Effectiveness of hot water foot bath therapy on body temperature among patients with fever in selected ICUs of a tertiary care hospital, Ludhiana, Punjab

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Abstract
Fever itself is not an illness. A fever is usually a sign that immune system is busy fighting an infection or other illness. Water is an excellent conductor, which allows it to transfer heat effectively and quickly. Water has a temperature conducting capacity twenty-seven times that of air. When Hot Water Foot Bath applied for 15-20 minutes the blood vessels in the feet starts expanding and gets improved circulation, and relieving aches, tiredness and fever. The improved blood circulation resets the hypothalamic set points by heat transfer from higher heat area to lower heat area.

Objectives: To assess the effectiveness of hot water foot bath therapy on body temperature among patients with fever.

Methodology: In this study, with Quantitative approach, pre-test and post-test control group design was used. This study was conducted in ICUs of Tertiary care Hospital, Ludhiana The target population consists of patients with fever admitted in ICUs. Purposive sampling technique was used to draw sample from target population as per inclusion and exclusion criteria. With lottery method, patients (N= 50) were divided into two groups i.e. n_1=25 (experimental group) and n_2=25 (Control group). Pre-test of body temperature was done by using standardized digital thermometer. For experimental group, hot water foot bath therapy at 107.6 °F (42°C) water temperature as measured with lotion thermometer was given for 15 minutes. Later, post-test of body temperature was done to determine the effectiveness of hot water foot bath therapy.

Result: The findings of the study showed that significant difference has been found in experimental group and control group in pre-test and post-test between the groups and within experimental groups. In between the groups, i.e. in experimental group was 99.424±0.5811 and in control group was 100.648±05516. Within the experimental group, mean value of body temperature in pre-test was 100.632 ±0.4110 °F, in posttest it was 99.424 ±0.5811°F, whereas, in control group mean value of body temperature in pre-test was 100.624±0.4944°F, and in post-test it was 100.648±0.5516°F.

Conclusion: The finding of the study demonstrated that hot water foot bath therapy was an effective non-Pharmacological method to reduce the body temperature. The mean post-test body temperature was lower than mean pre-test body temperature. There was significant difference in body temperature has been found between the experimental group and control group, as well as with in the experimental group in pre-test and post-test.

Keywords: hot water foot bath therapy, body temperature

Introduction
Body temperatures based on the heat produced lose the heat lost. Heat is decreased by radiation, convection, and conduction, but the overall loss by all three processes depends on a gradient between the body and the outside. Thus, when the external temperature is minimal, radiation is the most vital form of heat loss. When there is a maximum external temperature, evaporation is the most important form of heat degradation. The balance of heat produced and heat lost regulate a constant body temperature. However, temperature does differ during the day, and this set point is controlled by the hypothalamus. The fever special to the ICU settings could result from interventions or therapies provided during ICU care or the patient manifesting new-onset fever due to SIRS, septic, metabolic or neuroendocrine response. However, clinical and/or management-related overlaps between different patient groups are not unexpected. In ICUs patients, various factors are the cause of fever. Catheter-associated bloodstream infections are one of the most prevalent reasons for patients to have fever in the ICU. Central venous and arterial catheters are necessary tools for monitoring patients and delivering fluids, antibiotics, nutrition, and other therapies. Pneumonia is the second most familiar cause of infection acquired in the ICU and ventilator-associated pneumonia (VAP) is a common source of fever in the intubated patient's between ten to 25% of patients on mechanical ventilation will grow VAP during their ICU stay. Surgical site infections can be important causes of fever in patients rescuing from recent surgery. These infections will often present with

erythema and discharge at a surgical site and eventually may lead to part of the wound. Immediate the surgical debridement is generally needed for patients with this etiology of fever. Many medications may be associated with an allergic response that carries fever. Some medication can cause fever due to hypersensitivity, which may manifest as fever only to life-threatening hypersensitivity. Most common drugs common to cause fever are beta-lactam antibiotics, phenytoin, quinidine, procainamide, and methyldopa. The critical care unit creates a potential environment for recovery of the patients who have lesser chance of survival. Thus treatment in intensive care unit involves many equipment procedures and constant medical tests and observations. Temperature is one of the most important vital signs to be observed in all patients, including intensive care units (ICU). Fever or hypothermia often require further physical evaluations, investigations, and change in treatment in the ICU. Furthermore hot water foot bath therapy (HWFBT) is one of the hydrotherapeutic measures, which improves warmth, promotes muscle relaxation, relieves pain, dilates blood vessels and promotes circulation, relaxes the connective tissue and provides a soothing and healing effect. This improves the circulation, resets the thermostatic set points in the hypothalamus by heat transfer for higher heat area to lower heat area. There are many non-pharmacological measures like cold sponging, tepid sponging, external cooling, warm water therapy that are found to be effective in controlling the temperature. There is a disagreement regarding the indication for and the use of the heat and cold therapy. But many studies have shown that, hydrothermal therapy is an effective method for treating fever (Glastar, 2004). Hot water application to the foot causes the congested blood to flow towards distant parts of the body and is brought to the dilated vessels of the foot and leg. A comfortable warm to hot bath lead relief to muscle spasms and cramps, increases blood flow that eliminates lactic acid and toxin waste formed in the muscle cell.

Materials and Methods

Quantitative approach was used for the study. The research design for the present study was experimental designs i.e. Pretest- posttest control group design. Mean value of days of hospitalization, days of onset of fever after admission, duration of fever as clinical variables among experimental group and control group.

Table 1: Frequency and percentage distribution of patients with fever among experimental group and control group as per their selected clinical profile N=50

| Clinical profile	Experimental group (n1=25)	Control group (n2=25)	x^2 statistics
	f (%)	f (%)	
Day of hospitalization¤			1.2987
1-7 days	13(52 %)	9(36 %)	df=1
8-14 days	9(36 %)	9(36 %)	p=0.2544 [NS]
More than 15 days	3(12 %)	7(28 %)	
Day of onset of fever after admission			
1-7 days	25(100 %)	23(92 %)	-
8-14days	-	2(8 %)	
Duration of fever¤			
Past 1 day	2(8 %)	0	0.8021
Past 2 days	8(32 %)	7(28 %)	df=1
Past 1 week & above	15(60 %)	18(72 %)	p=0.3704[NS]

(¤ merge) (NS – Non Significant)

Mean days of hospitalization ±SD in experimental group= 3.928 ± 4.173, Mean days of hospitalization ±SD in control group =11.680 ± 7.553

Mean day of onset of fever after admission ±SD in experimental group=7.800 ± 5.845, Mean day of onset of fever after admission ±SD in control group =2.958 ± 2.578

Mean duration of fever ±SD in experimental group=1.920 ± 1.497, Mean duration of fever ±SD in control group =3.72 ±0.45
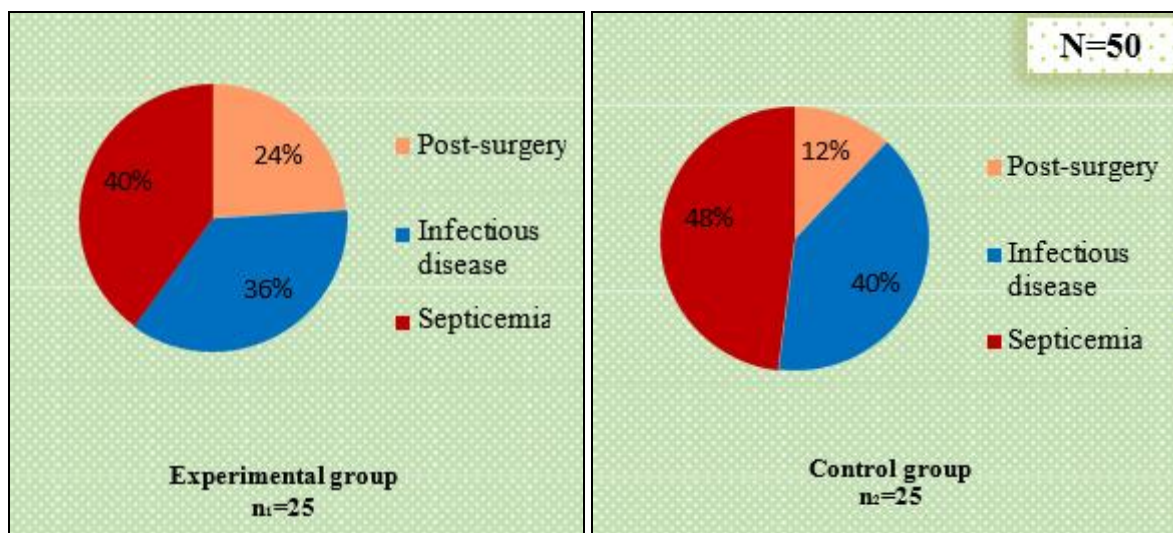
Table 1 depicts the distribution of patients with fever among experimental group and control group as per their selected clinical profile. According to day of hospitalization, in experimental group majority of patients.i.e. 13 (52%) had 1-7 days of hospitalization followed by 9 (36%) had 8-14 days of hospitalization and remaining 3(12%) had in the more than 15 days of hospitalization. In control group, equal of the patients i.e. 9(36%) were in 1-7 and 8-14 days of hospitalization and remaining 7(28%) had more than 15 days of hospitalization. According to day of onset of fever after admission, in experimental group, all of the patients, i.e. 25(100%) had onset of fever in 1-7 days. In control group, majority of the patients i.e. 23(92%) had onset of fever in 1-7 days followed by 2(8%) had onset of fever in 8-14 days. According to duration of fever, in experimental group, majority of the patients, i.e. 15(60%) had fever since 1 week & above followed by 8(32%) had fever from 2 days and remaining 2(8%) having fever since 1 day only. In control group, majority of the patients, i.e. 18(72%) had fever since 1 week & above followed by 7(28%) had fever from 2 days. Hence, it was found that the two groups i.e. experimental group and control group were statistically identical (p>0.05) as per their clinical profile which

includes day of hospitalization, days of onset of fever after admission, duration of fever, of the patients with fever.
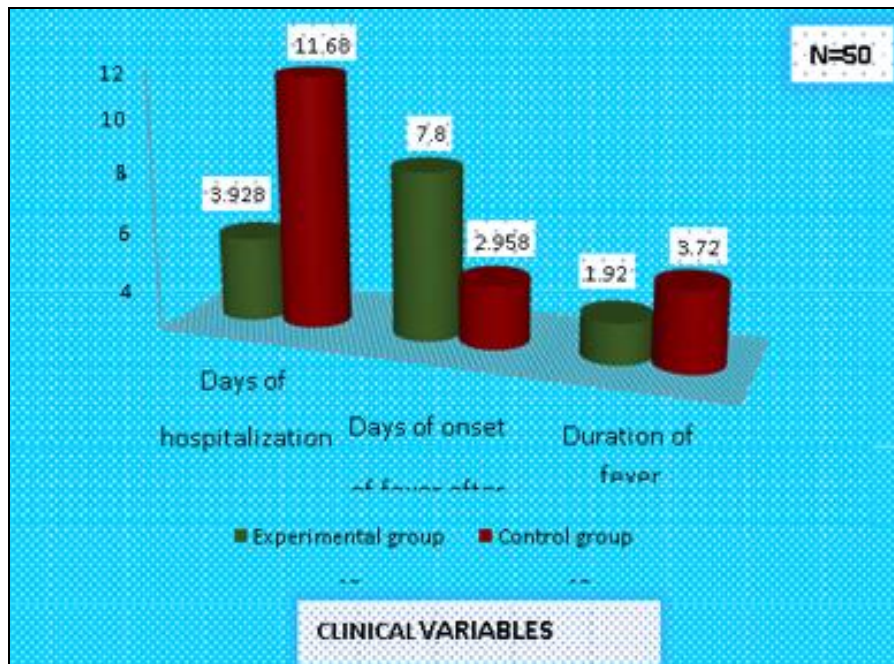
Fig 1: Mean value of days of hospitalization, days of onset of fever after admission, duration of fever as clinical variables among experimental group and control group.

Fig 1 depicts the mean±SD value of days of hospitalization, days of onset of fever after admission, duration of fever as clinical variables among experimental group and control group. According to day of hospitalization, mean±SD in experimental group was 3.928±4.173 and in control group, 11.680 ±7.553. According to day of onset of fever after admission, mean±SD in experimental group, was 7.800±5.845 and in control group, mean value was 2.958±2.578. According to duration of fever, in experimental group, mean±SD was 1.920±1.497 and in control group, mean value was 3.72±0.45. Hence, it was found that days of hospitalization and duration of fever mean value of experimental group were lower than control group, whereas, mean value of days of onset of fever after admission was more in experimental group.

Fig 2: Distribution of patients with fever according to their relative reason of fever in experimental group and control group

Fig 2 depicts distribution of patients with fever according to their relative reason of fever in experimental group and control group. In experimental group majority of patients, i.e. 10(40%) had septicemia followed by 9(36%) were having infectious disease and remaining 6(24%) were post- surgery patients seems to be their relative reasons of fever. In control group majority of patients, i.e. 12(48%) were having septicemia followed by 10(40%) were having infectious disease and remaining 3(12%) had post -surgery patients explained to be their relative reasons of fever.
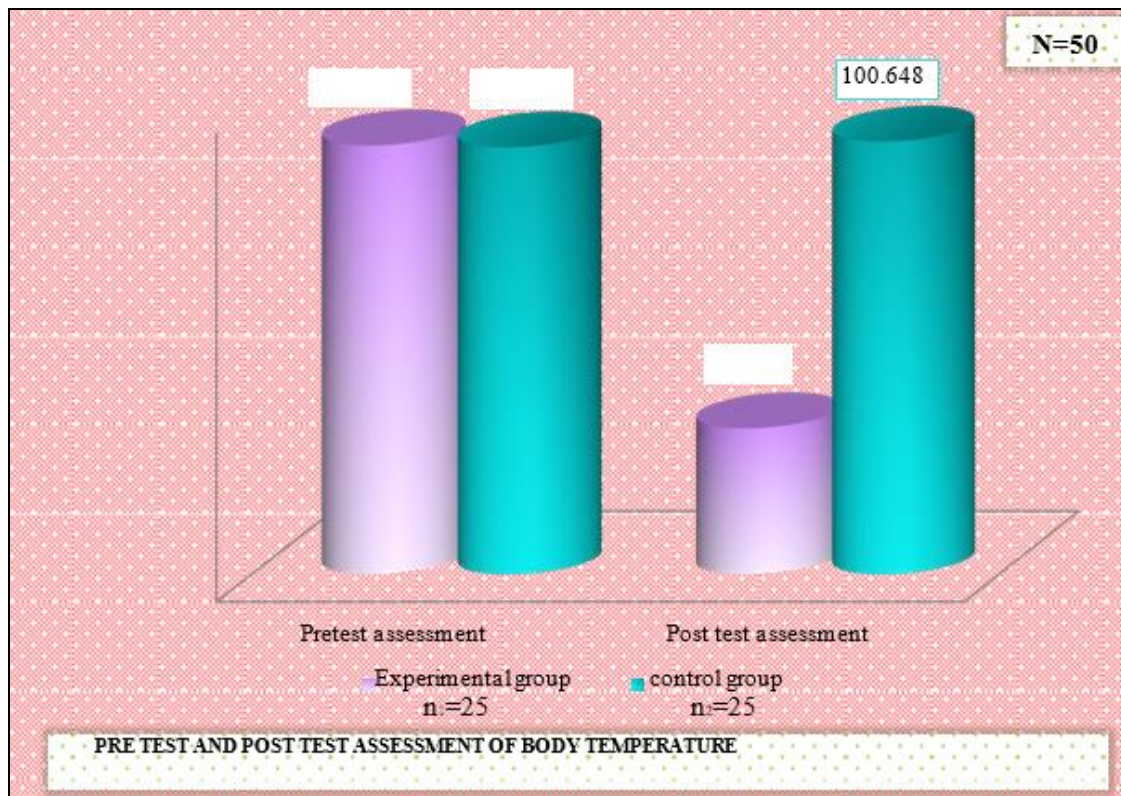
Table 2: Comparison of temperature of the patients with fever among experimental group and control group in pre-test and post-test within the groups and between the groups N=50

Pre/Post	Experimental group n1=25 Mean ±SD	Control group n2=25 Mean ±SD	Mean difference	Unpaired-t test
Pre-test	100.632 ±0.4110	100.624 ±0.4944	0.008	t=0.062df=48 p=0.951NS
Post test	99.424 ±0.5811	100.648 ±0.5516	1.224	t=7.638 df=48 p=0.000*
Paired t-test	t=13.028 df=24 p=0.000*	t=0.562 df=24 p=0.543 NS	-	-

* =Significant p<0.05 NS= Non-significant

Table 2 illustrates comparison of temperature of the patients with fever among experimental group and control group in pre-test and post-test between the groups and within the groups. In between the groups, i.e. in experimental group was 99.424±0.5811 and in control group was 100.648±05516. Within the experimental group, mean value of body temperature in pre-test was 100.632 ±0.4110 °F, in post test it was 99.424 ±0.5811°F. Whereas, in control group mean value of body temperature in pre-test was 100.624±0.4944°F, and in post-test it was 100.648 ± 0.5516°F. Hence, significant difference has been found between both the group's i.e. experimental group and control group as well as within the experimental group at p<0.05 level of significance, Thus, null hypothesis (Ho) is rejected i.e.

Ho: There will be no significant difference in the body temperature reduction between experimental and control group after hot water foot bath therapy at 0.05 level of significance.

Fig 3: Comparison of mean value of temperature of the patients in pre-test and post -test between the experimental group and control group

Major finding of the Study

▪ As per socio demographic profile of critically ill patients both groups were found to be homogenous (p>0.05) as per their age, gender, habitat, religion, marital status, dietary habits, occupation and socio economic status whereas the two groups i.e. experimental group and control group were found to be heterogonous (p<0.05) as per their educational status. Mean age±SD (in years) of experimental group was 44.840 ± 1.7648 and in control group was 51.760 ± 1.582. As per clinical profile of critically ill patients both the groups were found to be homogenous (p>0.05) as per their days of hospitalization, day of onset of fever after admission, duration of fever, previous history of hospitalization, E.S.R, blood culture, relative reasons of fever, associated symptoms with fever is present, any antipyretic given. Whereas the two groups i.e. experimental group and control group were found to be heterogonous (p<0.05) as per their diagnosis of patients and T.L.C lab value, Mean±SD values of days in experimental group was 3.928±4.173, and in control group, 11.680±7.553. Mean±SD days of onset of fever after admission in experimental group was 7.800±5.845, and in control group 2.958±2.578, Mean ±SD duration of fever in experimental group was 1.920 ± 1.497 and in control group 3.72±0.45.

Important findings
Findings revealed that Mean ± SD of body temperature among experimental group and control group in pre-test and post-test between the groups and within the groups. In between the groups, i.e. in experimental group was 99.424±0.5811 and in control group was 100.648±05516. Within the experimental group, mean value of body temperature in pre-test was 100.632 ±0.4110 °F, in post-test it was 99.424 ±0.5811°F. Whereas, in control group mean value of body temperature in pre-test was 100.624±0.4944°F, and in post-test it was 100.648 ±0.5516°F, Hence, significant difference in body temperature has been found between both the group's i.e. experimental group and control group as well as within the experimental group at $p<0.05$ level of significance, Thus, null hypothesis (Ho) is rejected i.e.
Ho: There will be no significant difference in the body temperature reduction between experimental and control group after hot water foot bath therapy at
0.05 level of significance.

Discussion
Hot water foot bath therapy (HWFBT) one of the hydrotherapeutic measures, which improves warmth, promotes muscle relaxation, relieves pain, dilates blood vessels and promotes circulation, relaxes the connective tissue and provides a soothing and heeling effect. The improves the circulation resets the thermostatic set points in the hypothalamus by heat transfer for higher heat area to lower heat area. Hot application to the skin increases the oxidation of the toxins and increases the blood flow through peripheral vessels

Conclusion
The finding of the study demonstrated that hot water foot bath therapy was an effective non-pharmacological method to reduce the body temperature. The mean post-test body temperature was lower than mean pre-test body temperature. There was significant difference in body temperature has been found between the experimental group and control group, as well as with in the experimental group in pre-test and post-test.

Conflict of Interest
None

Source of Funding
Self

Ethical Clearance
The research study was approved by research and ethical committee of Hospital and University. The subjects were explained about the objectives and activities of research projects. Instructions were given to them and they were assured that their responses would be kept confidential by providing information sheets and informed consent was obtained from the patients

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