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Influence of Various Cooling Down Techniques on Athlete Recovery

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ABSTRACT:
Introduction: Athlete recovery plays a pivotal role in optimizing sports performance and minimizing the risk of injury.

Objectives: The study will compare the effectiveness of various cooling down methods in enhancing post-exercise recovery.

Methods: A randomized experimental study design was intended to examine the influence of different cooling techniques on athlete recovery. A total of sixty participants (age: 24.0 ± 0.9 years, height: 169.4 ± 5.2 cm and body mass: 60.9 ± 6.3 kg) were randomly assigned to cold-water immersion (CWI), active cooling down activity (ACD) or yogic practice (YP) groups. "DOMYOS High-Performance Treadmill T900D" has been used for 10 minutes of incremental running protocol starting from 5 km/h and 4% incline, up to 12 km/h and 8% incline. Physiological parameters including heart rate (HR), blood glucose (BG), and hemoglobin (Hb) levels were measured pre-exercise (~5 minutes before treadmill running), post-exercise (immediate after treadmill running) and post-recovery (~10 minutes after treadmill running).

Results: One-way ANOVA revealed no significant differences ($p > 0.05$) in pre-exercise HR (CWI: 79.0±4.2 bpm, ACD: 75.9±2.5 bpm, YP: 82.4±3.7 bpm), post-exercise HR (CWI: 181.5±6.0 bpm, ACD: 184.9±3.62 bpm, YP: 181.1±4.62 bpm) and post-recovery HR (CWI: 106.4±3.72 bpm, ACD: 102.9±10.0 bpm, YP: 105.8±10.8 bpm) among the groups. Similar finding has been observed in blood glucose (BG) and level of hemoglobin (Hb).

Conclusions: The study highlights the comparable effectiveness of CWI, ACD and YP in facilitating athlete recovery, suggesting that individuals can select a cooling technique based on personal preference without compromising recovery outcomes.

1. Introduction

The historical evolution of cooling down procedures after physical activity demonstrates an increasing awareness of human physiology and the critical role of post-exercise recovery. During the preceding centuries, ancient Greek athletes utilised hot baths and massages as methods for reducing the physical fatigue that resulted from strenuous physical activities. The importance of cooling down became more widely recognised as sports and exercise programmes were institutionalised in the nineteenth century. In competitive sports, improving recovery between training sessions allows athletes acclimatise to larger training volumes and improve performance (Bishop et al., 2008). In the 1960s and 70s, there was a notable change in fitness routines as aerobics and high-intensity interval training became popular. This led to the development of new techniques for cooling down, such as static stretching, dynamic stretching, and foam rolling. These methods were designed to decrease muscle tension, prevent injuries, and assist in recovery and the efficacy of recovery can be assessed by monitoring post-recovery heart rate (Andriana et al., 2020). There is an increasing scholarly focus on the application of cooling techniques as a means to promote

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recovery and minimise the risk of sports-related injuries. The term "cooling down" currently incorporates a variety of techniques, including static stretching, active recovery and cryotherapy.

2. Objectives

Primary focus of current research is to determine the most effective methods for obtaining particular physiological outcomes. The development of cooling methods over time is a reflection of our growing comprehension of human physiology and our continued recognition of the critical role that recovery plays in sports performance. While the exact techniques may vary depending on the era, the general ideas always hold true: a well-executed cool-down is crucial for encouraging rest, accelerating healing, and decreasing injuries. From this point of view the study attempts to evaluate appropriate cooling measures, such as cold-water immersion, active cooling-down activities, and yogic practices, for improving athlete recovery in the Indian environment.

3. Methods

A total of 60 residential BPED and MPED students (age: 24.0 ± 0.9 years, height: 169.4 ± 5.2 cm and body mass: 60.9 ± 6.3 kg) randomly selected from Panskura Banamali College (Autonomous), Purba Medinipur. All the volunteers were aware about the benefit, procedure of the study and filled written consent. The design of the study was approved by institutional ethical committee.

A randomized experimental block design was employed for the study. All volunteers were randomly assigned to one of three groups: (a) cold-water immersion (CWI), (b) active cooling down activity (ACD) and (c) yogic practice (YP). Respective recovery techniques were implemented immediately after the prescribed incremental treadmill running (see Table 1). Prior to the actual testing protocols, all volunteers underwent necessary practice trials to familiarize themselves with the procedures. The entire testing process, encompassing baseline data collection (Pre-Ex.) (approximately 5 minutes before treadmill running), immediate post-exercise measurements (Post-Ex.) (immediately after completing treadmill running), and post-recovery measurements (Post-Re.) (10 minutes after completing treadmill running), took place in the morning from 7:00 a.m. to 10:00 a.m. at the gymnasium, spanning four consecutive days.

Table 1: Prescribed incremental running protocol on DOMYOS High-Performance Connected Treadmill T900D

Duration (minutes)	Speed (km/h)	Incline (%)
0-2	5	4
2-4	6	5
4-6	8	6
6-8	10	7
8-10	12	8

Recommended methods of cooling down:

Cold-water immersion (CWI): The volunteer was asked to submerge their body (at chest level) in cold water (02-04°C or 35.6-39.2°F) immediately after treadmill activity for a maximum of two minutes to reduce muscle soreness, inflammation, and fatigue.

Active cooling down activity (ACD): The volunteer was asked to walk, followed by stretching exercises targeting the worked muscles. Each stretch should be held for 15-20 seconds, along with deep breathing. The volunteer was also advised to use a foam roller for gentle muscle massage to reduce muscle soreness, inflammation, and fatigue.

Yogic practice (YP): The volunteer was instructed to commence the cool down session with Child’s Pose (Balasana), engaging in gentle stretches targeting the hips and thighs, followed by Downward-Facing Dog (Adho Mukha Svanasana), Cat-Cow Pose (Marjaryasana/Bitilasana), Standing Forward Bend (Uttanasana), Reclining Bound Angle Pose (Supta Baddha Konasana) and in the final pose, the volunteer was guided to lie on their back with eyes closed, focusing on deliberate, deep breaths to achieve a comprehensive state of relaxation.

Demographic characteristics, along with some physiological parameters, were measured during pre-exercise, post-exercise, and post-recovery of treadmill running.

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Table 2: Measuring physiological parameters to explore the effect of recovery

Variables	Test equipment
Heart rate (HR)	Heart rate monitor (Polar H10)
Blood glucose (BG)	Glucometer (Accu-Chek)
Hemoglobin (Hb)	Hemoglobin meter (Mission Hb)

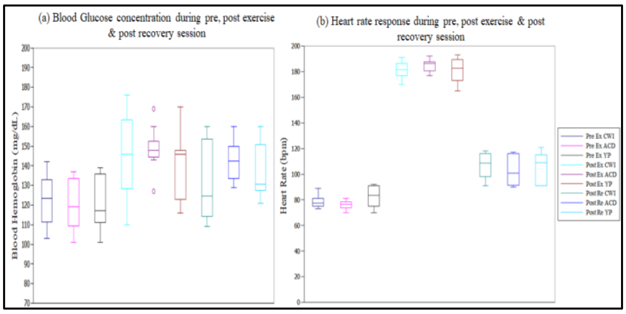
Descriptive and inferential statistics has been used to analysis the data. Majority of the data set found to be normal so a one way ANOVA has been employed. A significance level of $p < 0.05$ was established to ascertain the statistical significance of the findings. The Gnumeric spreadsheet (Ver: 1.12.48), a publicly available statistical software programme, was utilised to do statistical analysis and create graphical representations. This ensured a rigorous and dependable study of the data.

4. Results

Table 3: Summary of physiological parameters among the groups

Parameters	**CWI**	**ACD**	**YP**	**P value**
Pre-Ex. HR (bpm)	79.0±4.2	75.9±2.5	82.4± 3.7	0.16
Post-Ex. HR (bpm)	181.5±6.0	184.9±3.62	181.1±4.62	0.57
Post-Re. HR (bpm)	106.4±3.72	102.9±10.0	105.8±10.8	0.83
Pre-Ex. BG (mg/dl)	122.1±11.4	120.3±13.6	120.6±13.9	0.96
Post-Ex. BG (mg/dl)	145.0±10.6	148.8±7.5	140.1±3.45	0.65
Post-Re. BG (mg/dl)	131.9±14.5	142.5±9.6	137.4±11.6	0.44
Pre-Ex. Hb (g/dl)	13.5±0.6	13.6±0.5	13.6±0.3	0.95
Post-Ex. Hb (g/dl)	13.9±0.7	13.9±0.2	13.8±1.4	0.72
Post Re. Hb (g/dl)	13.5±0.4	13.6±0.3	13.6±0.4	0.83

Figure 1: Graphical representation of BG concentration and HR response during Pre-Ex, Post-Ex and Post Re. sessions among CWI, ACD and YP groups



Discussion

The investigation into the impact of different cooling down methods on post-exercise recovery is essential for optimizing exercise regimens and promoting overall well-being. In the present study, we explored the effects of CWI, ACD and YP on post-exercise heart rate and blood glucose levels. The results revealed no significant differences in post-exercise heart rate among the three cooling down groups, indicating that all methods were equally effective in facilitating heart rate recovery.

The lack of significant variations in post-exercise blood glucose levels among the cooling down groups further supports the notion that the body's metabolic processes efficiently regulate blood glucose levels after exercise (Mul et. al, 2015), regardless of the cooling down method employed. These findings are in line with previous research, emphasizing the robustness of the body's inherent mechanisms for post-exercise recovery, as reported by Van and Peake (2018). Importantly, the absence of significant differences in post-exercise heart rate and blood glucose levels suggests that individuals can choose a cooling down technique based on personal preferences and circumstances without compromising the physiological recovery process. This flexibility in

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choosing a method aligns with the individual-dependent effectiveness reported by Bongers et. al. (2017), where some volunteers experienced positive effects from cold water immersion, while others benefited from cool down exercises and yoga.

The observation that the pre-exercise heart rate serves as an indicator of baseline physical condition is crucial in understanding individual responses to exercise stress. In this study, the volunteers reached or approached their maximum heart rate during treadmill incremental exercise, indicating a high level of physical exertion. Surprisingly, no significant differences were observed in post-exercise heart rate across the different cooling down methods. This implies that, regardless of the specific technique employed, the volunteers were able to effectively recover their heart rate to a similar extent. The consistency of these findings with previous research (Takahashi et al, 2002) suggests that the body's natural physiological mechanisms for heart rate recovery function effectively, independent of the cooling down method. Consequently, individuals can tailor their choice of cooling down method based on personal preferences without compromising the recovery process. However, it is crucial to acknowledge some variability in individual responses, as noted by Bongers et. al. (2017). Some volunteers experienced positive effects from CWI, while others benefited from alternative methods. This highlights the individual-dependent effectiveness of cooling down techniques and emphasizes the importance of tailoring choices to individual interests and preferences. Despite the valuable insights gained from this study, it is important to recognize its limitations. The focus on the immediate post-exercise recovery period and the use of healthy individuals in the sample may limit the generalizability of the results to specific populations with certain health conditions or individuals engaging in high-intensity or prolonged exercise. Future research should explore the long-term effects of different cooling down methods and consider diverse populations to enhance our understanding of post-exercise recovery mechanisms. Overall, the present study contributes to the growing body of knowledge on exercise physiology and recovery strategies, providing valuable information for individuals and practitioners in optimizing post-exercise recovery.

The study revealed no significant variations in post-exercise heart rate or blood glucose levels among the three groups, indicating the effectiveness of the body's natural physiological mechanisms in restoring these parameters to baseline values after exercise. This robustness in post-exercise recovery underscores the adaptability of the body's intrinsic systems. However, further exploration is warranted to understand the long-term effects of diverse cooling strategies on overall recovery and performance outcomes. It is essential to acknowledge the individual variability in responses, as noted in the preferences of volunteers for different cooling methods. While the results suggest that individuals can choose a cooling down method based on personal preferences without compromising recovery, caution should be exercised in generalizing findings to specific populations or high-intensity exercise scenarios. Overall, this study contributes valuable insights to the understanding of post-exercise recovery mechanisms and emphasizes the need for personalized approaches in optimizing cooling strategies.

References

1. Andriana, L. M., Ratna Sundari, L. P., Muliarta, I. M., Ashadi, K., & Nurdianto, A. R. (2022). Active recovery is better than passive recovery to optimizing post-exercise body recovery. Jurnal SPORTIF : Jurnal Penelitian Pembelajaran, 8(1), 59-80. https://doi.org/10.29407/js_unpgri.v8i1.17685
2. Bishop P. A., Jones E., Woods A. K. (2008). Recovery from training: a brief review. J. Strength Cond. Res. 22 1015–1024. https://doi.org/10.1519/JSC.0b013e31816eb518
3. Bongers CC, Hopman MT, Eijsvogels TM. Cooling interventions for athletes: An overview of effectiveness, physiological mechanisms, and practical considerations. Temperature (Austin). 2017 Jan 3;4(1):60-78. doi: 10.1080/23328940.2016.1277003. PMID: 28349095; PMCID: PMC5356217.
4. Mul JD, Stanford KI, Hirshman MF, Goodyear LJ. Exercise and Regulation of Carbohydrate Metabolism. Prog Mol Biol Transl Sci. 2015;135:17-37. doi: 10.1016/bs.pmbts.2015.07.020. Epub 2015 Aug 20. PMID: 26477909; PMCID: PMC4727532.
5. Takahashi T, Okada A, Hayano J, Tamura T. Influence of cool-down exercise on autonomic control of heart rate during recovery from dynamic exercise. Front Med Biol Eng. 2002;11(4):249-59.

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doi: 10.1163/156855701321138914. PMID: 12735426.

6. Van Hooren B, Peake JM. Do We Need a Cool-Down After Exercise? A Narrative Review of the Psychophysiological Effects and the Effects on Performance, Injuries and the Long-Term Adaptive Response. Sports Med. 2018 Jul;48(7):1575-1595. doi: 10.1007/s40279-018-0916-2. PMID: 29663142; PMCID: PMC5999142.
7. Zheng X, Qi Y, Bi L, Shi W, Zhang Y, Zhao D, Hu S, Li M, Li Q. Effects of Exercise on Blood Glucose and Glycemic Variability in Type 2 Diabetic Patients with Dawn Phenomenon. Biomed Res Int. 2020 Feb 21;2020:6408724. doi: 10.1155/2020/6408724. PMID: 32149118; PMCID: PMC7057022.