DEVELOPMENT, TRAINABILITY AND INTERPRETATION OF Endurance Performance Capacity in Children and Youth

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INTRODUCTION

The endurance performance capacity (EPC), which is also an index for the aerobic endurance, is of particular importance in many types of sport. This is valid for classical endurance sport as well as for sports games. There are many studies about trainability of the EPC in adults, whereas only few information is given about development, trainability and the age independent interpretation of the EPC in children and youth. A great demand for research in this case can be assumed. A one-way interpretation of the EPC, e.g. by the heart rate (Conconi et al. 1982) or by an investigated lactate threshold (Karlsson et al. 1982), is not suitable to the complex of the metabolic influences on the EPC. The interpretation of the development and trainability of the EPC therefore needs an investigation, which considers several metabolic parameters.

METHODS

The investigation had a combined longitudinal/cross-sectional design: > A longitudinal investigation over two years showed by a field step test (running; duration about 5 min, first step 2.4 or 2.8 nvs-1, step wide 0.4 nvs-1) the development and trainability of the EPC in 10 to 16 year old boys who played soccer (S; n=41; 12.5±1.1 years) or performed track-and-field (TF; n=17; 12.2±1.3 years) or were untrained (C; n=16; 12.3±1.0 years). The criteria for the EPC is the running velocity at a blood lactate concentration of 4 mmol/1 in the field step test. In the TF-group were some athletes, who concentrated on middle- and long distance running (TFE; n=6; 13.2±1.4 years). The S- and TF-athletes came from international successful german sport clubs. C consists of pupils of a german grammar-school who were not involved in extracurricular sport. The investigations for the training groups took place all 3 months and for C all 6 months.

<2> The approximation of the maximal lactate formation rate (VLamax), as an index for the anaerobic-lactic capacity, as well as the development of the VLamax at the age of 11.2 - 18.7 years, was the purpose of a cross-sectional study, which was realized with patients of the same group (n=96). According to the results of a pretest, a 60m sprint test was applied for the approximately determination of the VLamax.

<3> To get further information for the interpretation of lactate performance curves as well as for the development and trainability of the EPC, a second cross-sectional study with 18 patients was carried out. This study provided information about the maximal oxygen uptake (VO2max) (maximal treadmill test), the oxygen uptake (VOj) on submaximal loads (treadmill step test), the VLamax (60m sprint test) and the lactate performance curves (treadmill step test). The results of these investigations (running speed, running time, maximal-post-exercise-lactate-concentration [MaxPELC]) were post-interpreted by a computer-supported program for the indirect determination of the relative VO2max and the VLamax (Mader 1994).

RESULTS

(1) The development of the EPC in the longitudinal study shows, that the EPC cannot be significantly increased only by aging (C: 3.02±0.22 nvs-1 [Dec. 92] - 3.05±0.23 nvs-1 [Dec. 94], n.s.). To this an additional aerobic endurance training (TFE: 3.92±0.20 nvs-1 [Dec. 92] - 4.14±0.31 nvs-1 [Dec. 94], p<0.05; S: 3.65±0.25 m-s-1 [Dec. 92] - 3.92±0.22 nvs-1 [Dec. 94].
psO.Ol) or a higher training volume (TF: 3.39±0.24 m-s\(^{-1}\) [Dec. 92] - 3.55±0.27 m-s\(^{-1}\) [Dec. 94], n.s.) is necessary. Therefore the higher EPC is associated with training, but not with aging. The results show, that a sensitive phase for the EPC-training in puberty cannot be confirmed. (2) The experimental data in combination with the computer-supported post-interpretations showed, that this aging dependent absence of the EPC doesn't mean, that there are no changes in the metabolism capacity and the VO\(_2\) on submaximal loads. The EPC is nearly unchanged during the longitudinal study without an adequate training by both, an increased VLamax (C: +0.12 mmoM\(^{-1}\)S\(^{-1}\); predominantly because of a greater muscle share with glycolytical enzymes and an increasing muscle mass portion from the whole body mass [Tanner et al. 1981]) and an increased relative VO\(_2\)max (C: +2 ml-min\(^{-1}\)kg\(^{-1}\); predominantly because of an increasing muscle mass portion from the whole body mass). A lower VO\(_2\) on submaximal loads by aging (C: •1 ml-min\(^{-1}\)kg\(^{-1}\); predominantly because of a higher efficiency [Krahenbuhl et al. 1979]) influences the EPC as an additional factor. The increasing VLamax shifts the lactate performance curve to the left, the increasing relative VO\(_2\)max and the decreasing VO\(_2\) on submaximal loads to the right. (3) For the interpretation of lactate performance curves, which are determined by field- or treadmill step tests, it has to be noticed, that an identical EPC can be traced back to different metabolic capacities.

**DISCUSSION**

For the interpretation of the endurance development in children and youth a definition and diagnosis problem appears along with a one-way reflection problem. In terms of endurance diagnosis it is insufficient to use simple tests of motor behavior in sport. For an objective, reliable and valid performance diagnosis a differentiation of the endurance in at least four areas (short-term endurance, medium-term endurance, long-term endurance I and EPC) is necessary. Each with specific, multi item performance diagnosis methods. To guarantee optimal development possibilities of their genetic potential, these reflections are of special importance for children and youth.

**REFERENCES**