Acute Response Heartbeat of Single Artistic Athletes IPSI Sukoharjo during Championship Simulation

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ABSTRACT
Research on the sport of pencak silat regarding heartbeat is rarely studied, heartbeat is a precursor to the intensity of an athlete's training, a benchmark for the readiness of an athlete's performance. This study aims to understand the response of the heart when carrying out a match simulation performance in a single artistic category pencak silat athletes. The subject used was a single artistic athlete from IPSI Sukoharjo who advanced to the PORPROV Central Java Championship (Central Java Provincial Sports Week), a heart rate monitor was used to find out how his heartbeat responded during appearances. The results of this study, the first second to start the simulation moves, namely 142bpm (74% max. of heartbeat), then in the first 10 seconds it is 155bpm (77% max. of heartbeat), the first 20 seconds is 168bpm (84% max. of heartbeat), then increasing slowly and steadily 180-185bpm (90-92% max. of heartbeat) in the 01.50 to 03.00 minutes. This study concludes that the heart rate will always be in rhythm with the intensity of the movements carried out by the athlete, the more maximal the movements carried out, the higher the heart rate, up to the maximum limit of his ability.

Keywords: Heartbeat; Heart Rate; Artistic Category; Martial Art; Acute Response Body.

INTRODUCTION
The intensity of the exercise becomes a reference for a coach in determining the training program given, the intensity of this exercise can be seen from the heartbeat of an athlete. The frequency of heartbeat per minute will increase according to the intensity of the training given by the coach to the athlete (ACSM's, 2018; Kapteijn et al., 2022). Exercise intensity is divided into 5, very light, light, moderate, vigorous and maximum. These five intensities have a different effects on an athlete's body, from the intensity we also know whether the athlete has performed optimally or not (Hoeger et al., 2019; Javeed & Matveyenko, 2018).

Category single artistic athletes perform for 3 minutes, within 3 minutes an athlete...
must be able to make precise and steady moves, full of soul, powerful, fast, and beautiful to look at (Düking et al., 2020; PB IPSI, 2022). The energy system used in the artistic category is Anaerobic ATP-PC, around 60-70% anaerobic and 40-30% aerobic (Bompa & Buzzichelli, 2019; Costanzo, 2011). Many athletes find it difficult to be able to maintain their explosive muscle power until the last second, resulting in a reduction in points because the movement is weak (Billah & Irawan, 2022; Syamsudin et al., 2023).

The measurement of the heartbeat should be done automatically, with a heart rate monitor we can monitor the heartbeat continuously, both before the performance, during the performance, and after the performance (Sarief & Nuryadi, 2019; Schiweck et al., 2019). By knowing the heartbeat automatically, coaches can freely evaluate the cardiovascular abilities that occur in athletes. For example, before a performance, sometimes athletes experience stage fright, are nervous because of the rehearsal atmosphere, etc. That makes the heartbeat increase, although an increase in heart rate this increase can interfere with the athlete's performance during the show (Teixeira et al., 2021).

Previous research on the sport of pencak silat was the effect of sports massage on decreasing heartbeat post-exercise (Mubarak et al., 2020), then there was research on the correlation of VO2max ability on post-exercise heartbeat recovery (Sutisna & Imanudin, 2019), other research namely the correlation between circulo massage, crosbath, heartbeat on lactic acid in pencak silat athletes after competing (Rohmawati et al., 2019), another research is the effect of sports massage on reducing lactic acid when reaching maximum heartbeat (Kresnapati & Setiawan, 2021), another study is about the difference in the effect of active and passive recovery on post-exercise heartbeat reduction (Syaeefulloh Ivan & Purbodjati, 2022).

From previous studies, there have been many studies measuring heartbeat after training/after a match, but there has been no study measuring heart rate during practice/performance/competition, and even then measurements were made by palpation/touching by placing the index and middle fingers into the radial or carotid arteries. The athlete does the count himself, in this case, a miscalculation is prone to occur due to his exhausted physical condition after performing.

This research has never been done before, measuring the acute response of the heartbeat of a single artistic category pencak silat athletes to heartbeat using an automatic heartbeat detection machine. This study will analyze the differences in heartbeat cycles for each performance duration, from the first second and minute to the second and the last minute of the three-minute performance.
METHOD

This research is a type of quantitative descriptive research by collects data using tests and measurements. The method used is quantitative, the results of the research data are in the form of numbers and analysis using statistics (Hardani, 2020; Sahir, 2022).

The simulation is carried out by creating an atmosphere like a real championship, with lots of spectators and there are referee judges who evaluate. The IPSI single artistic is carried out the same as the championship, which is full for 3 minutes show

The dependent variable in this study is in the form of a heartbeat, a heartbeat which is obtained directly when the athlete is performing. The independent variable as well as the subject of the study were pencak silat athletes in the single artistic category, Sukoharjo district. The study uses a heartbeat measuring device that is worn around and attached to the chest to the back using a Heart Rate Monitor (GEOID-HS500-Chest Strap), connected to the researcher's smartphone so that the researcher can monitor and retrieve data directly on the athlete's heartbeat.

RESULTS AND DISCUSSION

This match simulation is carried out D-7 from the match day of PORPROV Central Java, pencak silat athletes routinely carry out full movement simulations when it is approaching the D-day of the match, this is usually called the pre-competition program. The goal is to simulate training exactly as when competing later. Following are the specifications of the athletes who were the subject of the research, the Sukoharjo district single artistic athlete who won the bronze medal at PORPROV Central Java:

<table>
<thead>
<tr>
<th>Variable</th>
<th>Information</th>
</tr>
</thead>
<tbody>
<tr>
<td>Height</td>
<td>1,50 metres</td>
</tr>
<tr>
<td>Weight</td>
<td>47 kg</td>
</tr>
<tr>
<td>IMT</td>
<td>20,89 kg/m2</td>
</tr>
<tr>
<td>Age</td>
<td>21 years</td>
</tr>
<tr>
<td>MFT Level</td>
<td>7,6</td>
</tr>
</tbody>
</table>

The following are the results of measuring the athlete's heartbeat when simulating the single kick movement in the championship.
From the graph above it can be seen that the heart rate increases as time goes on, at certain times the heart rate decreases for a moment but not significantly, this is because the interval/pause before doing a movement that brings out maximum strength and speed again.

The Jurus single artistic consists of 100 moves, divided into 14 moves, 7 barehanded moves, 3 machete moves, and 4 stick moves, performed for 03.00 minutes. The jury's assessment includes stability consisting of: 1. Movement; 2. Movement Rhythm; 3. Animating the Movement; and 4. Energy and Endurance (PB IPSI, 2022).

The subjects completed 7 moves with bare hands in 1 minute 20 seconds, machetes in 50 seconds, sticks in 40 seconds, and the total of all movements was 03.00 minutes. Starting from the beginning of the movement, the subject performs the movement with full power and speed, so that the heartbeat that is obtained after several movements also immediately increases rapidly. In this case, the task of the heart is to distribute blood to the muscle tissue that needs it.

The subject's maximum heartbeat is 199 bpm. 142 bpm is the heartbeat before performing, meaning that the heartbeat is around 71% of the subject's maximum heartbeat. Then in the first 10 seconds, it is 155 bpm, meaning that it is already 77% of the heart's maximum capacity. Then the next 20 seconds is 168bpm, meaning that it is already 84% of the maximum capacity of the heart. Then in the following seconds and minutes, the heart rate is always above 84%, the highest is at 02.30 minutes, which is 185bpm, meaning 92% of the heart's maximum capacity.
At rest, the cardiac output is 5 L per minute (bottom of figure); during heavy exercise the cardiac output increases to 25 L per minute (top of figure). At rest, for example, the brain receives 15% of 5 L per minute (= 750 ml/min), whereas during exercise it receives 3% to 4% of 25 L per minute (0.03 × 25 = 750 ml/min). Flow to the skeletal muscles increases more than twentyfold because the total cardiac output increases (from 5 L/min to 25 L/min) and because the percentage of the total received by the muscles increases from 15% to 80% (Costanzo, 2011).

While the vascular resistance in skeletal muscles decreases during exercise, the resistance to flow through the visceral organs and skin increases. This increased resistance occurs because of vasoconstriction stimulated by adrenergic sympathetic fibres, and it results in decreased rates of blood flow through these organs. During exercise, therefore, the blood flow to skeletal muscles increases because of three simultaneous changes: (1) increased total blood flow (cardiac output); (2) metabolic vasodilation in the exercising muscles; and (3) the diversion of blood away from the viscera and skin. Blood flow to the heart also increases during exercise, whereas blood flow to the brain does not appear to change significantly. During exercise, the cardiac output can increase fivefold—from about 5 L per minute to about 25 L per minute. This is primarily due to an increase in cardiac rate. The cardiac rate, however, can increase only up to a maximum value, which is determined mainly by a person’s age. In well-trained athletes, the stroke volume can also increase significantly, allowing these individuals to achieve cardiac outputs during strenuous exercise up to six or seven times greater than their resting values. This high
cardiac output results in increased oxygen delivery to the exercising muscles; this is the major reason for the much higher than average maximal oxygen uptake (VO2 max) of elite athletes (Syamsudin et al., 2021).

CONCLUSIONS AND SUGGESTIONS

The conclusion from this study is that the heartbeat of single artistic athletes will always be in rhythm with the intensity of the movements carried out by the athlete, the more maximal the movements carried out the higher the heartbeat, but when in the interval pause phase between series of moves the heartbeat also decreases, although only a moment and very small.

Coaches and athletes are expected to be able to use a heart rate monitor as a benchmark for measuring heartbeat because with this tool it will be easier for coaches to determine the intensity of training decisions.

This research is beginning to find out the acute response of heartbeat in single athletes, future research on other artistic categories such as solo creative, double, and team is needed, of course with a larger number of samples.

REFERENCES


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