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Article

Differences in The Effectiveness of Electroacupuncture and Fire Cupping on Knee Pain Among of The Seliwerun Running Club, Bandung City

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ABSTRACT

Knee pain was frequently experienced by runners due to repetitive activities. Electroacupuncture (EA) and fire cupping (FC) were non-pharmacological methods commonly used for knee pain management; however, comparative evidence regarding their effectiveness remained limited. This study aimed to analyze the differences in effectiveness between EA and FC in reducing knee pain among runners of the Seliwerun Running Club, Bandung City. A quasi-experimental study with a pretest–posttest design was conducted. A total of 30 runners were divided into EA and FC groups (n = 15 each). The interventions were administered six times over three weeks. Knee pain was measured using the WOMAC questionnaire. Data were analyzed using the Paired Sample t-test and Independent Sample t-test. The Paired Sample t-test showed that both groups experienced a significant reduction in WOMAC scores ($p < 0.001$) (EA: mean 34.33 ± 2.55, $t = 52.061$; FC: mean 29.40 ± 2.23, $t = 51.068$). The mean reduction in WOMAC score in the EA group (34.33) was greater than that in the FC group (29.40). The Independent Sample t-test indicated a significant difference between the two groups ($p < 0.001$, $t = –9.185$, mean difference = –4.600), with a reduction difference of 4.93. Electroacupuncture was more effective than fire cupping in reducing knee pain among runners.

I. INTRODUCTION

Knee pain was one of the most common musculoskeletal complaints among physically active individuals, including runners [(1)]. The rising popularity of running in Indonesia was demonstrated by the organization of 190 running events across multiple cities from January to November 2025 [(2)]. Repetitive muscle activity during running training and competitive events increased the risk of musculoskeletal pain and injury, particularly affecting the knee joint [(1)]. Knee injuries subsequently resulted in functional limitations, especially in movements involving knee flexion [(3)].

It was estimated that approximately 654.1 million individuals worldwide experienced knee pain in 2020 [4]. In Indonesia, the prevalence of knee pain due to sports-related injuries was 48 per 1,000 individuals, with 9% attributed to Anterior Cruciate Ligament (ACL) injuries [5]. A study conducted among participants of the Kediri Marathon reported that, out of 51 individuals who sustained musculoskeletal injuries, 80.4% were male and 19.6% were female [6]. The prevalence of knee pain in West Java was reported at 8.86%, while in Bandung City it was recorded at 9.35% [7].

Untreated or inadequately managed knee pain led to difficulties in performing daily activities [8]. Management of knee pain was generally conducted through pharmacological and non-pharmacological approaches. Non-pharmacological interventions commonly used in cases of knee pain included acupuncture and fire cupping therapy [9,10].

Various acupuncture methods were available, including electroacupuncture (EA), which involved the stimulation of acupuncture points using an electrostimulator device [11]. Acupuncture combined with electrostimulation was shown to have a significant effect on reducing knee pain [12]. Other studies also reported that electroacupuncture was effective in reducing knee pain intensity [13].

Another therapeutic modality for knee pain was fire cupping therapy (FC). The use of cups applied through a fire-induced method created negative pressure in the knee area, with the aim of improving local circulation and alleviating pain [9]. In cases of knee pain, fire cupping demonstrated a therapeutic effect with a moderate level of effectiveness [14]. Dry cupping therapy was also shown to reduce Numeric Rating Scale (NRS) scores in knee pain [15].

Both electroacupuncture (EA) and fire cupping therapy (FC) were shown to significantly reduce knee pain intensity; however, no studies had directly compared the effectiveness of these two therapies. The Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), as a validated instrument for assessing knee pain, was used as a comparative outcome measure [16]. The objective of this study was to determine whether there was a difference in the effectiveness of electroacupuncture and fire cupping therapy in reducing knee pain among members of the Seliwerun Running Club in Bandung City.

II. METHODS

The study location was Café Orient, which served as the Secretariat of the Seliwerun Running Club, located on Kayu Agung Street, Bandung City. The study period was from March to November 2025. The research design employed in this study was a quasi-experimental two-group design to address the research objectives. The study sample consisted of 30 subjects selected based on inclusion criteria, including membership in the Seliwerun Running Club, the presence of moderate knee pain, and the absence of concurrent medical treatment. The group allocation divided the subjects into two groups, with Group 1 receiving electroacupuncture (EA) intervention and Group 2 receiving fire cupping therapy (FC).

The intervention frequency consisted of six treatment sessions administered over a three-week period, with a frequency of two sessions per week. The intervention sites for both EA and FC included ST34 (Liangqiu), ST36 (Zusanli), SP10 (Xuehai), SP9 (Yinlingquan), and EX-LE2 (Heding). The electroacupuncture procedure utilized a KWD-808 device with a frequency of 2–4 Hz, a dense–disperse waveform, and an intensity adjusted to participant tolerance for a duration of 20 minutes. The fire cupping procedure involved two applications at each point, with each application lasting 2 minutes, using fire cupping cups number 1 and 2.

The pain measurement instrument employed in this study was the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) questionnaire, which has been widely used to assess knee pain and knee joint function. The measurement timing was conducted before and after the intervention in each group.

The data analysis procedure began with normality and homogeneity testing. The normality assessment used the Shapiro–Wilk Test (n<50) with an assumed significance value of p>0.050. The normality test results showed significance values of 0.881 for EA pretest, 0.126 for EA posttest, 0.953 for FC pretest, and 0.333 for FC posttest, indicating that all data were normally distributed. The homogeneity assessment applied Levene's Test with an assumed significance value of p > 0.05. The homogeneity test results for pretest data showed a two-tailed significance value of 0.716 (> 0.05), indicating homogeneous data. The posttest data results showed a two-tailed significance value of <0.010 (< 0.050), indicating non-homogeneous data. The between-group statistical analysis therefore employed the Independent Sample t-Test using the "equal variances not assumed" option. The within-group comparison of pain scores before and after the intervention was analyzed using the Paired Sample t-Test. The between-group comparison of pain reduction was analyzed using the Independent Sample t-Test, with a significance level set at p < 0.050.

III. RESULT

This study was conducted from March to November 2025 at the Seliwerun Running Club, Bandung City. A total of 30 subjects with knee pain who met the inclusion criteria were recruited and divided equally into two intervention groups: the electroacupuncture (EA) group (n= 15) and the fire cupping (FC) group (n= 15). Each group received six treatment sessions, administered twice weekly for three weeks. Data were analyzed using univariate and bivariate approaches.

Table 1. Characteristics of Respondents

Characteristics	n	%
Age (years)		
< 20	2	6.7
20–29	11	36.7
30–39	14	46.7
≥ 40	3	10.0
Gender		
Female	8	26.7
Male	22	73.3
Occupation		
Private employee	26	86.7
State-owned enterprise	1	3.3
University student	2	6.7
Student	1	3.3
Syndrome		
Cold-Damp	15	50.0
Heat-Damp	8	26.7
Blood Stasis	4	13.3
Yin Deficiency	3	10.0

Table 1 shows that the largest proportion of respondents were aged 30 to 39 years (46.7%), male (73.3%), and employed in the private sector (86.7%). Based on syndrome differentiation, Cold-Damp syndrome was the most common pattern (50.0%).

Table 2. WOMAC Scores Before and After Intervention

Variable	EA Group (n = 15)	FC Group (n = 15)
Pre-test	43.80 ± 2.55	43.47 ± 2.23
Post-test	9.47 ± 1.41	14.07 ± 1.58

Table 2 demonstrates that both groups experienced substantial reductions in WOMAC scores after treatment. However, the EA group showed a greater mean reduction (34.33 points) compared with the FC group (29.40 points).

Table 3. Normality Test

Variable	n	p
EA Pre-test	15	>0.050
EA Post-test	15	>0.050
FC Pre-test	15	>0.050
FC Post-test	15	>0.050

The Shapiro–Wilk test indicated that all datasets were normally distributed (p > 0.050). Therefore, parametric tests were used for further analysis.

Table 4. Paired Sample t-Test Within Groups

Group	MD	t	p
EA	34.33	52.06	<0.001
FC	29.40	51.06	<0.001

Table 4 shows significant differences between pre-test and post-test WOMAC scores in both groups (p<0.001). These findings indicate that both electroacupuncture and fire cupping therapy were effective in reducing knee pain.

Table 5. Independent T-Test

Comparison	MD	t	p
EA vs FC	4.93	5.63	<0.001

The independent sample t-test demonstrated a statistically significant difference in effectiveness between the two interventions (t = 5.63; MD= 4.93; p < 0.001). The electroacupuncture group showed a greater reduction in WOMAC scores compared with the fire cupping group, indicating that electroacupuncture was more effective in reducing knee pain.

IV. DISCUSSION

The age characteristics of the study subjects showed that the majority were in the 30 to 39-year age group (46.7%). This age range is classified as a productive period with high levels of physical activity, particularly intensive running exercise [1]. Previous literature has reported that knee pain frequently occurs in individuals of productive age, especially runners, due to repetitive use of the knee joint (overuse) during training and competition. Excessive mechanical loading may lead to structural disorders of the joint and surrounding soft tissues [1,10].

Based on disease etiology theories in both conventional medicine and acupuncture, individuals aged 30 to 39 years still have relatively good tissue regeneration capacity, allowing optimal responses to non-pharmacological therapies such as electroacupuncture (EA) and fire cupping therapy (BA) [1,10]. These therapies exert their effects by improving local circulation, reducing inflammation, and promoting the flow of Qi and Xue in the knee area affected by stagnation [9,10].

Based on gender distribution, subjects experiencing knee pain were predominantly male (73.3%). This finding was consistent with previous studies reporting that lower extremity injuries among runners were more common in males (80.4%) than females (19.6%) [6]. The higher frequency of knee pain in males may be influenced by several factors, including inadequate warm-up before exercise, insufficient cool-down after running, and increased training volume leading to repetitive muscle use (overuse), which increases the risk of knee pain [1]. Both EA and BA therapies provide therapeutic benefits through activation of the peripheral nervous system, reduction of inflammation, and release of endorphins in the central nervous system, thereby reducing pain perception regardless of gender, although individual responses may vary [9,10,17].

Most study subjects were employed in the private sector. Running practice after work requires muscles that have already been used throughout the day to perform moderate to high-intensity activity. This condition aligns with theories on the causes of knee pain, which state that occupational activities involving prolonged standing or

repetitive movements can increase mechanical stress on the knee joint, leading to pain and stiffness [1].

The habit of training at night after work, combined with inadequate warm-up and cool-down routines, increases the risk of injury and contributes to knee joint stiffness and pain [1,10]. Electroacupuncture and fire cupping therapies helped alleviate knee stiffness through mechanisms involving increased local blood circulation and muscle tissue relaxation, thereby reducing stiffness and pain caused by muscle fatigue [1,9,10].

Most study subjects were diagnosed with Bi Zheng syndrome of the cold-dampness type, characterized by obstruction of the meridians by cold and damp pathogenic factors. The habit of training in the afternoon or evening after work, when the body is sweating, combined with insufficient cooling-down, may increase exposure to cold and elevate the risk of injury [1].

This condition is consistent with acupuncture theory, which describes cold-damp Bi syndrome as presenting with persistent pain, a sensation of heaviness in the knee, limited movement, numbness, and minimal pain on pressure [10,18]. Previous studies have shown that EA and FC stimulation help resolve stagnation, enhance the circulation of Qi and Xue in the local area, and reduce pain through segmental and general pain inhibition mechanisms [9,13,17].

The mean difference between pretest and posttest WOMAC scores in the EA group was (Mean= 34.33; SD= 2.55), while in the BA group it was (Mean=29.40; SD= 2.23). These findings indicated that the reduction in WOMAC scores was greater in the EA group compared to the BA group, with a mean difference of 4.93 points. Statistically, the reduction in WOMAC scores for knee pain among members of the Seliwerun Running Club was greater in the EA group.

These findings were consistent with previous studies reporting that acupuncture resulted in a greater reduction in pain scores compared to cupping therapy [15]. This difference may be attributed to the mechanisms of electroacupuncture, which act at local, segmental, and general levels [17]. In contrast, fire cupping therapy works primarily through negative pressure, which promotes the circulation of Qi and Xue in the knee area [9].

The mean reduction in WOMAC scores in the EA group was (Mean= 34.33; SD= 2.55) and $p < 0.001$, indicating that electroacupuncture was effective in reducing WOMAC scores in subjects with knee pain. These findings were consistent with previous studies reporting that EA works by stimulating acupuncture points around the painful area, such as ST34 Liangqiu, ST36 Zusanli, SP10 Xuehai, SP9 Yinlingquan, ST35 Dubi, EX-LE2 Heding, and EX-LE4 Neixiyan [19].

Stimulation of these points facilitates the flow of Qi and Xue, reduces stagnation, and improves blood circulation in the knee area. Additionally, EA inhibits pain at the segmental spinal level and stimulates the release of endorphins, which suppress pain at the general (central) level [13,17].

The BA group showed a mean reduction in WOMAC scores of (Mean= 29.40; SD= 2.23) and $p < 0.001$, indicating that fire cupping therapy was also effective in reducing knee pain. These results were consistent with studies reporting that cupping therapy reduces injury-related pain through negative pressure and local heat effects, which cause capillary vasodilation, increased microcirculation, and elimination of cold–damp pathogenic factors through

skin pores [14]. This mechanism aligns with previous findings indicating that cupping therapy functions to remove Qi and Xue stagnation and expel external pathogenic factors such as cold and dampness, which contribute to pain [9,20].

The Paired Sample T-Test results showed that the reduction in WOMAC scores in the EA group was 4.93 points greater than in the BA group. Clinically, this indicates that electroacupuncture was more effective than fire cupping therapy in reducing WOMAC scores among subjects with knee pain. This finding was consistent with previous studies reporting greater pain score reduction in the EA group (19.59) compared to the cupping group (13.41) [15]. The greater reduction observed in the EA group may be attributed to differences in therapeutic mechanisms, as fire cupping therapy acts primarily at the local knee area, whereas electroacupuncture exerts effects at local, segmental, and general levels [9,17].

Based on the Independent Sample T-Test, a significant difference in WOMAC scores was found between the EA and BA groups ($p < 0.001$; MD = –4.60), indicating that the reduction in the EA group was greater than in the BA group. Statistically, these results demonstrated that electro-acupuncture was more effective than fire cupping therapy in reducing knee pain among the study subjects.

These findings were consistent with previous studies showing that both local-point acupuncture and dry cupping therapy were effective in reducing knee pain ($p < 0.050$); however, the acupuncture group exhibited a greater reduction in pain scores compared to the cupping group [15].

The difference in effectiveness may be explained by the mechanisms of EA, which alleviate knee pain through reduction of local inflammation, segmental pain inhibition via the Gate Control mechanism, and release of β-endorphins in the hypothalamus, producing a general analgesic effect(17). In conclusion, electroacupuncture was more effective than fire cupping therapy in reducing WOMAC scores, with a mean difference in score reduction of 4.93 points. Both EA and BA may be considered effective non-pharmacological treatment options for the management of knee pain, particularly among runners.

V. CONCLUSION

Both electroacupuncture (EA) and fire cupping (BA) were effective in reducing WOMAC scores. Electroacupuncture was more effective than fire cupping, as indicated by a two-tailed $p< 0.001$, MD= 4.93. hese findings indicate a significant difference in effectiveness between the two interventions, supporting the study objective to compare electroacupuncture and fire cupping in reducing knee pain.

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