



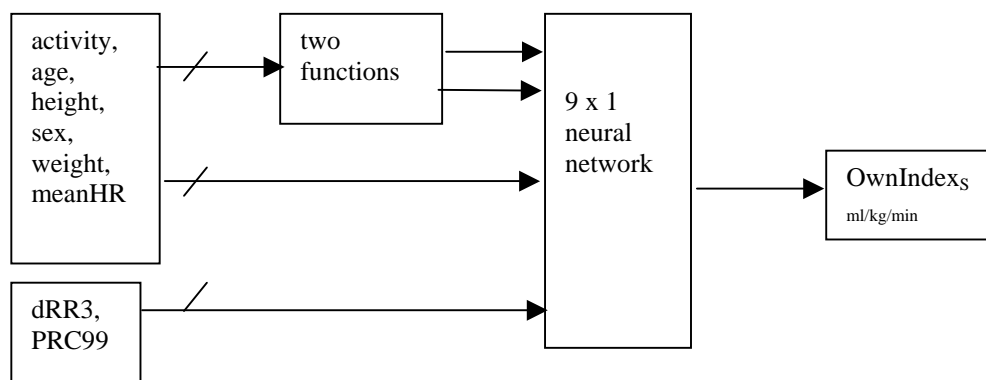
R&D/Research/Polar Electro Oy
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Development and evaluation of Polar OwnIndex_S

Polar OwnIndex_S is an advanced modification of Polar Polar Fitness Test™ and OwnIndex (Kinnunen et al. 1999). The test predicts maximal aerobic power (maximal oxygen uptake, VO_{2max}) and has been developed using artificial neural network calculation. Polar OwnIndex_S predicts aerobic fitness (VO_{2max}) from resting heart rate, heart rate variability, gender, age, height, body weight and self-assessment of physical activity. Activity assessment is done by selecting an appropriate number (1-4) that best describes general activity level for the previous 6 months:

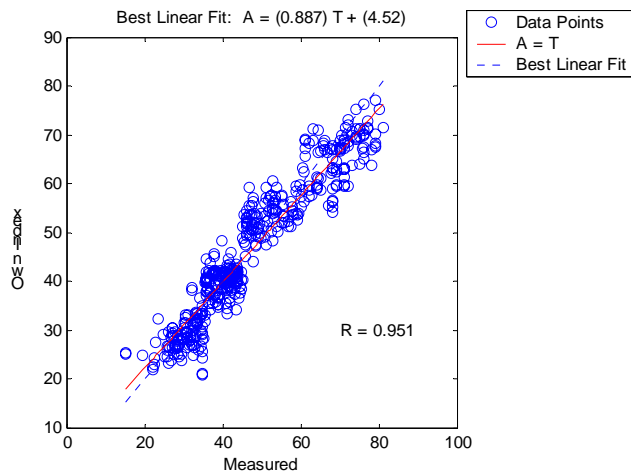
- Low (1) You do not participate regularly in programmed recreation sport or heavy physical activity. E.g. you walk only for pleasure or exercise occasionally sufficiently to cause heavy breathing or perspiration.
- Middle (2) You participate regularly in recreation sports. E.g. you run 5-10 km per week or spend 1/2-2 hours per week in comparable physical activity or, your work requires modest physical activity.
- High (3) You participate regularly, at least 3 times a week, in heavy physical exercise. E.g. you run 10-20 km per week or spend 2-3 hours per week in comparable physical activity.
- Top (4) You participate regularly in heavy physical exercise at least 5 times a week. E.g. you exercise to improve performance for competitive purposes.

To obtain the measures for heart rate and heart rate variability 257 heart beats (3-5 min) need to be measured. The figure below illustrates the structure of the OwnIndex_S calculation.



In the test development study, 450 laboratory fitness measurements of 15-65-year-old healthy men (n=307, age range 15-65 yrs) and women (n=143, age range 18-61 yrs) were performed. The measured maximal aerobic power values in the data varied between 1.0-6.5 l/min (15-81 ml/min/kg). Nineteen percent of men and 27% of women had VO_{2max} less than average, 26% and 22% had average VO_{2max} and 55% and 51% above average (Shvartz and Reibold 1990). None of the subjects had any medication.

Correlation coefficient between the laboratory measured VO_{2max} and OwnIndex_S prediction in the data of all 450 subjects was 0.96 and the mean error in the prediction was 8.2% (3.7 ml/kg/min, SD=4.7). In 95% of the cases the error in the prediction was less than 9.4 ml/kg/min. In the figure the laboratory measured VO_{2max} and OwnIndex_S prediction (ml/kg/min) in 450 subjects are compared.



The mean error of the OwnIndex_S prediction (8.2%) is good and comparable to any other predictive tests, in which the mean errors vary between 8-15%. In the laboratory measurements of VO_{2max} , the test-to-test variation within the same individual is between 3-5% due to physiological day-to-day variation and technical parameters.

References

Kinnunen, Hautala, Mäkikallio, Tulppo, Nissilä. Artificial neural network in predicting maximal aerobic power. ACSM Annual Meeting 2000, accepted abstract, 1999.

Shvartz, Reibold. Aerobic fitness norms for males and females aged 6 to 75 years: a review. *Aviat Space Environ Med* 61, 3-11, 1990.