, length and BMI. Reference VO2max was obtained by performing a sub-maximal single stage treadmill walking test [2].

RESULTS: The model with the highest percentage of explained variance (R²=0.93) combined the slope and intercept parameter of the relation between heart rate and activity counts, together with gender. The model had a standard error of the estimate of 1.78 ml O2 kg⁻¹ min⁻¹.

DISCUSSION: Results of the model are comparable with commonly used submaximal laboratory tests to estimate VO2max. Fusing heart rate and accelerometer data during steady state activities seems promising for ambulant estimation of VO2max and would not require the subject to carry out a high performance test. The applicability of current method on a broader age group and in daily life is part of ongoing research.

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REFERENCES