

The Evaluation of the Training Intensity and Physiological Load for Adolescent Table Tennis Players

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1. Introduction

Physiological load is the human body's physiological function reaction caused by sports. It can also be defined as sports load. In the past, we were in lack of quantitative data during the evaluation of training intensity and physiological load for adolescent table tennis players, so the judgment on the quantity of sports load only depends on one's observation and experience. Such a judgment was lacking a scientific basis. In order to scientifically improve the training of table tennis players, it is necessary to put forward objective evaluation indices for the training intensity and physiological load of technical exercise in common use.

KEY WORDS: Training Intensity. Physiological Load. Heart Rate.

2. Purpose of this study

This paper is intended to put forward objective evaluation indices in fixed quantity for the training intensity and physiological load of adolescent table tennis players so as to scientifically improve the training of table tennis players.

3. Method of this study

The experimental method was adopted in the study. First, training sessions with high, medium, or low sports load were designed. Second, the exercise time was strictly controlled and the exercise content of basic techniques was flexibly adjusted to practical needs. Twenty-four person-time experiments related to various sports load were carried out on eight subjects (four were youths and four were adolescents). More than 1800 data of heart rate have been collected. In order to obtain reliable heart rate data, a heart rate telemeter was used as a measurement instrument. We tested the heart beats per ten seconds every other minute during training sessions and analyzed the data with the method of mathematical statistics. As a result, eight heart-rate diagrams showing three kinds of sports load have been drawn in accordance with respective individuals. In addition, we referred to some documents and papers on heart rate and physiological load.

Experiment programme is as follows:

4. Experiment results

4.1 Twenty-four group's average-heart-rate value table for training sessions with high, medium or low training intensity.

4.2 Twenty-four groups physiological load index table for training sessions with high, medium or low training intensity.

4.3 Average-heart-rate diagrams of exercise items in the 24 experiment sessions with high, medium or low training intensity(Diagrams 1 to 8).

5 Discussion and analysis

5.1 On training intensity and heart rate

According to the 24 groups average-heart-rate numerical table of high, medium, low training sessions, the load is 30 beats/10 seconds for high intensity, 25 beats/10 seconds for low intensity and 25-29 beats/10 seconds for medium intensity. Energy consumption per unit time of exercise is a comprehensive index reflecting training intensity. The human body's energy consumption in exercising must be increased by strengthened material metabolism, and the oxygen necessary for metabolism must be supplied by speeding up blood circulation. On the other hand, power for blood circulation comes from the heart, so that the heart would speed up and strengthen its pulse. From the statement above we can find a close relation between every consumption and heart beat. So heart rate can reflect training intensity. The higher the training intensity, the larger the amount of the oxygen consumption, and the faster the heart rate. Heart rate variation in the high, medium, low training session also proves this relation.

5.2 On physiological load indices and heart rate

Twenty-four groups' physiological-load indices are closely related to 24 groups' average-heart-rate value, because

$$\text{physiological load index} = \frac{\text{average - heart - rate}}{\text{quiet pulse before session}}$$

In this index, not only have training intensity, frequency, time, and exercise times been taken into consideration but also quiet pulse before the session. The variation in heart rate increment comes from differences of specific individuals, and the true physiological load varies even when the maximum heart rates are identical because of the variation of quiet heart rates. As an index reflecting sports load, it is quite comprehensive and objective. According to evaluation table of physiological load listed by sports medicine, the index is over 2 for heavy load, below 1.5 for low load and 1.5-2 for medium load. Physiological load data collected in the former experiment sessions are: 2 for heavy load, 1.8 for medium load, and 1.5 for low load. They are basically in conformity with the evaluation table of sports medicine.

5.3 On sports load and heart rate

Average-heart-rates collected in this experiment are: 27 beats/10 seconds for heavy load, 24 beats/10 seconds for medium load, and 22 beats/10 seconds for low load.

During the training session with heavy load, we arranged 3 exercise items of high intensity, 2 of medium intensity and 2 of low intensity. The subjects acted as the main trainees throughout session. In the medium-intensity session, we arranged 1 exercise item of high intensity, 2 of medium intensity and 2 of low intensity. The subjects acted half the times as the main trainees, the other half of the times they acted as training partners. As much attention was paid to technical exercises as to tactical ones. In the low-intensity sessions, we gave first place to technical exercises and the intensity was generally low. The time that subjects acted as main trainees or training partners was half and half, too.

6. Conclusions

6.1 Heart rate data of the telemeter tests show that the average-heart-rate are: 27/10 seconds for heavy load, 24/10 seconds for medium load and 22/10 seconds for low load. The physiological indices are 2 for heavy load, 1.8 for medium load and 1.5 for low load. So the heart rate can be considered to be a main evaluation index for the training intensity of table tennis training.

6.2 There is a close relation between physiological load and sports load. Physiological load could be considered to be a quite comprehensive and objective evaluation index for table tennis training sessions because it takes training intensity, frequency, time and exercise times into consideration as well as the quiet pulse before the session. It also reflects the variation in heart rate increment among specific individuals. According to the fact that the indices of the physiological load are greatly affected by the quiet pulse before the training session, measurement must be carried out with accuracy and complete reliability.

6.3 Training intensity evaluation of table tennis basic techniques must be applied in accordance with different individuals. For the same exercise content, players with a higher technical level will bear higher training intensity and frequency than the ones with a lower technical level, so their heart rates are higher, too. We can see that training intensity is closely related to the level of table tennis technique.

6.4 Table tennis coaches should regulate exercise intensity properly according to the technique level of adolescent players. Testing the heart rate at regular intervals, in order to regulate sports load properly, will help to treat players individually and improve the training scientifically.

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