Pulse rate during running 5 laps: comparative study before and after dehydration?

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Abstract

Background and Study Aim. Dehydration is a condition where there is a lack of fluid in the body, accompanied by disturbances in the body's metabolic processes. This study aims to prove the effect of dehydration on 5 lap running by comparing the pulse rate before and after dehydration.

Materials and Methods. This study used an experimental method. The population in this research is Tanjungpura University sports students. Purposive sampling technique so that a sample of 19 students was obtained. The sample consists of 4 women and 15 men. In the research, the implementation procedure will be to measure 2000 meter running performance before and after losing fluid, weighing body weight to precision ounces. Analysis was assisted using SPSS 26.

Results. The results of the analysis showed a significance value of 0.000 <0.05, which is a significant difference between the pulse rate before and after dehydration when running 5 laps. The pulse rate after dehydration tended to be higher, indicating an increased cardiac workload during physical activity.

Conclusions. This study concludes that dehydration has a direct influence on pulse rate when running 5 laps. The existence of this difference highlights the importance of maintaining an optimal hydration state in supporting a healthy cardiovascular response during physical activity, particularly in high-intensity exercise such as running. These findings can be used as a basis for the development of more effective hydration strategies in the context of aerobic physical activity.

Introduction

Engaging in physical activities like running necessitates optimal functioning of the cardiovascular system to distribute oxygen and nutrients throughout the body (Hidayatulloh & Gandasari, 2023). Pulse rate, reflecting the frequency of heart contractions per minute, stands out as...
one of the commonly measured indicators of cardiovascular performance (Schäfer & Vagedes, 2013). The equilibrium of body fluids, particularly water, is pivotal in preserving cardiovascular function during physical activity. Dehydration, characterized by the body losing more fluid than it takes in, has the potential to impact various bodily functions, including the pulse rate during running.

Dehydration occurs when the body lacks fluid due to an imbalance between fluid loss and intake. The consequences of dehydration extend to risks of obesity and reduced concentration (Sutarna, 2021). Maintaining proper hydration involves athletes consuming adequate fluids before, during, and after training sessions (Haetami et al., 2022). Previous research has demonstrated that dehydration can elevate pulse rates during exercise, indicative of potential adverse effects on physical performance and overall well-being.

Water content stands as an indispensable nutrient for the body, varying in muscle and adipose tissues with different water compositions (Nurfrida & Lestari, 2023). Dehydration, involving the loss of significant solutes and water, can disrupt the body's thermoregulation and cardiovascular functions (Sannolo & Carretero, 2019). Dehydration not only poses health risks but also increases the body's workload. Elevated body temperature, reduced reaction speed, and diminished concentration are observed when dehydration inhibits energy production (Ramdhan & Rismayanti, 2016). Recognizing fluid intake's crucial role is imperative, given its functions such as dissolving compounds, regulating body temperature, lubricating joints, facilitating transportation, and maintaining normal cell structures and bodily functions (Habibati et al., 2022).

Dehydration often goes unnoticed due to its lack of direct and pronounced impact on the body. It is characterized by an imbalance where the amount of incoming fluid is insufficient compared to the outgoing fluid (Leksana, 2015; Sari Maslicha & Anang S.B, 2017). Thus, early detection techniques for body dehydration are essential to prevent more severe health issues (Samodra, 2020). Despite the crucial importance of physical well-being for athletes, many still neglect it in their pursuit of optimal performance, considering the level of body fluid needs as unimportant. A reduction in body fluid can diminish endurance capacity during exercise (Fen Tih et al., 2017).

Water holds great significance for maintaining cellular homeostasis in humans (Maryanto, 2020). Managing dehydration involves implementing interventions that carefully monitor fluid intake and output (Muhammad et al., 2020). Ensuring adequate fluid administration from training periods to matches is crucial for maintaining hydration status (Haetami et al., 2022). Dehydration can impact the performance of cardiovascular organs and the regulation of body thermoregulation (Kusuma, 2020). Electrolytes play a role in maintaining fluid balance, and their deficiency can contribute to dehydration (Nahdlotul Halimi et al., 2019).

However, a fundamental question that still requires further explanation is the extent to which pulse rate changes during physical activity, particularly running, when individuals are dehydrated. Is there a significant difference in pulse rate before and after dehydration? The answer to this question has important implications for athletes, coaches and physically active individuals, and may provide further guidance for hydration strategies during exercise. In this case, there was no significant change between the isotonic drink and guava juice groups on pulse rate recovery and hydration levels (Nugroho, 2022). Hydration can be caused by several factors including hot work climate and nutritional status (Jayasekara et al., 2019).

People who experience fatigue or are still in a tired condition, one of which will be seen from the pulse rate above the normal pulse rate, the pulse rate measurement is calculated how many beats in 1 minute. A good VO2 max influences the heart performance process when running (Pramono et al., 2018). But this anaerobic glycolysis metabolic pathway produces a by-product called lactic acid (Nagara & Roepadjadi, 2020). At the time of recovery, electrolyte fluids can stabilize the body, especially the pulse rate, therefore body position affects the pulse recovery process, such as when supine has the highest percentage in reducing the pulse rate (Pramono et al., 2018).

In this context, this study aimed to investigate the changes in pulse rate during a 5-lap run before and after dehydration. By understanding how dehydration affects cardiovascular responses during
exercise, we can identify potential risks, improve hydration strategies, and promote awareness of the importance of maintaining hydration status to support optimal health and physical performance.

**Materials and Methods**

**Participants.**

This research was conducted at the Sultan Syarif Abdurahman pontianak stadium. The research population was students of the Tanjungpura University Sports Coaching Education study program in semester 5. The sampling technique used purposive sampling so that 19 students were obtained. The sample consists of 4 girls and 15 boys.

**Research Design.**

This research employs an experimental approach, utilizing a specific procedure. The methodology involves assessing the performance of running 2000 meters before and after fluid loss, with precise body weight measurements in ounces. The researchers aim to observe the impact of fluid loss through sweating during a 2000-meter run. This will be accomplished by weighing the participant before and after the run, calculating the approximate fluid loss percentage, and evaluating the running performance before and after fluid loss. The measurement of fluid loss involves utilizing tools and materials such as a stopwatch, a body weight scale with precision up to ounces, raincoat coats (to facilitate fluid loss if necessary), and a running track spanning 2000 meters. The data collection equipment includes stationery, a stopwatch, and the 5-round running track (2000 meters).

**Statistical analysis.**

The data collected is statistically analyzed to identify significant differences in performance parameters between the dehydrated and hydrated groups. Statistical analysis such as t-test or analysis of variance (ANOVA) may be used. In this study, analysis was assisted using SPSS 26.

**Results**

This study compares the results before and after dehydration. The treatment given is in the form of running 5 laps or 2000 meters, where these results are to see if before and after dehydration there is a difference in pulse rate. This research goes through the prerequisite stages of normality and hypothesis testing. Based on the results of the normality test, the significance value is $0.106 > 0.05$ so it can be concluded that the data is normally distributed. The results can be seen in table 1.

The results of the difference test provide information on the significance value of $0.000 < 0.05$, so it can be concluded that there is a significant difference in pulse rate between before and after dehydration using the 5 lap running treatment. These results explain that lack of fluid affects and causes an increase in pulse rate, so fluid intake must be considered and maintained. Results can be seen in table 2.

Based on descriptive results, the treatment of 19 samples with a pulse value before dehydration mean 69.53 is smaller than the pulse value after dehydration mean 167.53. These results provide strong information regarding the difference in pulse rate, where there is a difference in the mean value of 45.53. Results can be seen in table 3 and figure 1.

<table>
<thead>
<tr>
<th>Table 1. Uji normality in the One-Sample Kolmogorov-Smirnov Test</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Result</strong></td>
</tr>
<tr>
<td>N</td>
</tr>
<tr>
<td>Normal Parameters$^{a,b}$ Mean</td>
</tr>
<tr>
<td>Std. Deviation</td>
</tr>
<tr>
<td>Most Extreme Differences Absolute</td>
</tr>
<tr>
<td>Positive</td>
</tr>
<tr>
<td>Negative</td>
</tr>
<tr>
<td>Test Statistic</td>
</tr>
</tbody>
</table>
Asymp. Sig. (2-tailed) .106

Table 2. Independent Samples t Test Before and After Dehydration

<table>
<thead>
<tr>
<th>Result</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1 Before and After Dehydration</td>
<td>-98.000</td>
<td>45.407</td>
<td>-9.408</td>
<td>18</td>
<td>.000</td>
</tr>
</tbody>
</table>

Table 3. Descriptive Results Before and After Dehydration

<table>
<thead>
<tr>
<th>Result</th>
<th>Pulse Before Dehydration</th>
<th>Pulse After Dehydration</th>
</tr>
</thead>
<tbody>
<tr>
<td>N Valid Missing</td>
<td>19</td>
<td>19</td>
</tr>
<tr>
<td>Mean</td>
<td>69.53</td>
<td>167.53</td>
</tr>
<tr>
<td>Median</td>
<td>84.00</td>
<td>174.00</td>
</tr>
<tr>
<td>Mode</td>
<td>96</td>
<td>180</td>
</tr>
<tr>
<td>Std. Deviation</td>
<td>39.813</td>
<td>18.822</td>
</tr>
<tr>
<td>Minimum</td>
<td>11</td>
<td>102</td>
</tr>
<tr>
<td>Maximum</td>
<td>120</td>
<td>186</td>
</tr>
</tbody>
</table>

Discussion

This study seeks to demonstrate the impact of dehydration on running 5 laps by comparing pulse rates before and after the onset of dehydration. The findings indicate a significant difference in pulse rates before and after dehydration, with a mean difference of 45.53. Relevant research supports the notion that significant differences exist before and after dehydration, particularly in relation to fluid levels (Hidayatullloh & Gandasari, 2023). Hydration factors come into play during intense physical activities that surpass the body's capacity (Janiszewska & Przybyłowicz, 2020). Factors like hot weather during exercise contribute to increased sweat output, affecting overall health (de Korte et al., 2021). Temperatures exceeding 37°C can elevate cardiovascular stress, leading to increased dehydration as a physiological response to temperature elevation. The initial signs of heightened body temperature are often reflected in salivary fluid content, making the ideal exercise temperature range 20-23°C (Mintarto & Fattahilah, 2019). Measurable values such as body temperature, pulse rate, sweat output, and respiration can be assessed using tools or applications (Derisma & Saputra, 2020). Individuals, particularly those aiming for rapid weight loss, may experience substantial dehydration (Samodra, 2020). It is advisable to avoid extreme training or weight loss exceeding the 4% level, as it can adversely affect bodily performance.

In light of this, electrolyte fluids become essential during vigorous physical activity, especially in sports, to prevent dehydration (Senay, 2022). Consuming coconut water before exercise has been shown to enhance exercise endurance, particularly in adult men (Fen Tih et al., 2017). The study on the effects of honey pineapple juice on pulse rate and blood pressure after long-distance running is
noteworthy (Herlambang et al., 2022). While 400-meter running does not pose a dehydration risk and is beneficial for overall health when done with proper form (Admin & Mujahidin, 2020). Running, although beneficial for overall health, can potentially trigger a heart attack (Setiarini et al., 2021). There is a discernible difference in the impact between three-corner running training and side jump sprints on resting pulse rates (Budriarsa, 2013).

Fluid loss or dehydration doesn't solely result from activity or exercise (Suprabaningrum & Dieny, 2017). Environmental temperatures also play a role in dehydration, as even exposure to cold room temperatures can lead to mild dehydration (Mintarto & Fattahilah, 2019). Inadequate or limited air temperature in the environment causing sweating is another factor contributing to dehydration (Elon, 2019). Hence, the body is prone to rapid dehydration in hot temperatures.

The individual variability in fluid replacement needs during activities is notable. The body's demand for fluids during sweat-inducing activities tends to differ among individuals, necessitating fluids that enhance fitness, boost stamina, and facilitate rapid recovery (Narindra et al., 2020; Rubiono & Setiawan, 2020). Some individuals opt for drinks containing caffeine, while others choose those with sodium or calcium content. However, according to research by Rodriguez-Giustiniani et al., (2022), for a balanced replacement of body fluids, the necessary fluids should contain electrolytes that function within the body's system.

Conclusion

In this study, we conducted a comparison of pulse rates during a 5-lap run before and after dehydration. The results provide a deeper understanding of the cardiovascular response to a dehydrated state during physical activity. The main finding of this study showed that there was a significant difference in pulse rate between pre- and post-dehydration conditions. Dehydration, as a state of excessive body fluid loss, was found to have a direct impact on cardiovascular responses during running. The higher pulse rate after dehydration reflects the increased workload of the heart during aerobic physical activity. This conclusion underscores the importance of maintaining an optimal state of hydration when performing physical exercise, especially in the context of high-intensity activities such as running. Dehydration can increase the risk of cardiovascular stress and affect the performance of athletes or individuals engaged in regular physical activity. Thus, a practical recommendation from this study is the importance of monitoring and maintaining a good hydration state before, during and after physical activity. Coaches, athletes and healthcare professionals can use these findings as a basis for designing hydration programs that suit individual needs, which in turn can support optimal cardiovascular health and performance. It should be noted that this study has certain limitations, and further research may be needed to further explore the impact of dehydration on other cardiovascular variables and in the context of a wider population. Nonetheless, the findings of this study make an important contribution to our understanding of the relationship between hydration and cardiovascular responses during running.

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Conflict of Interest And Funding

There is no conflict of interest.

References


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