

# Effect of Tap Water versus Normal Saline Iontophoresis in Subjects with Palmar Hyperhidrosis for Reducing Severity and Improving Quality of Life

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**Abstract:** Idiopathic (primary) hyperhidrosis is defined as an excessive sweating and a common condition that is frequently exacerbated by emotion and anxiety. <sup>(1-2)</sup>It is also explained as an excessive production of sweat more than the physiological amount required to maintain thermal homeostasis. <sup>(3)</sup> Excessive sweating is extremely debilitating, can have a negative impact on life and leads to clammy hands and feet, which causes even dripping of sweat from the hands. <sup>(2-3)</sup> There are variety of treatments have been discovered to control or reduce the profuse sweating involving the palms, soles and axilla, like systemic anticholinergic drugs, injection of botulinum toxin A or a surgical approach known as sympathectomy. <sup>(1-3)</sup> Iontophoresis was first established to treat hyperhidrosis in 1952 and it is an electrical treatment that includes the use of an electromagnetic force to enhance percutaneous absorption of a drug or chemical. <sup>(1-2)</sup>It works on a principle of local absorption of a drug or chemical on the skin, in the forms of ions. It has been proved to be a safe, effective and inexpensive treatment and if applied appropriately, it does not have any adverse reactions. <sup>(1)</sup>Our study aims to compare the effect of tap water versus normal saline iontophoresis in subjects with palmar hyperhidrosis in reducing severity and improving quality of life. This study was conducted in palmar hyperhidrosis subjects who presented to the physiotherapy OPD in department of physiotherapy between August 2018 to February 2019. A total of 15 patients were included in the study. The excessive sweating appearing on palms of the patient were significantly (<0.001) reduced after treatment of three weeks.

Hence forth the above study showed that normal saline iontophoresis was more effective than tap water iontophoresis in subjects with palmar hyperhidrosis for reducing severity and improving quality of life.

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## I. Introduction

Idiopathic (primary) hyperhidrosis is defined as an excessive sweating and a common condition that is frequently exacerbated by emotion and anxiety. <sup>(1-2)</sup> In idiopathic hyperhidrosis, excessive sweating usually occurs bilaterally, symmetrical on palmar, plantar, fascial, axillary, or cervical region which results in social, psychological, emotional and professional difficulties for the afflicted. <sup>(1)</sup>In both genders, the incidence of idiopathic hyperhidrosis is seen to be between 0.6 to 2.8%. It may start in childhood and does not occur during sleep but continues for the rest of the subject's life. <sup>(1)</sup>It is a disease of unknown etiology. The cerebral cortex is responsible for emotion and stress and idiopathic hyperhidrosis is normally a result of stimulation of these areas in brain. The pathophysiology of primary hyperhidrosis also said to be associated with overstimulation of hypothalamic sweat center which controls sweating. <sup>(3)</sup> In 1952, iontophoresis was first established to treat hyperhidrosis and it is an electrical treatment that includes the use of an electromagnetic force to enhance percutaneous absorption of a drug or chemical. <sup>(1-2)</sup>Tap water iontophoresis is considered as an initial treatment of choice for palmoplantar hyperhidrosis because of its low adverse effect profile and effectiveness. In this procedure, the hands or feet are immersed into water and electrodes are applied. It consists of continuous direct current but pulsed direct current can be used alternatively, which is easier to handle but slightly less effective. <sup>(6)</sup>The mechanism of action of iontophoresis is unknown whereas different theories postulate blockage and obstruction of eccrine ductal without damage to the sweat ducts, hyper keratinization, blockage of neuroglandular transmission and inhibition of secretory mechanism at cellular level. <sup>(3)</sup> It is assumed that the mechanism of action is a reversible disruption of the ion transport in the sweat glands, lead to accumulation of protons in the sweat gland duct. <sup>(6)</sup>Reduction of sweating level is thought to be the main beneficial effect of iontophoresis treatment.

## II. Material and Methods

This prospective comparative study was carried out on subjects in MVP'S Dr Vasant Rao Pawar Medical College, Hospital and Research Centre, Physiotherapy OPD from August 2018 to February 2019. A total 15 subjects (both males and females) of aged 14 to 45 years were included in this study.

**Study Design:** Comparative study

**Study Location:** MVP'S Dr Vasant Rao Pawar Medical College, Hospital and Research Centre, Physiotherapy OPD, Nashik

**Study Duration:** 6 Months

**Sample Size:** 15

Group A: 15      Group B: 15

### Inclusion Criteria:

- Age- 14 years to 45 years<sup>(3)</sup>
- Visible and excessive sweating for a minimum 6 months duration<sup>(1)</sup>
- Bilateral and relatively symmetrical sweating<sup>(1)</sup>
- Disruption of daily physical activities<sup>(1)</sup>
- Family history of sweating<sup>(1)</sup>
- One sweating period in a week<sup>(1)</sup>
- Occurrence of sweating below the age of 25 years<sup>(1)</sup>
- Cessation of focal sweating during sleep<sup>(1)</sup>

### Exclusion Criteria:

- Pregnancy<sup>(3)</sup>
- Any cuts, abrasions, eczema or infections on hands<sup>(3)</sup>
- History of ischemic heart disease<sup>(3)</sup>
- Metal implants like pacemaker<sup>(3)</sup>
- Previous treatment like botulinum toxins or sympathectomy<sup>(3)</sup>

### Procedure Methodology

Under convenient sampling method, subjects were taken from MVP'S DR Vasant Rao Pawar Medical College, Hospital and Research Centre, Physiotherapy OPD, Nashik. The subjects were screened as per the inclusion and exclusion criteria and were put in group A (TAP WATER IONTOPHORESIS) and group B (NORMAL SALINE IONTOPHORESIS). Procedure and purpose of study was explained to participants in understandable language. All the subjects read and signed an informed consent form. All subjects were divided by convenient sampling method in group A and group B. There were two groups, a group treated with tap water iontophoresis on right hand and a group treated with normal saline iontophoresis on left hand for the palmar hyperhidrosis.

**Group A** Subjects received seven sessions given in three weeks treatment of iontophoresis with tap water on right hand. The procedure was performed with single diagnostic stimulator. Before the beginning of the study, the patient was asked to report the intensity of sweat using the dermatological quality life index and hyperhidrosis disease severity scale. The apparatus consists of a machine that delivers direct current between 0-50 mA and a plastic tray consist of tap water in which the rubber pad (active electrode) was placed. An inactive electrode was placed at upper arm and will be attached with the help of strap. The patient immersed one hand in pronated position and hand was in contact with the rubber pads that was connected to active electrode. Current intensity was slowly increased till a maximum comfortable level was achieved, maintain for 30 mins in each session. Intensity of direct current was decreased if possible adverse reactions were noted. The tap water was administered in each session for 30 mins with 7 applications on days 1, 2, 4, 7, 11, 16 and 21 of the study.

**Group B** Subject was treated with seven sessions given in three weeks treatment of iontophoresis with normal saline water on left hand. The apparatus consists of a machine that delivers direct current between 0-50 mA and a plastic tray consist of normal saline in which the rubber pad (active electrode) was placed. An inactive electrode was placed at upper arm and was attached with the help of strap. The subject immersed one hand in pronated position and hand was in contact with the rubber pads that was connected to active electrode. Current intensity was slowly increased till a maximum comfortable level is achieved, maintained for 30 mins in each session. Intensity of direct current was decreased if possible adverse reactions were noted. The normal saline water was administered in each session for 30 mins with 7 applications on days 1, 2, 4, 7, 11, 16 and 21 of the study. At the end of each session, the patient was asked to wash her hands and dry them by wiping with a tissue. At the end of the study, the patient was asked to report the intensity of sweat using the Dermatological Quality Index Score Questionnaire (DQI) and Hyperhidrosis disease severity scale (HDSS).

**Statistical Analysis**

Data was analysed using Graph pad in this study. Baseline characteristics of the two treatment groups namely tap water iontophoresis versus normal saline iontophoresis were compared to evaluate the success of randomization. The within group (Intra group) comparisons of the change in the Hyperhidrosis Disease Severity Scale (HDSS) and the Dermatological Quality Index Score Questionnaire (DQI) score PRE& POST was assessed by paired t test. The between group (Inter group) comparisons of the change in the Hyperhidrosis Disease Severity Scale (HDSS) and Dermatological Quality Index Score Questionnaire (DQI) scorePRE & POST was assessed by unpaired t test. The level P <0.05 was considered as the cutoff value or significance.

**III. Result**

After 3 weeks of treatment, it was found that palmar sweating was reduced bilaterally after seven sessions of tap water and normal saline iontophoresis treatment. The result of this study showed significant reduction in the means of pre and post interventions ofDQI and HDSS between the groups.

Group A (Tap water iontophoresis) the p value for DQI is <0.0001, which is statistically extremely significant and the p value for HDSS is <0.0001, which is statistically extremely significant.

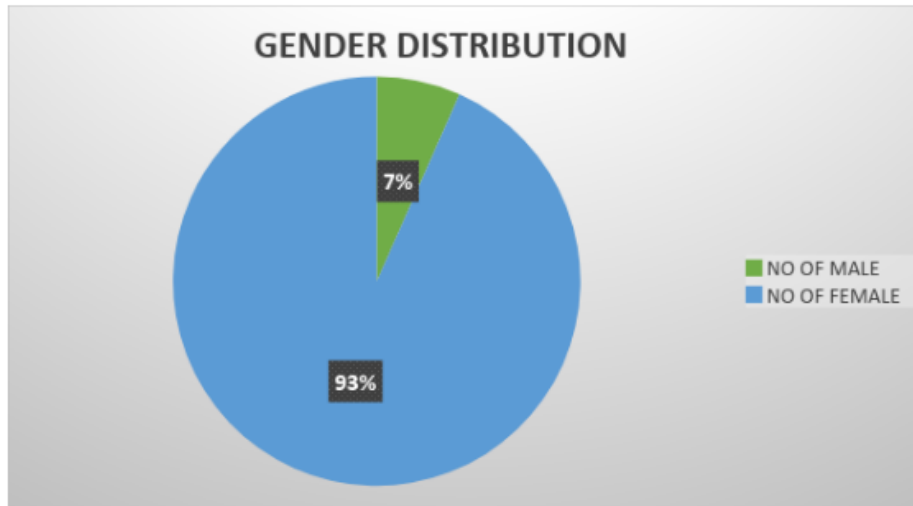
Group B (Normal saline iontophoresis) the p value forDQI is <0.0001, which is statistically extremely significant and the p value for HDSS is <0.0001, which is also statistically extremely significant.

Mean values of tap water and normal saline iontophoresis on DQI are 14.33 and 25.67 respectively, the p value is 0.0005. Mean values of tap water and normal saline iontophoresis on HDSS are 0.93 and 1.47 respectively, the p value is 0.0013.

**TABLE NO 1**

TOTAL NO. OF MALES	01
TOTAL NO. OF FEMALES	14

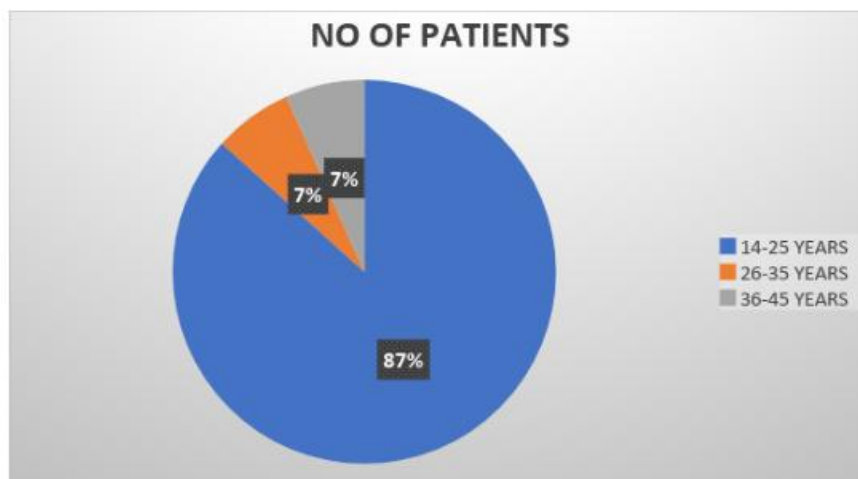
**GRAPH NO 1**



GRAPH NO 1: Shows the distribution of no. of all females and males in the study out of 15. There are 14 females in study noted by Purple in colour in pie, while 01 male in study noted by Red colour.

**TABLE NO 2 AGE DISTRIBUTION**

AGE GROUP	NO. OF PATIENTS
14-25 YEARS	13
26-35 YEARS	01
36-45 YEARS	01



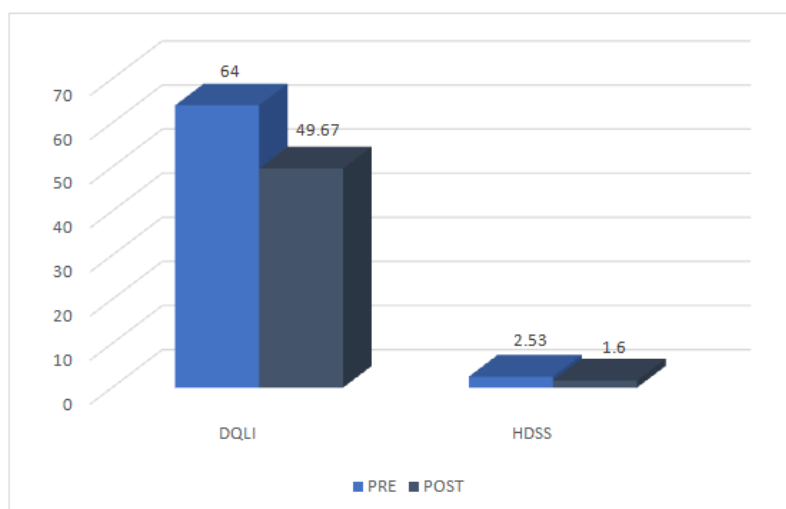
**GRAPH NO 2**

GRAPH NO 2: Shows distribution of various age groups in study of 15 subjects.

**TABLE NO 3** Comparison of pre and post mean treatment scores of DQI and HDSS of group A (Right Hand-Tap water) using paired t test

Paired t test of group A	DQI		HDSS	
	PRE	POST	PRE	POST
MEAN	64.00	49.67	2.53	1.60
SD	14.24	11.50	0.64	0.63
P-VALUE	<0.0001		<0.0001	
T-VALUE	12.56		14.00	
RESULT	EXTREMELY SIGNIFICANT		EXTREMELY SIGNIFICANT	

**GRAPH NO 3**

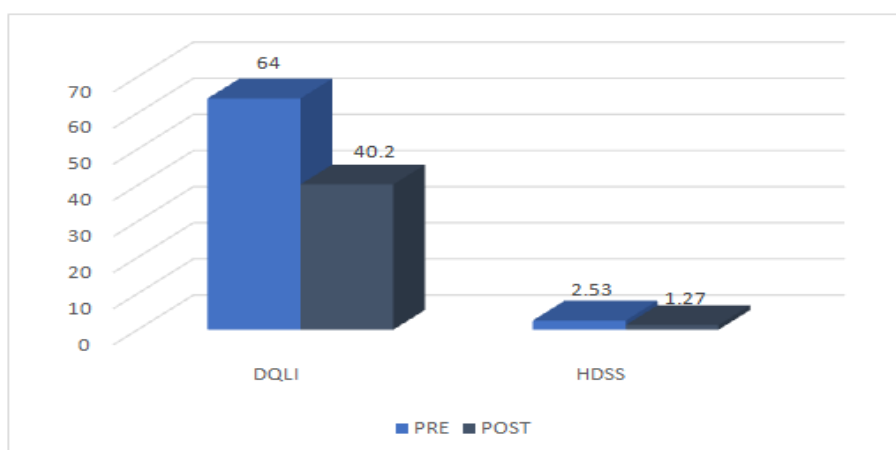


INTERPRETATION- The mean value of group A for DQI was 64.00 before the treatment and after the treatment the mean was 49.67. The mean value for HDSS for group A was 2.53 and after the treatment it was 1.6 and P-value is <0.0001 and the results are extremely statistically significant.

**TABLE NO 4** Comparison of pre and post mean treatment scores of DQI and HDSS of group B (Left Hand-Normal saline) using paired t test

Paired t test of group B	DQI		HDSS	
	PRE	POST	PRE	POST
MEAN	64.00	40.20	2.53	1.27
SD	14.24	8.98	0.64	0.46
P-VALUE	<0.0001		<0.0001	
T-VALUE	13.16		10.71	
RESULT	EXTREMELY SIGNIFICANT		EXTREMELY SIGNIFICANT	

GRAPH NO 4

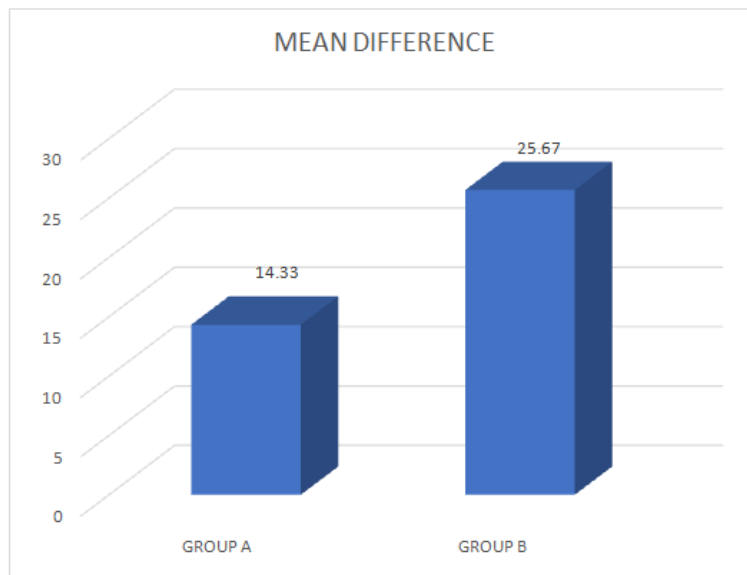


**INTERPRETATION-** The mean value of group B for DQI was 64.00 before the treatment and after the treatment the mean was 40.20. The mean value for HDSS for group B was 2.53 and after the treatment it was 1.27 and P-value is <0.0001 and the results are extremely statistically significant.

TABLE NO 5 Comparison of the mean difference in group A and group B for DQI using unpaired t test

GROUP	SAMPLE SIZE	GROUP A MEAN	GROUP B MEAN	P VALUE	t value	SIGNIFICANCE
Dermatological Quality Index Score Questionnaire	15	14.33	25.67	0.0005	3.9662	EXTREMELY STATISTICALLY SIGNIFICANT

GRAPH NO 5



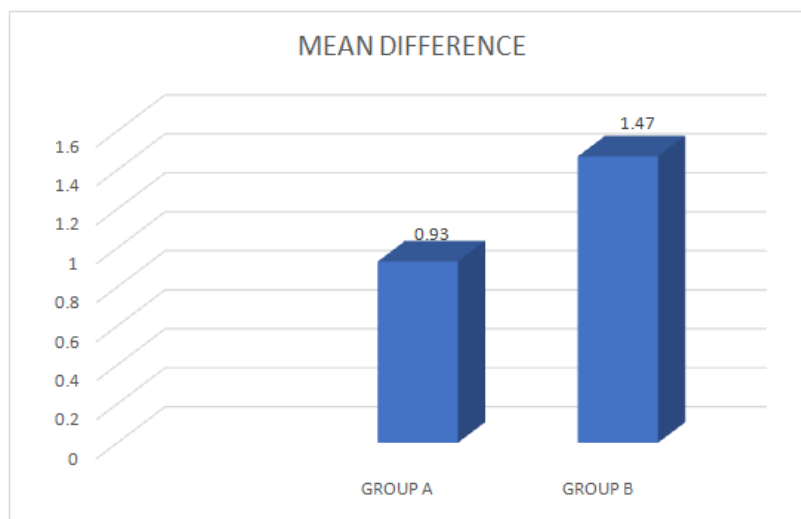
**INTERPRETATION-** The mean difference value of group A for DQI was 14.33 and for group B it was 25.67, t value was 0.0005, which is extremely statistically significant comparing the effect of tap water and normal saline iontophoresis on palmar hyperhidrosis with Dermatological Quality Index Score Questionnaire.

**TABLE NO 6**

Comparison of the mean difference in group A and group B for HDSS using unpaired t test

GROUP	SAMPLE SIZE	GROUP A MEAN	GROUP B MEAN	P VALUE	t value	SIGNIFICANCE
HDSS	15	0.93	1.47	0.0013	3.5777	VERY STATISTICALLY SIGNIFICANT

**GRAPH NO 6**



**INTERPRETATION-** The mean difference value of group A for HDSS was 0.93 and for group B it was 1.57, t value was 0.0013, which is very statistically significant comparing the effect of tap water and normal saline iontophoresis on palmar hyperhidrosis with HDSS.

#### IV. Discussion

The purpose of this study was to compare the effect of tap water versus normal saline iontophoresis in subjects with palmar hyperhidrosis in reducing severity and improving quality of life. In this study, 15 palmar hyperhidrosis patients were assigned. Each patient was divided in two groups, where right hand of the patient received tap water iontophoresis 7 times in the period of 3 weeks mainly on 1<sup>st</sup>, 2<sup>nd</sup>, 4<sup>th</sup>, 7<sup>th</sup>, 11<sup>th</sup>, 16<sup>th</sup> and 21<sup>st</sup> day for 30 mins total duration while left hand of the patient was treated with normal saline iontophoresis 7 times in the period of 3 weeks mainly on 1<sup>st</sup>, 2<sup>nd</sup>, 4<sup>th</sup>, 7<sup>th</sup>, 11<sup>th</sup>, 16<sup>th</sup> and 21<sup>st</sup> day for 30 mins total duration. The outcome was measured by two scales namely The Dermatological Quality Index Score Questionnaire and Hyperhidrosis Disease Severity Scale. Outcome measures were assigned on day one pre-treatment and after 3 weeks post treatment for both groups.

In group A, the two tailed p value for paired t test was applied which showed  $p < 0.0001$  for Dermatological Quality Index Score Questionnaire and HDSS which was extremely statistically significant. Thus, study showed that tap water iontophoresis was effective in reducing excessive palmar hyperhidrosis and improving quality of life. Zahra Yaghabi et al<sup>(1)</sup> tested the effect of tap water iontophoresis for palmar idiopathic hyperhidrosis and observed decrease in sweat after every treatment session, with average of 25% for tap water. Tap water iontophoresis is safe, inexpensive and produced a beneficial effect in reducing excessive sweating with minimal adverse side effects, possibly due to mechanical or electrochemical occlusion of sweat ducts which lasts for at least four weeks. Tap water iontophoresis is an effective treatment similar to the findings of LY Chanet al<sup>(2)</sup> and Talad Masood Akbar et al<sup>(3)</sup>. They provided experimental evidence that the induction of hyperkeratinisation and the obstruction of eccrine sweat duct occurred which helps reduce the sweating. Similarly, Templeton et al<sup>7</sup> have suggested that anhidrosis due to iontophoresis results from ductal blockage without damage to the sweat glands while Holzle and Ruzicka et al<sup>(8)</sup> have suggested that iontophoresis by blocking neuroglandular transmission or inhibiting the secretory mechanism at a cellular level.

In group B, the two tailed p value for paired t test was applied which also showed  $p < 0.0001$  for Dermatological Quality Index Score Questionnaire and HDSS which was extremely statistically significant. Thus, study showed that normal saline iontophoresis was equally effective in reducing excessive palmar hyperhidrosis and improving quality of life. In this study, the efficacy of normal saline iontophoresis was more effective clinically than tap water iontophoresis. Pore obstruction of sweat ducts secondary to hyperkeratinisation, impairment of the electrochemical gradient of sweat, and biofeedback mechanism may be

involved in hyperhidrosis following iontophoresis. The tap water is said to be hard which may have adversely affected the efficacy of the treatment as compared to the normal saline water. Hard water might have different ions and compositions which might affect the degree of efficacy. Normal saline is considered a standard liquid with similar efficacy.

Palmar hyperhidrosis presents a serious health problem and produces a large burden on society. Inexpensive, safe, effective treatment procedures such as tap water or normal saline iontophoresis could be of great value. This provides reduction in the degree of sweating, reducing severity. And improving quality of life in subjects with palmar hyperhidrosis.

## V. Conclusion

Study concluded that normal saline iontophoresis is more effective than tap water iontophoresis in subjects with palmar hyperhidrosis for reducing severity and improving quality of life.

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