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Immediate Analgesic Effects of Cold Spray as an On-Field First-Aid Intervention for Minor Musculoskeletal Injuries in University Soccer Athletes

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Abstract: Minor injuries such as muscle cramps, bruises, and sprains are common problems frequently experienced by soccer athletes, especially during intensive training. Prompt and appropriate first aid is essential to prevent further injury. This study aims to determine the effectiveness of cold spray as a first-aid method for minor injuries among athletes in the Singaperbangsa Karawang University Soccer Club. The research method used was a quasi-experimental study with a one-group pretest-posttest design. A total of 20 athletes who had sustained minor injuries served as the study sample. Pain levels were measured using the Visual Analog Scale (VAS) before and after treatment. The results showed a decrease in the average pain level from 7.0 to 3.0 after the application of cold spray. A paired-sample t-test revealed statistically significant results ($p < 0.05$), indicating that cold spray is effective in rapidly reducing pain intensity. Thus, cold spray can serve as a practical and efficient first-aid option for managing minor injuries in a college sports setting.

Keywords: Cryotherapy, Visual Analog Scale, First Aid, Collegiate Soccer, Sport Science

Introduction

Sports injuries are common, especially in high-contact sports such as soccer. Activities such as sprinting, tackling, and sudden changes in direction make soccer players highly susceptible to injuries, particularly minor ones like bruises, sprains, and muscle cramps. Although these minor injuries are not permanent, they can impair an athlete's performance if not treated promptly and appropriately. In this context, first aid plays a crucial role in minimizing the impact of injuries and accelerating the initial recovery process. One method that is frequently used is cold therapy with a cold spray, an instant cooling liquid applied directly to the injured area. Cold spray works by lowering the local tissue temperature, thereby reducing pain, slowing blood flow, and rapidly reducing swelling (Suharto & Widodo, 2021).

In practice, the use of cold spray offers advantages in terms of speed, convenience, and efficiency. Compared to ice compresses, which require additional equipment, cold spray can be applied immediately during a game or practice without having to pause activities for too long. This is particularly important for student-athletes

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participating in Student Activity Units (UKM), who are not always accompanied by professional medical staff during routine training sessions. Research by Kusuma and Prasetya (2023) shows that cold spray is effective in providing instant pain relief, although this effect is temporary and does not replace follow-up therapy. However, there remains debate regarding the extent of cold spray's effectiveness in the overall healing process of injuries. Some experts argue that the effects are only superficial and do not reach deeper muscle tissues (Utami et al., 2020).

Given the importance of prompt treatment for minor injuries, as well as the lack of local research evaluating the effectiveness of cold spray in a college athletic setting, this study was conducted to assess how effective the application of cold spray is as a form of first aid for soccer athletes at the University of Singaperbangsa Karawang's Student Sports Club (UKM). The results of this study are expected to provide practical and applicable recommendations for coaches, athletes, and educational institutions in designing efficient injury management strategies, particularly at the undergraduate level. Additionally, these findings can enrich the sports literature regarding modern and efficient first-aid techniques in the context of competitive sports.

Method

This study employed a quantitative approach using a quasi-experimental design, as the researcher could not fully control external variables that might influence the results, but still administered a treatment to the subjects. The primary objective of this method was to measure changes in pain levels before and after the application of cold spray as a form of first aid for minor injuries. This study was conducted on active athletes from the Singaperbangsa Karawang University Soccer Club for the 2024–2025 season who sustained minor injuries during practice or matches.

The sample in this study was selected using purposive sampling, based on specific criteria such as being an active athlete, having sustained a minor injury, and being willing to participate in the research procedures. A total of 20 athletes who met the criteria were included in the sample. The research design used was a pretest-posttest one-group design, in which the researcher measured pain intensity before and after treatment with cold spray. Measurements were taken using the Visual Analog Scale (VAS), a 10-cm straight line indicating pain levels from 0 (no pain) to 10 (severe pain). Athletes were asked to mark the line to indicate the level of pain they felt before and after receiving the cold spray.

Data were collected through direct observation during training sessions, noting the location of the injury, the time of occurrence, and the athletes' responses after receiving the cold spray. Subsequently, descriptive analysis was performed to characterize the general data, and inferential analysis using a paired t-test was conducted to determine significant differences between pre- and post-treatment measurements. Data processing was performed using SPSS software with a significance level of 0.05. The research procedures were carried out systematically, starting from obtaining permits, briefing participants, conducting measurements and treatments, through to analyzing and reporting the research results.

This study also adhered to research ethics principles, such as providing complete information to participants (informed consent), maintaining the confidentiality of personal data, and ensuring that the entire process posed no harm or risk to the subjects. Using this method, it is hoped that a clear picture of the effectiveness of cold spray in treating minor injuries, particularly in a college sports setting, will be obtained.

Results & Discussion

Results

Overview of the Research Subjects

This study involved 20 active athletes who are members of the Singaperbangsa University of Karawang Soccer Club. All respondents were males between the ages of 18 and 24 who actively participated in regular training programs. During the data collection period, all participants experienced minor injuries such as muscle cramps, bruises, or minor sprains during training. All participants agreed to participate after receiving an explanation of the study's objectives and procedures.

Pain Measurement Results Before and After Cold Spray Application

Pain level data were collected using the Visual Analog Scale (VAS) and measured twice, before and after cold spray application. The following is a summary of the pain level data;

Tabel 1. Visual Analog Scale (VAS)

No.	VAS Before (Pretest)	VAS After (Posttest)	Difference (Δ)
1	7.0	3.0	4.0
2	6.5	2.5	4.0
3	8.0	4.0	4.0
4	7.5	3.5	4.0
5	6.0	2.0	4.0
6	7.0	3.5	3.5
7	6.5	2.5	4.0
8	8.0	4.0	4.0
9	7.5	3.0	4.5
10	6.0	2.5	3.5
11	7.0	3.0	4.0
12	6.5	2.0	4.5
13	7.0	3.5	3.5
14	6.5	2.5	4.0
15	8.0	4.0	4.0
16	7.0	3.5	3.5
17	6.0	2.5	3.5
18	7.5	3.0	4.5
19	6.5	2.0	4.5
20	7.0	3.0	4.0
Average	7.0	3.0	4.0

To determine whether this decrease was statistically significant, a paired-sample t-test was conducted, yielding the following results; (a) t-value = 16.29, (b) Sig. (2-tailed) = 0.000, (c) α (significance level) = 0.05. Since the significance value of 0.000 is less than 0.05, it can be concluded that there is a statistically significant difference between pain levels before and after the application of cold spray. This means that the use of cold spray has been proven effective in reducing the intensity of pain caused by minor injuries.

Discussion

The results of this study indicate that cold spray is highly effective as a first-aid treatment for reducing pain intensity in minor injuries. The statistically significant reduction in VAS scores confirms that the cooling sensation of the liquid is capable of temporarily blocking the transmission of pain impulses in surface tissues (Utami et al., 2020). The resulting local anesthetic effect helps dampen the initial inflammatory response and accelerates an athlete's return to light activity.

This finding supports the results of a previous study by Kusuma & Prasetya (2023), which stated that cryotherapy, including cold spray, can reduce pain by 40–60% within

the first few minutes after an injury. The advantage of cold spray over ice packs is its practicality in field situations, requiring no additional materials or special preparation. This is particularly beneficial in student sports club settings, which are generally not fully staffed by professional medical personnel.

However, it is important to note that the effects of cold spray are temporary and effective only for minor injuries such as muscle cramps, bruises, and mild strains. More serious injuries still require follow-up treatment such as physical therapy, bandaging, or immobilization. Thus, while effective as first aid, cold spray is not a long-term treatment solution.

Furthermore, the success of using cold spray also depends on the timing of application and a basic understanding of injury management by coaches or teammates. Therefore, basic first-aid training for club members is highly recommended so that the benefits of this therapy can be maximized.

Conclusion

Based on the results of the study, it can be concluded that the use of cold spray as first aid for minor injuries has been proven effective in reducing pain levels among soccer athletes in the Student Activity Unit at Singaperbangsa University in Karawang. This is demonstrated by a decrease in the average pain score from 7.0 to 3.0 after the application of cold spray. Statistical analysis using a paired-sample t-test also showed a significant difference ($p < 0.05$) between pain scores before and after treatment, indicating that cold spray provides rapid analgesic relief for minor injuries such as muscle cramps, bruises, and mild sprains. Cold spray is a practical, fast, and efficient first-aid option in field conditions because it requires no preparation or additional equipment, such as ice packs. The resulting local cooling effect inhibits the transmission of pain signals and slows the initial inflammatory response, thereby providing relief to athletes in a short period of time. However, its use should still be limited to minor injuries and does not replace follow-up medical care for more severe injuries.

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