ORIGINAL RESEARCH ARTICLE

Effectiveness of electroacupuncture in improving sperm motility and morphology in men with varicocele

DOI: 10.29063/ajrh2026/v30i1.5

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Abstract

Infertility affects 15% of couples worldwide, with male factors contributing to over half of the cases. Varicocele, present in 35% of men with primary infertility, impairs sperm quality. This study evaluates the effect of electroacupuncture (EA) on improving sperm motility and morphology in varicocele patients. A single-blind, randomized controlled trial was conducted with 14 participants divided into an EA group (n=7) and a control group (n=7). The intervention group received EA in combination with a herbal regimen and *Tribulus Terrestris*, while the control group received only the herbal regimen and *Tribulus Terrestris* without EA. Men aged 20–35 with ultrasound-confirmed varicocele and abnormal spermiograms were included. Statistical analysis used the paired t-test, Wilcoxon, and Mann-Whitney tests. The EA group showed significant improvements in sperm morphology (P=0.029) and motility (P=0.026) compared to the control group. These findings suggest that EA significantly enhances sperm quality in varicocele patients and may serve as an effective complementary treatment for male infertility. *(Afr J Reprod Health 2026; 30 [1]: 37-43).*

Keywords: Effectiveness; electroacupuncture; male infertility; varicocele.

Résumé

L'infertilité touche 15 % des couples dans le monde, les facteurs masculins contribuant à plus de la moitié des cas. La varicocèle, présente chez 35 % des hommes souffrant d'infertilité primaire, altère la qualité du sperme. Cette étude évalue l'effet de l'électroacupuncture (EA) sur l'amélioration de la motilité et de la morphologie des spermatozoïdes chez les patients atteints de varicocèle. Un essai contrôlé randomisé en simple aveugle a été mené auprès de 14 participants répartis en deux groupes: un groupe EA (n=7) et un groupe témoin (n=7). Le groupe d'intervention a reçu une combinaison d'EA, d'un traitement à base de plantes et de *Tribulus Terrestris*, tandis que le groupe témoin a reçu uniquement le traitement à base de plantes et le *Tribulus Terrestris* sans EA. Des hommes âgés de 20 à 35 ans, présentant une varicocèle confirmée par échographie et des anomalies au spermogramme, ont été inclus. L'analyse statistique a utilisé les tests t apparié, de Wilcoxon et de Mann-Whitney. Le groupe EA a montré une amélioration significative de la morphologie (P=0.029) et de la motilité des spermatozoïdes (P=0.026) par rapport au groupe témoin. Ces résultats suggèrent que l'EA améliore significativement la qualité du sperme chez les patients atteints de varicocèle et pourrait constituer un traitement complémentaire efficace contre l'infertilité masculine. *(Afr J Reprod Health 2026; 30 [1]: 37-43).*

Mots-clés: Efficacité; électroacupuncture; infertilité masculine; varicocèle.

Introduction

Infertility is clinically a disease of the male or female reproductive system characterized by failure to achieve pregnancy after 12 months or more of sexual intercourse without contraception.[1] Men are solely responsible in about 20% of cases and are the causative factor in another 30% to 40% of all infertility cases.[2]

Varicocele is an abnormal enlargement of the veins in the pampiniform plexus. This condition affects approximately 15% of the entire adult male population and 35% of men with primary infertility. Among men with secondary infertility, varicose veins are found in 80% of patients.[3] Varicoceles are linked to male infertility through a variety of mutually exclusive mechanisms, including increased production of reactive oxygen species

(ROS), which can cause sperm deoxyribonucleic acid (DNA) damage.[4,5]

Structural evaluation of sperm is based on appearance, morphology, concentration, plasma membrane integrity, and chromatin integrity, while functional evaluation is based on motility, capacitation, and acrosome reaction. Determination of sperm concentration and assessment of motility and morphology is an essential method for determining fertility.[6,7] Of the several parameters examined, sperm morphology and motility are parameters that have an essential role in assessing male fertility. Male fertility depends on normal linear progressive motility and normal morphology.

Acupuncture is a key component in Traditional Chinese Medicine (TCM) fertility therapy.[8] TCM theory is based on Meridian acupuncture points and blood flow principles.[9] In Electroacupuncture (EA), a small electrical current is applied to a pair of acupuncture needles, and research has shown that the therapeutic efficacy of EA can be modulated by varying the frequency, intensity, and duration of electrical stimulation.[10,11] Electroacupuncture at traditional acupuncture points BL-23, ST-36, CV-1, and CV-4 has therapeutic effects on sperm motility and quality and can be used as a promising alternative treatment therapy for male infertility in clinical practice.[12] However, a further systematic review of the effects of EA on poor sperm quality is still needed.[13]

This research was conducted to determine improvements in sperm morphology and motility in male infertility with varicoceles carried out by EA.

Methods

Study design

The research method used an experimental single-blind randomized controlled trial and a pre-test post-test control group design to determine the effect of EA on improving male infertility on sperm morphology and motility. The research was conducted at the Sekar Fertility Clinic, Dr. Moewardi General Hospital, from August to November 2023.

Participants

Inclusion criteria: men with varicocele aged 20-35 years, ultrasound showing the presence of a varicocele, no contraindications for EA. Exclusion criteria: sperm analysis (azoospermia, severe oligozoospermia (concentration <5 million/mL)), ultrasound showing other abnormalities.

The sample size is calculated using the formula:

$n = (Z_{1-\alpha} + Z_{\beta})^2$

n = number of samples for each group

$Z_{1-\alpha}$ = standard normal distribution value at a certain selected α (α=0.05)

Z_{β} = The normal standard value depends on β (β=0.2)

Based on the data obtained it is used to calculate the number of samples in each group as follows:

$Z_{1-\alpha} = 1.645$; $Z_{\beta} = 0.842$;

So: $n = (Z_{1-\alpha} + Z_{\beta})^2$

$n = (1.645 + 0.842)^2$

n = 6.185169 rounded to 7 participants per group

A total of 14 infertile men with ultrasound-confirmed varicocele were enrolled and randomly assigned into two groups: the intervention group (n=7) received EA in combination with a herbal regimen and *Tribulus Terrestris*, and the control group (n=7) received the same herbal regimen and *Tribulus Terrestris* without EA.

The intervention group received EA in combination with a herbal regimen in the form of a single oral tablet containing *Polygoni Hydropiperis Herba* (30%), *Cyperi Rhizoma* (30%), *Croptophylli Folium* (40%), and *Rutosidum* (300 mg), administered once daily for 5 days. This was followed by oral administration of *Tribulus Terrestris* (275 mg) once daily for 40 days. The control group received the same herbal regimen and *Tribulus Terrestris* protocol but without EA.

Electroacupuncture procedure

EA was performed at selected acupoints known to support male fertility: CV 4 (Guanyuan): 3 cun below the navel, CV 6 (Qinghai): midline, 1.5 cun caudal from the navel, ST 36 (Suzanli) bilateral: above the lateral side of the anterior ligament 1 middle finger width from bilateral anterior tibial crest, SP 6 (Sanyinjiao) bilateral: 3 cun proximal to the medial malleolus, ST 29 (Guilai) bilateral: 1 cun cranial to the pubic bone, and 2 cun lateral to the midline, KI 3 (Taixi) bilateral: mid-distance between the malleolus internus and Achilles tendon, at the level of the peak of the internal malleolus, LI 4 (Hegu): 3 bilateral highest points of

the dorsal interosseous muscle, and GV 20 (Baihui): vertex of the head. See Figure 1 for acupoint locations.

Procedure: 1) The subjects were placed in the supine position, and the skin was cleaned using an aseptic technique; 2) Stainless steel disposable acupuncture needles (Huanqiu, China; 0.25 × 25 mm or 0.25 × 40 mm based on body mass index) were inserted until the Deqi sensation was achieved; 3) After needle insertion, Electrodes of a stimulator (Hwato SDZ-V, Shanghai, China) with alligator clip electrodes, which were fixed firmly for strong electrical conduction.

It was administered for 15 minutes using a 2 Hz frequency continuous wave electrical stimulation; 4) The stimulator was switched off, electrodes were removed, and needles were slowly withdrawn after completion. EA was administered twice a week, totaling 12 sessions.

Semen collection

Semen samples were collected via masturbation in a private room within the clinic after 2–7 days of abstinence. Samples were deposited into sterile, wide-mouthed containers and maintained at 20–37°C. After labeling, the samples were allowed to liquefy at 37°C for up to 30 minutes and checked visually to ensure complete liquefaction before analysis.[14] Semen analysis was performed twice: at baseline (before intervention) and one week after the final intervention session to reflect post-intervention sperm quality.

Morphology

Sperm morphology was evaluated using a light microscope (Olympus, Tokyo, Japan) with a 100× oil immersion objective and 10× ocular lens, resulting in 1000× total magnification.

A minimum of 200 spermatozoa were assessed per sample across multiple representative fields. Morphology assessment focused on the head, neck, and tail, and the classification of normal versus abnormal forms was based on the WHO 2021 strict criteria.[14] An ocular micrometer was used when necessary to measure dimensions.

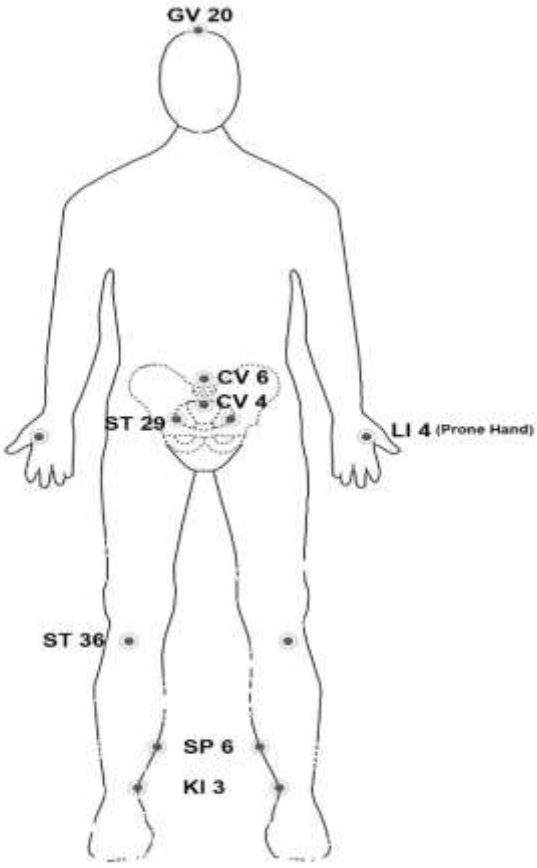

Figure 1: Acupoint Locations

Motility

Motility was assessed using a pre-warmed glass slide (36–37°C) with a 10 µL drop of well-mixed semen, covered with a cover slip. The sample was observed under a microscope at 200× to 400× magnification. At least 200 spermatozoa were evaluated per sample. Motility was categorized into progressive motility (PR), non-progressive motility (NP), and immotility (IM) according to WHO 2021 criteria, with normal total motility defined as ≥40% and progressive motility as ≥32%.[14]

Statistical analysis

Data were analyzed using SPSS version 25. Paired t-test or Wilcoxon signed-rank test was used to compare pre- and post-intervention values within each group. An independent t-test or Mann–

Whitney U test was used to compare differences between the intervention and control groups.
A significance level of P<0.05 was considered statistically significant.

Ethics committee approval

This study was approved by Dr. Moewardi General Hospital Ethics Committee Approval number 704/V/HREC/2023, dated May 5, 2023. All participants provided written informed consent before participation.

Results

Categorical data are presented as frequency distributions (%), and comparisons between independent groups were analyzed using the appropriate chi-square test or Fisher's exact test.

Table 1 presents the baseline characteristics of participants in the intervention and control groups. The distribution of variables such as age, duration of infertility, BMI, smoking history, education level, occupation, and erectile dysfunction was comparable between the two groups. Most participants in the intervention group (100%) were aged 31–35 years, compared to 57.1% in the control group (p = 0.192). The majority of participants in both groups had experienced infertility for less than 10 years: 57.1% in the intervention group and 71.4% in the control group (p = 1.000).

Table 1: Subject Characteristics

Characteristics	Group		p
	Intervention (n=7)	Control (n=7)	
Age (year)			
26-30	0 (0.0%)	3 (42.9%)	0.192**
31-35	7 (100.0%)	4 (57.1%)	
Duration of infertility (year)			
<10	4 (57.1%)	5 (71.4%)	1.000**
>10	3 (42.9%)	2 (28.6%)	
BMI			
Normal	5 (71.4%)	4 (57.1%)	1.000**
Obesitas	2 (28.6%)	3 (42.9%)	
Smoking			
No	6 (85.7%)	4 (57.1%)	0.559**
Yes	1 (14.3%)	3 (42.9%)	
Education			
Senior high school	2 (28.6%)	2 (28.6%)	1.000**
College	5 (71.4%)	5 (71.4%)	
Occupation			
Civil servants	1 (14.3%)	1 (14.3%)	0.753*
Self-employed	3 (42.9%)	2 (28.6%)	
Private employees	3 (42.9%)	3 (42.9%)	
Not yet working	0 (0.0%)	1 (14.3%)	
Erectile dysfunction			
No	5 (71.4%)	6 (85.7%)	1.000**
Yes	2 (28.6%)	1 (14.3%)	

* Chi-square test
** Fisher's exact test

Table 2: Sperm morphology (%) before and after interventions

Group	Before intervention (Pre-test)	After intervention (Post-test)	p
Intervention	2.142 ± 0.899	3.285 ± 0.755	0.005 [a *]
Control	1.428 ± 0.534	2.285 ± 0.755	0.034 [b *]
p	0.165 [d]	0.029 [c *]	

[a] Paired t-test
[b] Wilcoxon
[c] Independent t-test
[d] Mann-Whitney
[*] p<0.05, statistically significant

Table 3: Sperm motility (%) before and after intervention

Group	Before intervention (Pre-test)	After intervention (Post-test)	p
Intervention	32.285 ± 2.870	45.000 ± 6.531	0.017 [b *]
Control	31.857 ± 4.705	38.000 ± 6.298	0.041 [b *]
p	0.383 [d]	0.026 [d *]	

[b] Wilcoxon
[d] Mann-Whitney
[*] p<0.05, statistically significant

Regarding BMI, 71.4% of participants in the intervention group and 57.1% in the control group had normal weight (p = 1.000). Most participants were non-smokers (85.7% in the intervention group and 57.1% in the control group, p = 0.559). Regarding education level, 71.4% of subjects in both groups had attained a college education (p = 1.000). Private employment was the most common occupation (42.9% in both groups, p = 0.753). Erectile dysfunction was absent in the majority of participants, with 71.4% in the intervention group and 85.7% in the control group reporting no issues (p = 1.000). These findings indicate no significant differences between groups at baseline.

Table 2 compares sperm morphology between the intervention and control groups before (pre-test) and after (post-test) the intervention. Both groups showed statistically significant improvements in morphology following the intervention ($p < 0.05$). In the intervention group, the paired t-test yielded a p-value of 0.005, while in the control group, the Wilcoxon test resulted in a p-value of 0.034. Between-group comparisons showed no significant difference at baseline (p = 0.165), but a significant difference was observed post-intervention (p = 0.029), indicating a greater improvement in the intervention group.

Table 3 presents sperm motility outcomes. The intervention group exhibited an increase in motility from 32.285% on the pre-test to 45.000% on the post-test, with a difference of 12.714%. Meanwhile, the control group increased from 31.857% to 38.000% in the post-test, with a difference of 6.142%. Both groups experienced significant within-group improvements (p = 0.017 for the intervention group and p = 0.041 for the control group). However, between-group comparisons revealed a statistically significant difference post-intervention (p = 0.026), favoring the intervention group. These results suggest that EA had a more pronounced effect on improving sperm motility than the control group.

Discussion

This study demonstrated significant improvements in sperm morphology and motility in both the intervention and control groups. However, the improvements were notably greater in the intervention group. The mean increase in sperm morphology was 1.142 ± 0.690 in the intervention group, compared to 0.857 ± 0.690 in the control group, indicating the effectiveness of EA in men with varicocele. These findings are consistent with

Sprevious research. Feng et al. (2022) reported the therapeutic potential of acupuncture in male infertility.[15] Behtaj & Weber (2019) observed a 25% increase in sperm morphology following acupuncture treatment,[16] while Zhu *et al*. found that acupuncture normalized abnormal sperm morphology.[17]

The proposed mechanism of EA involves the stimulation of adenosine secretion triggered by needle insertion and rotation. This leads to increased extracellular purine and adenosine levels, which play roles in tissue repair and anti-inflammatory effects. Adenosine binds to A1 receptors, providing peripheral antinociceptive effects and reducing local inflammation. Additionally, acupuncture has been shown to modulate the activity of brain regions involved in neuroendocrine function, including the somatosensory cortex, limbic system, basal ganglia, brainstem, and cerebellum.[18]

Regarding sperm motility, our findings align with previous studies. Cui et al. (2019) demonstrated that EA at BL23 and ST36 acupoints significantly improved sperm motility, while Wang et al. (2023) reported that EA provided the most effective improvement among non-pharmacological strategies.[19,20] Other research by Ahmadian *et al*., has shown significant increases in progressive sperm motility in acupuncture-treated patients compared to controls ($p = 0.02$), supporting the use of EA as a cost-effective alternative for idiopathic male infertility.[21]

The efficacy of acupuncture in male infertility is considered to be through several physiological processes, including hormonal regulation, anti-inflammatory effects, and improved semen quality.[22] For EA, a mild electric current is transferred through a series of acupuncture needles. EA's therapeutic action has been determined to be influenced by adjusting the frequency, strength, and duration of electrical stimulation.[10,11] Electroacupuncture stimulation of traditional acupoints BL-23, ST-36, CV-1, and CV-4 has been observed to improve sperm motility and overall semen quality and is a promising adjunctive therapy for male infertility.[12]

Overall, the outcomes of this research are the protective effect of EA on semen parameters, particularly sperm morphology and motility. The findings further testify to the efficacy of EA as a promising evidence-based therapy for men with infertility caused by varicocele.

Limitations

This study has several limitations. First, the small sample size (n=14) limits the generalizability of the findings. Second, the study duration may not have been sufficient to evaluate the long-term effects of EA on sperm quality. Third, uncontrolled lifestyle factors, such as diet, stress, and physical activity, may have influenced fertility outcomes. Lastly, hormonal and inflammatory biomarkers were not assessed, limiting understanding of the physiological mechanisms underlying EA's effects. Future studies with larger sample sizes, longer follow-up periods, and comprehensive biomarker assessments are recommended to strengthen these findings.

Conclusion

This study demonstrated that EA significantly improves sperm morphology and motility in men with varicocele. Participants in the intervention group showed greater improvements compared to the control group, indicating that EA may be an effective complementary therapy for male infertility. These findings are consistent with previous research highlighting the positive effects of acupuncture on semen quality.

Acknowledgment

The authors thank Universitas Sebelas Maret and Dr. Moewardi Hospital for their support. This work was funded by the Mandatory Research grant from Universitas Sebelas Maret (Grant No. 228/UN27.22/PT.01.03/2023).

Author contributions

U.R.B: conceptualization, design methodology, funding acquisition, writing-original draft preparation, review final manuscript; B.M: supervision, conceptualization, funding acquisition, review final manuscript; T.P: data collection, funding acquisition, review final manuscript; I.N:

intervention, data analysis, funding acquisition, review final manuscript; A.L: design methodology, data collection; E.M: data administration, sample collection; M.S: sample collection, data analysis; A.S.W: resource data, data analysis; Y.R: data collection, data analysis, writing-original draft preparation.

Conflict of interest

There are no conflicts of interest.

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