

VARIATIONS IN LEVELS OF BLOOD LACTATE AND FREQUENCY HEART RATE DURING A MARATHON RUNNING

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(Original scientific paper)

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Abstract:

The object of current research is to determine the variation of two physiological indexes depending on speed of running during a marathon running. An object of research are two sportsmen with amateur status at age $43,25 \pm 2,5$ year old, weight $62,77 \pm 1,9$ kg. , height $179,7 \pm 2,5$ sm. and personal best $3,15,70 \pm 0,3$ ÷. The research shows that, regardless the amateur status and professional engagement (banker and engineer) of sportsman they have comparatively good level of preparation.

Key words: *functional preparedness, lactic acid, body weight, body height, regression*

INTRODUCTION

A marathon running is a real test of will and possibilities of human body. According to some authors: Astrand (1960); Mc. Ardle, et al. (2000); Sjodin et al. (1985), Wilmore & Costill (2005), during such a physical loadings the human body works mainly in aerobic state and a tiny part (7-8%) are provided from anaerobic energy sources. Experimentally is proved, that regardless of level of preparation, the aerobic work is connected with increment of blood lactate from $1,0 \text{ mmol/l}^{-1}$ in the beginning till $5,0-6,0 \text{ mmol/l}^{-1}$ in the end of running: Shepard (1982); Ripero, et al. 1985); Jacob (1985); Margaria, DiPrampo, et al. 1963). Necessary energy for supporting working capacity is provided also through spending muscle glycogen and fatty acids.

There is data Hartley et al. (1969); Svedenhag & Sjodin (1984); Seiler (2009); Costill, et al. (1973), that connection between speed of running, level of excurrent blood lactate (LA) and heart rate(HR) is exponential curve. Increasing duration of physical loading or intensity, other indexes (LA and HR) increase simultaneously, even though in different dynamic.

Object of research: The object of current rese-

arch is to determine the variation of two physiological indexes depending on speed of running during a marathon running.

METHODS

Organization of research: An object of research are two sportsmen with amateur status at age $43,25 \pm 2,5$ year old, weight $62,77 \pm 1,9$ kg. , height $179,7 \pm 2,5$ sm. and personal best $3,15,70 \pm 0,3$.

Using a step-type test of veloergometer with loading till stopping (standard method – increasing loading every 1,30min.) is registered the level of LA during the inflex point of $4,0 \text{ mmol/l}^{-1}$ and minimal pulse ($185 \pm 2,2$ beats/min.)

Pulse frequency is registered automatically using pulse-tester (Type Seka Sporton-250- using diskette record every kilometer of the distance)

The level of blood lactate is measured at the start of every 10 km – tests are taken from pinna using *Lactate Testefen, Accusport, Boeringer – Manhem – Germani*.

It is not measured indexes during the rest, immediately after running.

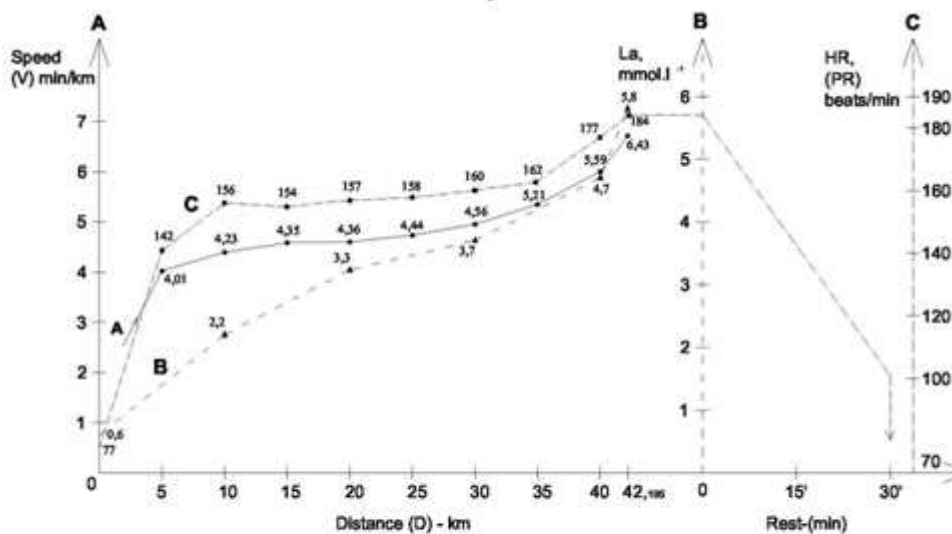


Fig.1 Registration of speed (min/km), Level of lactat (La,(mmol/l)) and Pulse rate (beats/min) in time of marathon running \ May-2008 \

RESULTS OF RESEARCH

The registered three indexes show clearly the connection between intensity of running, LA, HR and their variations.

On fig. 1 the index-speed of running (A-m/s) show, that competitors are in continuous regression i.e. the speed reduces from start to the final.

First 20km. are run with stable speed from 4,01 till 4,36 min/km. and this pace is kept till 25th km. The difference in speed for every 5km. is insignificant (around 0,25s. or variety of 2,8%). First significant change of speed become between 30-35km., where is registered decrease – 0,65s/km or 14,25%. Because of the growing fatigue the speed is decreased even more in the last 7195m., which are run for poor 6,43min/km. This is a clear indication of collapse in energy system of human constitution, so from aerobic state transit in anaerobic.

Physical index – LA describe the concentration lactic acid in blood. It shows a multistep increase of 1,1 mmol/l⁻¹ every 10km. and from 0,6 mmol/l⁻¹ at start reaches 5,8 mmol/l⁻¹ in the final. This could not be considered as an anomaly. Probably the human constitution reveals other physical factors for compensating and removing LA in blood mainly in working muscles cells, while aerobic enzyme fight with increasing acidosis. The level of LA between 35 and 42,195km. jumo from 4 to 5,8 mmol/l⁻¹, which indicate that last 6-7km. human constitution works in anaerobic state and provide energy from not oxygen sources.

Another index, HR is in direct connection with running speed and to some extend with increasing lactate. At starting level of 77beats/min in the beginning of running, in the first 5-10km. is marked natural growth of HR with 70-75 beats/min. At he end of first 5km. its values are around 142 beats/min, which are kept around 25km. Regardless of the low qualification of competitors, they maintain 35km. in the zone called Steady State, where main source is the oxygen, Changes in HR between 20 and 35 km. are just 6 beats/min and are below the level of inflex point from 4,0 mmol/l⁻¹ lactate. Critic point occur after 35km., when pulse frequency increased and in the last 2km. is 177-184 beats/min. As it shown in Fig.1 this is connected with increased of LA, which is distinct sign of exhaustion of aerobic supplies of body. Fig. 1 is attached in the end of the article.

CONCLUSIONS

The research shows that, regardless the amateur status and professional engagement (banker and engineer) of sportsman they have comparatively good level of preparation

A change for worse in three indexes (speed,LA,HR), indicate for insufficient running practice and lapse of continuous (over 20km.) running during training sessions

The level in LA in blood is not only a function of intensity of running. It is affected from several inner and outer factors.

Pulse frequency is more unstable index for changes in human constitution. In this particular case a speed of 3,38m/s till 3,8m/s is sufficient to put human body in aerobic state – at level of LA in the range 3,0-3,7 mmol/l⁻¹

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ПРОМЕНИ ВО НИВОТО НА КРВНИОТ ЛАКТАТ И ФРЕКВЕНЦИЈАТА НА ПУЛСОТ ЗА ВРЕМЕ НА МАРАТОНСКОТО ТРЧАЊЕ

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(Оригинален научен труд)

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Апстракт:

Целта на ова истражување беше да се утврди промената на два физиолошки показатели во зависност од брзината на трчањето во текот на маратонското трчање. Као примерок на испитаници се избирани двајца спортисти со аматерски статус на возраст 43,25±2,5 години, со телесна тежина 62,77±1,9 килограми, телесна височина 179,7±2,5 сантиметри и личен резултат во маратонското трчање од 3,15,70±0,3 часови. Истражувањето покажа дека независно од аматерскиот статус и професионалниот ангажман (банкар инженер) на избираниите спортисти, тие имаат задоволителна функционална подготовка.

Клучни зборови: функционална подготовка, млечна киселина, телесна тежина, телесна височина, регресија