Modern Applied Science

www.ccsenet.org/journal.html

Vol. 2, No. 3

May 2008

A Study on the Relationship between RPE and Bogy Enginery Evaluation Index

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Abstract

The "rating of perceived exertion (RPE)" is a simple and effective index to evaluate sports intensity between physiology and psychology, which is being studied and applied in many European and American countries at present. The deep research of this index has great significance promoting competitive sports and nationwide body-building.

Keywords: Rating of perceived exertion (RPE), Cardiovascular, Incretion, Blood lactic acid

1. RPE and its meanings

RPE is a sort of simple and effective medical supervision method to evaluate sports intensity, which is researched and applied in many European and American countries at present. RPE is the index between physiology and psychology. In 1962, Borg firstly put forward the 21 points table measuring the perceived exertion (Borg, G., 1962, p.1-63), and in 1970, he further introduced the 15 points table to open out the change of sports function about body sports intensity. For example, the table was used to measure the RPE of healthy adults and trainers, and the result showed that on which degree the physiological index had pertinence with the psychological index. Afterward, that result was abroad applied in those swimming and running patients (Borg, G., 1970, p.4548-57 & 1970, p.92-8 & 1970, p.17-26). In fact, the appearance of RPE is psychological, but it reflects the change of physiological enginery. That is the reason why European and American physiologists simultaneously measured and comprehensively analyze the RPE index and the change of physiological index. The basic concept of RPE rating comes from human feeling of subjective physical force, because human possess the strong ability to perceive energy consumption, i.e. perceiving exertion. This sort of perceiving exertion offers a sort of basic information to human, i.e. the human endurance degree to certain sports intensity or the pain degree human subjectively feels. In actual living or sports practice, proper physiological intensity stimulation will be a sort of active feeling if it is a sort of amused experience though sometimes the intensity is little large. Therefore, psychologist, sports psychologist and medical staff have so many enthusiasms to study the relation between enginery perceiving degree and intensity load, and the enginery level of athlete or diseased symptom. Based on above cognitions, many people thought this sort of subjective feeling should be changed to the index with actual meanings, and it was very important to adopt a sort of method to quantize it, and this method could be used by most people and without influences of sex, age and race. Based on this concept, Borg firstly put forward "RPE".

The modern sports training theory thinks that the sport is the comprehensive representation of bogy ability and psychological ability, which is completely different with the view that thought the body sport is irrespective with psychological factor early. At present, people thought the body sport is not the physical sport all along, because the stress status when the body exercises contains psychological factors. It can induce enthusiasms and competitive consciousness to mobilize body potential to adapt present stress under the special condition when certain motivation starts. At that time, various physiological and psychological indexes in the body will change with the change of the intensity. So according to the concept of RPE put forward by Borg, we can find out the quantitive relation between RPE and concrete physiological and psychological indexes (Kurokawa, 1992, p.277-88).

2. Borg's RPE grade table and its meanings

The intention that Borg established RPE is to take the value of RPE as a sort of simple tool to evaluate and regulate sports intensity in human physical exercise. The measurement division of RPE includes all perceived exertion range from the lightest exertion to the most intense exertion and organically combines the physiological index. The Borg's RPE intensity includes that 6 represents easy at all, 7-8 represents extremely easy, 9 represents very easy, 10-12 represents easy, 12-14 represents little difficult, 15-16 represents difficulty, 17-18 represents very difficult, 19 represents extremely difficult and 20 achieves the maximum of the body. The measurement of 6-20 accords with the intensity of 60-200 times per minute heart rate. He thought that the verbal RPE value in certain intensity sport must linearly

increase with the power of the power bicycle, and this linear relation must not mean the simple process between heart rate and perceived exertion. However, it made the value of RPE possess special actual meanings.

The perceived exertion generally refers to the feeling of a collectivity or complete sports degree. It is a sort of complex feeling which involves various different signals. In these signals, the changes of muscle, joint sport and breath circulation system going with the pains to the sport will make perceived exertion change to the comprehensive physiological and psychological feelings. In sport, we sometimes require the tester try to differentiate the local feeling from working organ with the discomfort in the chest.

Before the RPE index is confirmed, it is very important to understand age differences and individual differences. The sports sort is selected according to these characters. At present, adopted sports sorts include lab power bicycle and electric running platform, and the sport mainly aim at the training, competition and nationwide body-building. When the power bicycle is used, it begins from small intensity such as 10w, 30w or 50w and sustains certain time such as 5 minutes. Then, the power bicycle increases with same w value such as 30w or 50w, and the tester does the sport in another 5 minutes under this intensity, and in this way, until the maximum sports level is achieved, which is equal to 160-180 times per minute (youth and wrinkly) or 130-150 times per minute (the elderly). The sports sorts can change with the testers' differences, the intention of the research or possible clinic symptom. If the sports time is enough long, the increase of heart rate will be stopped, but the tester's perceived exertion will continually increase. Under large intensity sport, the relation between above heart rate with RPE is stable, and generally the proper oxygen sport intensity is approximately in "13" (some persons may feel difficult or hard), and its range is generally in "13-15". To some persons who want to complete several groups of interval training plan or more training intensity, "17" or "19" can be adopted in the training. But it only aims at athletes, and the person who has heart blood vessel disease absolutely adopts this intensity.

3. RPE and the change of body incretion

After training, whether trainer or non-trainer, their body incretion levels will change to different extents. In the periodic sport, the changes of cortisal (C), free testosterone (FT)/cortisal, and total testosterone (TT)/cortisal may be influenced by the sports quantity or sports intensity. For the tester who continually increases sports intensity in short time, whose TT and FT levels reduce obviously and the creatine kenase (CK) ascends obviously. The change of above indexes will follow the decrease of sports ability and the increase of RPE grade. Even once the sport reduces, the TT and FT levels will increase and the CK level will reduce at the same time. Therefore, the indexes of TT, FT and CK may be the useful indexes to regulate excessive training (Hackney, 1989, p.117-27 & Hackney, 1988, p.60-5). Skrinar et al reported the large intensity endurance training which 15 female athletes took part in from 6 weeks to 8 weeks (Skrinar, 1983, p.1239-50). They respectively measured the RPE values before the training, in the training and after the training in the standard running platform experiment. The endurance training could make the center RPE and total RPE reduce, but it had no influences to the local RPE. The research result indicated that the blood lactic acid had pertinence with the local RPE, but the blood catecholamine had pertinence with the central RPE.

4. RPE and the change of blood lactic acid

The changes of the maximum ventilation exchange (VE), the ventilation gas exchange rate (VGER), the convalescence lactate concentration (La) and the RPE level are related with the sports sort. The research result thought that in healthy female group, the age factor would not be the factor which induces the decrease of body sports ability when using corresponding small muscle group to exercise before 60 years old. The reason inducing the decrease of sports ability mainly rests with the surroundings but not the nerve centre (Aminoff, 1996, p.180-5 & Aminoff, 1998, p.109-20). Kang et al observed 7 testers' functions of carbohydrate to RPE when they rode the bicycle from middle intensity to the exhausted intensity, discussed the relation between the hypo-margin intensity sport and RPE in 2 hours. The testers implemented sport in 70% of maximum corresponding oxygen absorption until up to the exhausted intensity. The testers took orally 6% dextrose/saccharose liguor 0. 6kg-1.hr^{-1} per kg avoirdupois, or took orally the artificial complex as the comfort medicine per 20 minutes. In the whole sports process, they measured lag RPE, chest RPE and total RPE per 20 minutes, and measured the oxygen absorption, ventilation exchange, dextrose oxygenation rate, blood dextrose concentration, glycerol and blood lactic acid (Mielke, 2008, p.293-302). The result also indicted that the decrease of blood carbohydrate induced by 70%VO_2max sustainable sport strengthened lag RPE and total RPE, and except for possible useful index such as carbohydrate, other indexes might function to the exhausted perceived exertion. The lag RPE and total RPE after 2 hours middle intensity sport possessed certain value to predict endurance sports ability of hypo-margin intensity. As we know, the training can produce different function to the body sport and emotion status. Though the training levels of trainer and non-trainer are completely different, but under most situations, testers' heart rates and RPE ascend linearly and the change of blood lactic acid accumulation level after training is very obvious. When the change of the heart rate is contrary to the change of RPE, the non-trainer's individual RPE grade is 15, and his heart rate of bicycle sport and running actually achieves 15-20 times per minute. On certain RPE level, the athlete's changes of above indexes have no obvious difference with runners. That indicated the special training can not only

enhance the body sports ability, but enhance athlete's psychological reactive ability.

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