Physiological responses as the basis for rationing wrestlers' training loads

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Abstract

The aim of this study is to identify the impact of varying intensity training loads on the physiological responses of the body's internal and how it is effectively used in rationing of training loads to wrestlers as well as the correlation between physiological variables in training loads (simple–medium–lower than maximum–maximum).

The sample of the study consist of 18 wrestler in age 16:20 the experimental method has been used, the results pointed that loads affect differently the physiological responses of the body's internal organs, in addition to a strong positive correlation between of physiological variables of the Circulatory and respiratory system in varying intensity training loads and the level of Physical efficiency, except for breathing time when the training load reach to medium and lower than maximum.

Keyword

Physiological responses, training loads, Cardiac output, Oxygen pulse, oxygen consumed , VO2 expressed per kg, Ventilation coefficient, Respiratory rate

Research problem

Athlete body's exposing to rationed physical loads is the scientific basis for training process, where the gradient increase in load affect physiological responses for internal body systems to the devices internal body organs which works to raise physical efficiency for wrestlers, these responses can also be used as scientific mean to ration training loads based on the abilities of each individual.

AbulElelaa Abdel Fattah (1997, p64), Mohamed Osman (2000, p165), and BahaSalameh (2002, p97) argued that rationing training loads process form the structure of training programs in terms of intensity, volume and rest used set by the coach to get his players to physiological adaption

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phenomenon and thus raise athlete performance level, if the training load is appropriate to athlete abilities ; its goal achieves, but if load is less than required physiological adaption is not achieved , If load is large than required; its negative effects appear not only athlete's performance level, but also on his health.

In general, there are many functional tests which are used for objective evaluation through physiological measurements to detect player's organs efficiency and readiness level and his training status, through results of these tests it is possible to evaluate body status as a whole, as well as the extent of organs adaptation under the influence of various physical loads, also these tests help in detection of body's functional reserve and hence general physical efficiency (Abu Elela Abdel Fattah and SubhiHassanein, 1997: p277, Kostov, Zlatin; Grigorov, Biser; Damjanova, Reni 2003: pp75-80).

As wrestling is one of violent sports which training on it leads to functional changes of various vital systems, Coach could not develop player's level without physiological information assist in evaluate temporary or permanent

Motor performance in wrestling requires muscle action with maximum strength since oxygen directing processes can't meet fast muscle work needs of energy, on this basis, energy is produced without any oxygeni.e. in anaerobic way (BahaaSalameh, 2002:p23).

Oparina (2003, pp39-40) ,Bojaziev (2004, pp90-105 and Kitmanov (2004, pp25-26) argued that of the most important tasks of sports scientific measurements is to identify and evaluate athlete's physical ability, circulatory system, respiratory system metabolism, as well as various body enzymes and hormones as a basis for diagnosis of athlete overall health status, and assessment of his physical abilities related to specialized sport activity; in addition to use their results in rationing training loads for various sports activities.

What mentioned above illustrate the importance of identifying physiological responses of wrestler's internal body organs resulted from

physical loads with different intensities through physiological tests before rationing training load; so coach can construct training loads and ration it with what suit wrestler health and physical abilities in order to identify the impact extent of these physical loads on the wrestlers' body internal vital organs and the development of their training status.

As each physical load has physiology effect on body organs body and these responses vary according to sport activity practiced, also load rationing according to individual differences has become a major obstacle for coaches who are forced to ration training loads for each player separately in all sports in general and wrestling in particular. Therefore, the researcher is trying to identify the physiological responses of body organs to training loads with different intensities, which can be used to ration training loads for wrestlers on a scientific basis and in line with their abilities of each wrestler and identify their contribution percentage to wrestlers' physical efficiency level to achieve the targeted results of these loads, as well as track development of wrestlers level.

Research objective

The research aims to try to ration wrestlers training loads using physiological responses for body internal organs by identifying:

1- Physiological responses of wrestlers' internal organs under the influence of physical loads of different intensities.

2- Differences between some of physiological responses of wrestlers' body internal organs under the influence of physical loads of different intensities.

3- The correlation relation between Circulatory and respiratory systems and level of physical efficiency for the training loads.

Research queries

4- What are the physiological responses of wrestlers' internal organs resulted from physical loads of different intensities?

5- Is there any statistically significant difference between training loads in physiological responses of wrestlers' body internal organs?

6- Is there a correlation between Circulatory and respiratory systems and level of physical efficiency of the

training loads under the study?

Research procedures

Research Methodology

The researcher used the experimental approach as it suits research nature.

Research sample

Research sample selected intentionally and consisted from 18 wrestlers aged between 16-20 years who enrolled in Qalioubeya wrestling area.

Table (1)
Sample description (n = 18)

Variables	unit	Mean	Median	SD	Skewness
Age	Year	17	17	1.07	1.286
Height	Cm	173.64	173	3.65	0.471
Weight	Kg	69.32	66	6.61	0.839
BMI	Kg/m2	39.92	38.37	3.73	0.949
Physical competency	Watt	259.16	259	14.47	0.539

Table (1) shows that the Skewness coefficient for each of age, height, weight and body mass index (BMI) and physical efficiency was between ± 3 which indicates homogeneity of sample under investigation.

Methods and data collection tools (appendix 1)

1- Measurements

Heart rate	pulse/min	Ventilation coefficient	L/min
Stroke volume	ml/pulse	Respiratory rate	ml/min
Cardiac output	L/min	Oxygen pulse	ml/pulse
Respiratory Frequency	times/min	Breathing time	sec
Tidal Volume	ml	volume of oxygen consumed	ml/min
Pulmonary Ventilation	liter/min	volume of carbon-dioxide produced	ml / min
VO2 expressed per kg	ml/kg/s		

2- Tests

1 – Novak test (Watt/kg)

Training load is determined based on body on treadmill (Watt per each Kg) so if body weight for player (80 kg), we begin with load (80 watts) for (2 minutes) and doubles load every two minutes so that it becomes in

minute (3, 4) = 160 watts, and (5 ,6) = 240 watts) and gradually increase the load until it reaches the individual maximum possible performance load(Elgohari, Y., 2003: pp77-79).

2 - Physical Competency Test (Watt)

It is done on ergometer bike; wrestler pedal on it for 6 minutes with heart rate so limited heart rate between 120: 140 pulse/sec, then wrestler take 10 minutes rest and then re-test on the bike for another 6 minutes so heart rate is between 150-170 pulse/sec, heart rate and energy produced are recorded for each time competency for wrestlers calculated by applying the following equation: (Kostov, Zlatin et al, 2003: pp190-196)

$$PWC_{170} = \left[\frac{(P_1 \times HR_2) - (P_2 \times HR_1)}{(HR_2 - HR_1)}\right] + \left[170 \times \left[\frac{(P_1 - P_2)}{(HR_1 - HR_2)}\right]\right]$$

P_1 Energy produced in the first time

P_2 Energy produced in the second time

HR_1 Heart rate in the first time

HR_2 Heart rate in the second time

3- Tools and equipment used

- Restameter attached medical scale to measure height and weight
- Quark Cpet device produced by COSMED company to measure the circulatory and respiratory systems variables with computer attached
-Ergometer bike
- Stopwatch

Main study

- Sample homogeneity measurements carried out in physical competency Laboratory, Faculty of Physical Education, Benha University.
- Main study was conducted in the period from 12/10/2012 to 15/01/2013 in physiological measurements Laboratory, Faculty of Physical Education for Men,Zagazig University on two groups each 9 Wrestlers, measurements done in accordance with the Novak method (Watt/kg).

Statistical Work

Researcher used SPSS program in all statistical work, 0.05 significance level was adopted in this research

Results and discussion

I –Results(appendix 1)

- First query results

Table (2)Description of the research sample for load intensity and physiological responses after simple and medium loads**.**

Table (3) Description of the research sample for load

intensity and physiological responses after lower than maximum and maximum loads

Second query results

Table (4)Analysis of variance between physical loads in load intensity and physiological responses

Table (5)LSD between physical loads in load intensity and physiological responses

- Third query results

Table (6)the correlation matrix between physical efficiency and physiological responses after performing varying intensity training loads.

II - Discussion

- First query discussion

Table 2 results show that load intensity was 69.39 wattfor simple load, 144.11 watt for medium load, 216.17 watt for lower than maximum load, and 288.22 watt for maximum load according to body weight on treadmill.

Aboul-Eela Abdel Fattah (1997, p54) argued that low-intensity load is between 15-25% while medium load ranges between 40-60%,lower than maximum load between 60-75%, while maximum load may up to 100%.

It is clear that all variables have varied responses to load intensity change e.g. circulatory system variables were affected significantly as heart rate average was between 108.83: 185.5 pulse/minute while stroke volume average ranged between 104.75: 126.90 ml/pulse, heart push average ranged between 11.44-23.56 L/min, and oxygen pulse average ranged between 8.78-13.33 ml/ pulse, as well as in the rest of the respiratory variables

- Second query discussion

It is clear from Tables (3, 4) presence of statistically significant differences – at 0.05 significance level - between different training intensity (simple, medium, lower than maximum, maximum) in favor of maximum load in physiological responses where F calculated value ranged between 10.74-405.44 05 except for stroke volumewhere differences were in favor of medium load and ventilation coefficient where the differences were in favor of simple load.

Researcher interpret these results with that may be happened due to player continuation to maximum load reduces heart's ability to

continue with same efficiency resulting in fatigue which leads to a lack of blood in each pulse as gradual increase in training loads increase working muscles need to oxygen to produce the energy needed to muscular work, response may be lowered as a result to load increase at beginning of fatigue.Increase in Total volume of oxygen consumed and Pulmonary Ventilation duer to lowing load point to lack of endurance and fast access to fatigue, which caused low ventilation coefficient.

This is consistent with what mentioned by Ahmed Khater and ALyElbik(1996, p24) and Mohamed NasrAlddinRadwan (1998,p260) and BahaaSalama(2000, pp86-87) that increasing physical load intensity increase heart rate until it reaches its maximum with maximum load performance.

Bompa (1999, p188) argued that any physical activity leads to physiological changes, vitality and psychological changes based on repetition (volume) or load intensity or frequency of performance (density) and the greater the main factors responsible for training (volume, intensity, density) the more increase in the resulting physiological changes.

This is indicated by the results, where respiratory frequency increased (24.10, 27.92, 30.36, 33.97) times/minute, respectively, for loads of training under discussion.AbulElela Abdel Fattah and Ahmed Nasreddin (2003, p238) indicate that respiration frequency increases from 14 to more than the 30.

As well increaseof Pulmonary Ventilation which ranged between 1248.4- 2182.6 ml, Pulmonary Ventilation also increased to become between 30.08-74 L/min.

While Total volume of oxygen consumed increased from 960.9 ml /minuteat simple load to 2474.3 ml/min at maximum load indicates.BahauddinSalameh (2002, p183) indicates that Total volume of oxygen consumed after performance of maximum load could be arrive to 4400 ml/min.

Total volume of carbon-dioxide produced increased and ranged between 1262.8-3386.1 ml/min as well as VO2 expressed per kg which ranged

between 12.01 ml/kg/minfor simple load, 30.93 ml/kg/s for maximum load.

AbulElela Abdel Fattah and Ahmed Nasreddin (2003,238) indicate that VO2 expressed per kg increases with load increase where it starts from 10.5 ml/kg/min and go even up to 42 ml/kg/s after the performance of maximum load.

Respiratory ratedecreased with load increase and ranged between 1.37- 1.30 ml/min due to low Total volume of oxygen consumed in simple load and its increase in maximum load while oxygen pulse ranged between 8.78-13.33 ml/pulse due to the increased effort. Researcher explains this with circulatory system inability to save effort and thatthey have not the necessary endurance to complete the work.

Jürgen Weinck (1998, p91) indicates that physical load increase lead to oxygen pulse decrease till it reaches its maximum value with maximum load performance and greater amount of oxygen pulse indicates increased capacity of the circulatory system of save effort.

Breathing time ranged between 2.50-1.77 seconds, as load increasing lead to fast breathing process to supply body's internal organs and muscles with their need of oxygen, so breathing time decreases.

These results are in agreement with result of Mohi El Din Dessouki (2000),Ashraf Mossad Ibrahim and Mohammed Abbas (2004),NaimFawzi et al (2004), and StefanovStevanov et al (2004).

- Third query discussion

Table (6) shows that the correlation coefficient between Circulatory and respiratory systems was 0.476: 0.837, heart rate ranked first, followed by cardiac output for simple load, while in medium load it was between 0.491: 0.799 where Respiratory Frequency ranked first Followed by Pulmonary Ventilation but it was an inverse for breathing time

While the correlation coefficient in lower than maximum load was limited between 0.463: 0.826 where the most physiological variables correlated with the level of physical efficiency were Cardiac output Followed by Pulmonary Ventilation , but

it was an inverse for Breathing time, While in maximum load the correlation coefficient was limited between 0.464: 0.835 between, where Stroke volume, Cardiac output and Total volume of oxygen consumed were in the same rank followed by Ventilation coefficient.

Researcher explains these results with that at beginning of physical effort most of internal organs respond to training load to meet its requirements of energy and oxygen to complete the muscle work which increases the response of circulatory system variables in simple load and relative decline for some respiratory variables, with training load increase physiological responses varies between the two systems and respiratory variables response increase to the supply working organs and muscles its need of oxygen with at least the beginning of lower than maximum load and, at end both most circulatory and respiratory organs response increased at maximum load.

And the researchers explains the inverse correlation for breathing time for simple and lower than maximum that at the beginning of the effort breathing is being deeply and slowly and with increasing physical load and muscle need of oxygen Respiratory Frequency increases, which reduces the time the body takes to complete the processes of inhalation and exhalation.

Ghazi Youssef (1998, p243) indicates that increased physical loads produce changes in various body functions as a result of body adaption to those physical loads.

Conclusions

In light of study results and research sample the following could be concluded:

1- Maximum load is the most influential physical load on the physiological responses, followed by lower than maximum load.

2- It is possible to ration training and measure the progress of players by measuring physiological responses to training loads within the program.

3- With beginning of the physical exertion, the physiological responses increase in each of circulatory and respiratory systems variables, with continued effort in medium load circulatory variables contribution rates

decrease while respiratory variables contribution rates increase.

4- Physiological responses of respiratory variables clearly increase with lower than maximum load and at maximum load most circulatory and respiratory variables increase

Recommendations

1- Using physiological responses in measuring players' progress and ration codify various physical loads of wrestlers following individual differences principle in training.

2- Using physiological responses in wrestlers' selection process.

3- Keeping a special register for each wrestler to record periodic physiological measurements and refer to them when planning special training programs.

4- Further similar studies to be carried out on other samples in different conditions.

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