



Effectiveness of Head Mist versus Tepid Sponging Among Febrile Children: A Comparative Study

Community Medicine

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ABSTRACT

This is a comparative study aimed to compare the effectiveness of head mist as a new modality of decreasing body temperature versus traditional method of tepid sponging among the febrile children. The study was conducted on 50 children aged 1-12 years old with axillary temperature $\geq 38.0^{\circ}\text{C}$ who came to the pediatric emergency department at King Fahd Hospital of the University in Al Khobar City for seeking medical help. They were divided into two groups on random basis, 25 children enrolled in each group. Group (1) received head mist which applied 15-20 cm distance from the child's forehead while he/she on sitting position by using Atom Soniclizer 305 machine producing mist, and group (2) received tepid sponging which was applied on the forehead (by using a basin and two towels, the towels used alternatively during sponging) while the child on lying position. Body temperature of children in the two groups was measured axillary before the intervention, at 15 and 30 minutes of the intervention by using an electronic thermometer. As well as paracetamol, 15 mg/kg was given to all children in the groups orally directly before the intervention. Results of the present study revealed that before the intervention, no statistically significant difference was found between body temperatures of children in the two groups. At 15 and 30 minutes of the interventions, statistical significant differences were observed between body temperature of children in the head mist and the tepid sponging groups with more prevalent of decreasing body temperature among children in the head mist group than those in the tepid sponging group. Mean \pm SD of body temperature was $38.3 \pm 0.4^{\circ}\text{C}$ and $38.6 \pm 0.55^{\circ}\text{C}$ for the two groups respectively, $P < 0.05$ at 15 minutes & $38 \pm 0.45^{\circ}\text{C}$ and $38.5 \pm 0.54^{\circ}\text{C}$ for the two groups respectively, $P < 0.001$ at 30 minutes. The study concluded that head mist could be an effective and alternative way compared to tepid sponging to decrease body temperature of febrile children. The present study recommended that head mist method can be integrated in the routine care of decreasing body temperature among febrile children, educational training programs for medical and nursing staff should be conducted to teach them how to use the machine and apply the head mist method to decrease body temperature among the febrile children.

KEYWORDS:

Head Mist, Tepid Sponging, Febrile Children, Saudi Arabia

Introduction

Fever is one of the most common problems for which parents seek medical advice for their children and it is one of the most common presenting complaints to emergency departments and accounts 25% of visits to pediatric emergency rooms.^(1,2)

Parents often perceive fever as a disease process rather than a symptom or a sign of illness and they are under the impression that fever can be very harmful to children and try to use various methods to lower children's body temperature.^(3,4) In a recent study, 91% of caregivers thought that a fever could cause harmful effects. Seven percent of parents thought that if they did not treat the fever, it would keep going higher.⁽⁵⁾

Fever is the host's adaptive response to an invading microorganism. The microorganism comes into contact with cells of the immune system, including macrophages and leukocytes, and this contact leads to release of various cytokines, most notably interleukin-1, tumor necrosis factor, and interleukin-6. These cytokines circulate and come into contact with neuronal cell groups around the edges of the brain's ventricular system. Prostaglandin E_2 is then released and

binds to receptors on neurons in the hypothalamus and brainstem, leading to up-regulation of the hypothalamic thermostatic set point. Once the thermoregulatory center is reset, it maintains a higher body temperature through various mechanisms such as cutaneous vasoconstriction or shivering.⁽⁶⁾ Fever is an elevation in the body's core temperature that is mediated by an increase in the hypothalamic heat-regulating set point and is defined as core body temperature $\geq 38.0\text{C}$.^(7,8)

Infants and young children are particularly susceptible to fever because of their small body size, high ratio of body surface area to weight, and low amount of subcutaneous fat. Although most experts consider fever a beneficial physiologic response to the infectious process, it can lead to patient irritability and stress as well as high parental anxiety.⁽⁹⁾ In addition the common manifestations are anorexia, myalgia, arthralgia, and fatigue. These discomforts are worse when the temperature rises rapidly or exceeds 39.5C .⁽⁹⁾

Seizures associated with a fever occur in 3% to 4% of all children, usually in those between 6 months and 6 years of age. About 30% of children have subsequent febrile seizures; a younger age at onset and

a family history of febrile seizures are associated with increased incidence of recurring episodes. Simple febrile seizures lasting less than 10 minutes do not cause brain damage or other debilitating effects.⁽¹⁰⁾

Options for treating fever include physical methods and antipyretics. The antipyretic medications as paracetamol and Ibuprofen have been found to be effective at lowering temperature. Therefore, physicians usually prefer to prescribe antipyretic agents in addition to non-pharmacologic, physical fever reducing modalities.^(8,11)

Nurses report actively treating fevers to reduce fever and/or prevent febrile convulsions, to increase comfort and reduce parental anxiety.⁽¹²⁾ The most beneficial fever management strategies are those that enhance the physiological response to infection, promote comfort, and prevent dehydration and conserves energy. The effectiveness of traditional methods of fever management, such as cool sponging, is questionable. Sponging does not result in a sustained reduction in body temperature and can cause further distress and shivering.⁽⁴⁾

Evidence-based information recommends that management of febrile children is based on their responses to the febrile illness, and not on the temperature level itself. This includes maximizing the immunological benefits of fever (fever enhances the immunologic response to infectious agents), promoting comfort, preventing dehydration, conserving energy, aiding recovery, safe care of children during a febrile convulsion and educating parents in evidence-based fever management.^(13,14)

Magnitude of the problem

The researchers in this study have done the first report of head mist as a new method of decreasing children's body temperature. This is evidenced by no researches were done in Saudi Arabia related to effectiveness of head mist versus tepid sponging among febrile children. This research will provide a new intervention for decreasing body temperature among febrile children if its results are proven. In addition, it is easy to apply and no need to expose the child (removing the child's cloths to apply compresses).

Aim of the study

The aim of the study was to compare the effectiveness of head mist as a new modality of decreasing body temperature versus traditional method of tepid sponging among febrile children 1- 12 years at King Fahd Hospital of the University in Al Khobar City.

Hypothesis

Children aged 1 - 12 years old with fever and exposed to (30 minutes) head mist will exhibit more decreasing in their body temperature than those who received tepid sponging.

Materials and Method

Research Design

Randomized controlled trial study design was used in the present study

Setting

This study was conducted in the pediatric emergency department at King Fahd Hospital of the University in Al Khobar City.

Subjects

The study subjects included 50 children aged 1 – 12 years old, who came to the emergency department with fever during the period of data collection. They were divided randomly into two groups, 25 children enrolled in each. Group 1 received head mist and group 2 received tipped sponging to decrease their body temperature

Statistical Analysis of data

The collected data was coded, analyzed, and tabulated using IBM SPSS Statistics¹⁹. Descriptive statistics in the form of frequencies, percentages for the qualitative variables, mean and standard deviation for the quantitative variables was used. Nonparametric

Tests were used because the distribution of data was not normal. The tests used are Mann-Whitney Test, Wilcoxon test, Friedman test and Kruskal-Wallis Test. P value ≤ 0.05 was taken as statistically significant.

Results

Table (1) shows the comparison between children in the head mist and the tepid sponging groups related to their demographic characteristics. No statistical significant differences were found between children in the head mist and the tepid sponging groups regarding all items in the table. Mean \pm SD of age was 6.4 ± 4.3 and 6.6 ± 4.4 for children in the head mist and the tepid sponging groups respectively, $P > 0.05$. Males and females constituted in (60%) and (40%) respectively of children either in the head mist and the tepid sponging groups, $P > 0.05$. Regarding diagnosis, the table illustrates that 72% and 84% of children in the head mist and the tepid sponging groups respectively had Upper respiratory tract infections. In addition, 24% of children in the head mist group and 40% of them in the tepid sponging group received paracetamol at home 4 hours before coming to emergency

Table (1) Comparison between children in the head mist and the tepid sponging groups related to their age, gender and diagnosis

Items	Head Mist Group N= 25	Tepid Sponging Group N= 25	Tests and P. Value
Age (Years): Mean \pm SD	6.4 \pm 4.3	6.6 \pm 4.4	Z=0.363 P=0.7
Gender: Males Females	No (%) 15(60%) 10(40%)	No (%) 15(60%) 10(40%)	X ² = 0 P= 1
Diagnosis - Upper respiratory tract infections - Gastrointestinal diseases - Lower respiratory tract infection -Gastrointestinal and Upper respiratory tract infection - Fever of unknown cause	No (%) 18 (72%) 3 (12%) 1 (4%) 1 (4%) 2 (8%)	No (%) 21 (84%) 3 (12%) 0 (0%) 1 (4%) 0 (0%)	FET P= 0.5
Home treatment Children given paracetamol at home 4 hours before coming	No (%) 6 (24%)	No (%) 10 (40%)	X ² = 1.471 P= 0.2

FET= Fishers exact test

Table 2: presents the comparison between children in the head mist and the tepid sponging groups related to their body temperature before interventions, and at 15 minutes of the interventions. No statistical significant difference was found between body temperature of children in the head mist and the tepid sponging groups before the interventions, $P > 0.05$. Mean \pm SD of body temperature was 38.69 ± 0.44 °C and 38.71 ± 0.57 °C for the two groups respectively. At 15 minutes of the interventions, a statistical significant difference was observed between body temperature of children in the head mist and the tepid sponging groups with more prevalent of decreasing body temperature among children in the head mist group than those in the tepid sponging group. Mean \pm SD of body temperature was 38.3 ± 0.4 °C and 38.6 ± 0.55 °C for the two groups respectively, $P < 0.05$. There is Significant decreasing in body temperature of children in the two groups with high rate of decreasing among children in the head mist group. Mean \pm SD for differences between temperature before and at 15 minutes of the interventions was 0.36 ± 0.24 °C and 0.036 ± 0.49 °C among children in the head mist and those in the tepid sponging groups respectively $P < 0.001$.

In comparing children's body temperature before and at 15 minutes

of interventions in each group, the table demonstrated that there are statistical significant differences in both groups $P < 0.001$ and $P < 0.003$ for children in the head mist and the tepid sponging groups respectively.

Table (2) Comparison between children in the head mist and the tepid sponging groups related to their body temperature before the interventions, and 15 minutes of the interventions

Groups	Temp. before the intervention	Temp at 15 minutes of the intervention	Differences of Temp before and at 15 minutes	Wilcoxon test before and at 15 minutes
Head mist group Min- Max Mean \pm SD Median (IQR)	38.0 – 40.0 38.69 \pm 0.44 38.7 (0.5)	37.6 – 39.3 38.3 \pm 0.4 38.4 (0.4)	0.0 – 0.9 0.36 \pm 0.24 0.3 (0.3)	Z= 4.117 P < 0.001*
Tepid sponging group Min- Max Mean \pm SD Median (IQR)	38.0 – 40.2 38.71 \pm .57 38.5 (0.8)	38.0 – 40.1 38.6 \pm .55 38.5 (0.8)	– 0.0 0.1 0.036 \pm 0.49 0.00 (0.1)	Z= 3.00 P= 0.003*
Mann-Whitney Test	Z= 0.350 P= .726	Z= 2.144 P= 0.03*	Z= 5.07 P < 0.001*	

*Statistically significant differences

Table 3 demonstrates the comparison between children in the head mist and the tepid sponging groups related to their body temperature at 15 and 30 minutes of the interventions. At 30 minutes of the interventions, a statistical significant difference was observed between body temperature of children in the head mist and the tepid sponging groups with more prevalent of decreasing body temperature among children in the head mist group than those in the tepid sponging group. Mean \pm SD of body temperature was 38 \pm 0.45°C and 38.5 \pm 0.54°C for the two groups respectively, $P < 0.001$. The table also illustrates the differences in decreasing body temperature between 15 and 30 minutes in the 2 groups. It is observed that a statistical significant difference between body temperature of children in the head mist group and the tepid sponging groups with higher rate of decreasing among children in the head mist group, $P < 0.007$.

Table (3) Comparison between children in the head mist and the tepid sponging groups related to their body temperature at 15 and 30 minutes of the interventions

*Statistically significant differences

Groups	Temp at 15 minutes of the intervention	Temp at 30 minutes of the intervention	Differences of temp. between 15&30 minutes	Wilcoxon test at 15and 30 minutes
Head mist group Min- Max Mean \pm SD Median (IQR)	37.6 – 39.3 38.3 \pm 0.4 38.4 (0.4)	37.2 – 39.1 38 \pm 0.45 38.0 (0.5)	0.00-0.8 0.32 \pm 0.22 0.3 (0.35)	Z= 4.210 P < 0.001*
Tepid sponging group Min- Max Mean \pm SD Median (IQR)	38.0 – 40.1 38.6 \pm .55 38.5 (0.8)	37.8 – 39.9 38.5 \pm .54 38.3 (0.7)	0.00-0.3 0.16 \pm 0.0916 0.2 (0.1)	Z= 4.176 P < 0.001*

Mann-Whitney Test	Z= 2.144 P= 0.03*	Z= 3.370 P < 0.001*	Z= 2.7 P= 0.007*	
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Table 4 demonstrates the comparison between children in the head mist and the tepid sponging groups related to their body temperature before and 30 minutes of the interventions. There is significant decreasing in body temperature of children in the two groups with high rate of decreasing among children in the head mist group. Mean \pm SD for differences between temperature before and at 30 minutes of the interventions was 0.67 \pm 0.32°C and 0.19 \pm 0.086°C among children in the head mist group and those in the tepid sponging group respectively $P < 0.001$.

Table (4) Comparison between children in the head mist and the tepid sponging groups related to their body temperature before and 30 minutes of the interventions

*Statistically significant differences

Groups	Temp. before the intervention	Temp at 30 minutes of the intervention	Differences of Temp between before and at 30 minutes	Wilcoxon test before and at 30 minutes
Head mist group Min- Max Mean \pm SD Median (IQR)	38.0 – 40.0 38.69 \pm 0.44 38.7 (0.5)	37.2 – 39.1 38 \pm 0.45 38.0 (0.5)	0.2-1.2 0.67 \pm 0.32 0.6 (0.5)	Z= 4.380 P < 0.001*
Tepid sponging group Min- Max Mean \pm SD Median (IQR)	38.0 – 40.2 38.71 \pm .57 38.5 (0.8)	37.8 – 39.9 38.5 \pm .54 38.3 (0.7)	0.0-0.3 0.19 \pm 0.086 0.2 (0.1)	Z= 4.300 P < 0.001*
Mann-Whitney Test	Z= 0.350 P= .726	Z= 3.370 P < 0.001*	Z= 5.149 P < 0.001*	

Table 5: It illustrates the relationship between demographic characteristics of children in the two groups and Mean \pm SD differences in their body temperature before and at 30 minutes of the interventions. No statistical significant differences between Mean \pm SD differences of body temperature among children in the both groups and their age, weight and gender. Mean differences of body temperature among males and females children in the head mist group was higher than that those in the tepid sponging group (male 0.7 \pm 0.29°C and 0.17 \pm 0.09°C) (females 0.6 \pm 0.36°C and 0.22 \pm 0.06°C) for children in the head mist and those in the tepid sponging group respectively, $P > 0.05$

Table (5) Relation between demographic characteristics of children in the two groups and Mean \pm SD differences in their body temperature before and at 30 minutes of the interventions

Items	Descriptive of head mist group	Head Mist Group	Descriptive of tepid sponging Group	Tepid Sponging Group
		Correlation		Correlation
Age 1- 12 years		R= - 0.02 P= 0.9		R= 0.18 P= 0.4
Weight 9.8 – 63 Kg		R= - 0.12 P= 0.6		R= 0.16 P= 0.4
Sex Male Mean \pm SD Median (IQR)	0.7 \pm 0.29 0.7 (0.3)	Mann-Whitney Test	0.17 \pm 0.09 0.2 (0.1)	Mann-Whitney Test
Female Mean \pm SD Median (IQR)	0.6 \pm 0.36 0.5 (0.75)	Z= 0.92 P= 0.36	0.22 \pm 0.06 0.2 (0.1)	Z= 1.21 P= 0.23

R= Correlation

P= Probability of chance (significance)

SD=std. deviation IQR=interquartile range

Z= Man Whitney test

Table (6): It presents the relation between diagnosis and body temperature before and at 30 minutes of the interventions. No statistical significant differences were found in the two groups in relation to body temperature before and at 30 minutes of the interventions with their diagnosis

Table (6) Relation between diagnosis and body temperature before and at 30 minutes of the interventions

Items	Head Mist Group	Tepid Sponging Group	Head Mist Group	Tepid Sponging Group
	Minimum. - Maximum. Mean ± SD Median (IQR)	Minimum. - Maximum. Mean ± SD Median (IQR)		
Diagnosis	0.2- 1.1	0.0-0.3	Kruskal-Wallis Test X ² = 2.571 P= 0.632	Kruskal-Wallis Test X ² = 5.571 P= 0.069
Upper respiratory tract infections	0.6± 0.32 0.6 (0.5)	0.2±0.07 0.2 (0.1)		
Lower respiratory tract infection	1 (4)	0.00		
Gastrointestinal diseases	0.3- 1.1 0.7± 0.4 0.9	0.0-0.2 0.1±0.1 0.1		
Gastrointestinal and upper respiratory tract infection	1(4)	1 (4)		
Fever of unknown cause	0.6- 1.2 0.9± 0.4 0.9	0		

Table (7): It showed the relation between present complains and home treatment among children in the two groups and Mean ± SD differences of their body temperature before and at 30 minutes of the interventions. No statistical significant differences are found in the two groups in relation to mean ± SD differences of their body temperature before and at 30 minutes of the interventions and their present complaints with higher rate of mean ±SD differences of decreasing body temperature among children in the head mist group than those in the tepid sponging group P>0.05 . While statistically significant difference is found and Mean ± SD differences of their body temperature before and at 30 minutes of the interventions among children in the head mist group related to paracetamol received at home before coming to the hospital, P<0.05.

Table (7) Relation between children in the two groups with present complaint, Home treatment and Mean ± SD differences of their body temperature at 30 minutes of the interventions

Items	Head Mist Group	Tepid Sponging Group	Head Mist Group	Tepid Sponging Group
	Mini -maxi. Mean ± SD Median (IQR)	Mini - maxi. Mean ± SD Median (IQR)		
Present complain	0.6- 1.1	0.2-0.3	Mann-Whitney Test Z= 1.26 P= 0.206	Mann-Whitney Test Z= 0.66 P= 0.510
Fever only	0.9± 0.26 1.0	0.2±0.041 0.2 (0.03)		

Fever and others	0.2- 1.2 0.64±0.32 0.6 (0.5)	.0-0.3 0.18± 0.096 0.2 (0.2)		
Home treatment	0.2- 1.1 0.4±0.35 0.25 (0.45)	0.1-0.3 0.2±0.047 0.2 (0.0)	Mann-Whitney Test Z= 2.24 P= 0.025*	Mann-Whitney Test Z= 0.06 P= 0.95
Children given paracetamol at home				

Statistically Significant differences*

P= Probability of chance (significance) SD=std. deviation Min= minimum Max= maximum Z= Man Whitney test IQR= interquartile range

Discussion

Nursing management of fever in children is not often based on research and remains inconsistent in practice. (Watts et al, 2003)⁽¹⁵⁾ Several methods have been recommended to reduce fever in children, which include tepid sponging, fanning, alcohol sponging and antipyretics. However, controversy surrounds the use of tepid sponge for reduction of fever. The effectiveness of tepid sponging as a treatment alongside antipyretic varies between studies, with some finding that it is of no benefit and others suggesting that it is helpful (Sharber, 1997)⁽¹⁶⁾

Findings of the present study revealed that there is no statistical significant difference between children in the head mist and tepid sponging groups regarding their age, sex, diagnosis and home treatment before coming to the Emergency department for seeking medical advising as shown in table (1). Twenty four Percent of children in the head mist group and 40% of them in the tepid sponging group received paracetamol orally 4 hours or more before their coming to emergency department with no statistical significant difference. This finding is supported by Sullivan et al, 2011⁽¹⁷⁾ who stated that parents administer antipyretics even when there is minimal or no fever, because they are concerned that the child must maintain a “normal” temperature. Walsh and Edwards 2006⁽¹⁸⁾ conducted a systematic review revealing that parents’ knowledge about the normal temperature in children and the definition of fever is generally poor. Parents often actively reduce temperature with incorrect doses of antipyretics, even though the child has only a mild fever or even a temperature within normal fluctuations. Li et al. 2000⁽¹⁹⁾ studied the dosing of antipyretic by parents; showed 51% of the parents surveyed gave an inaccurate dose of acetaminophen or ibuprofen. Of the patients who received acetaminophen, 47% received too little acetaminophen and 15% received too much. Of the patients who received ibuprofen, 12% received too little ibuprofen and 14% received too much. Crocetti et al. 2009⁽²⁰⁾ studied the management of fever among Latino parents revealed 66% of parents gave their child antipyretic medicine for temperatures <100.3o F (38.0o C); 36% dosing ibuprofen less than every six hours and 10% dosing acetaminophen less than every four hours. The misuse of antipyretics was not only in dosage but also in timing and dosing interval. Under dosing is more common in younger children.

Results of the present study indicated that the most common medical diagnosis of children in the head mist and tepid sponging groups were upper respiratory tract infections followed by gastrointestinal diseases with no statistically significant difference as shown in table (1).

At 15 and 30 minutes of the interventions, statistical significant differences were observed between body temperature of children in the head mist and the tepid sponging groups with more prevalent of decreasing body temperature among children in the head mist group than those in the tepid sponging group. P<0.05. As shown in tables (2&3).

These findings are congruent with those obtained by (Watts, et al, 2003)⁽¹⁵⁾ who said that there is a lack of evidence to support the routine use of sponging in temperate climates/environments. Sponging does not produce a sustained effect in reducing temperature. In addition, there is a significant risk of increasing discomfort, which in turn may raise the child's temperature. In addition, they are suggested that there is minimal clinical benefit from sponging in temperate climates. Only small decreases in temperature were reported, often at the expense of the child's comfort. However, in certain circumstances, such as high environmental temperatures and humidity, or in situations where there is a need for immediate temperature reduction, sponging may be warranted. Moreover, a systematic review of evidence on physical methods of cooling in children found limited evidence from three small trials that tepid sponging plus paracetamol gave a better antipyretic effect than the drug alone, but that it was likely to cause shivering, goose pimples and crying. Tepid sponging for fever may cause the child discomfort and should be avoided as reported by (BMJ Group, 2008)⁽²²⁾. In addition, (Thomas et al, 2009)⁽²³⁾ found that addition of tepid sponging to antipyretic administration does not offer any advantage in ultimate reduction of body temperature in children; moreover it may result in additional discomfort.

Moreover, it was observed high prevalence of decreasing in body temperature of children in the head mist group of fever only compared with those of fever and other complains. There was a statistically significant difference found between body temperature of children in the head mist group and received medication at home compared with those in the tepid sponging groups as shown in table (7)

A study conducted by (Thomas et al, 2009)⁽²³⁾ stated the combination of sponging and administration of antipyretic drugs appears to lower temperature slightly more rapidly during the first 30 min while causing significantly more discomfort. To offset excessive heat production and restore normothermia, the body uses four processes, which are Convection, Radiation, Conduction and Evaporation

Conclusion

The head mist can be an effective and alternative way to tepid sponging to decrease body temperature of febrile children. Head mist is an easy method to decrease body temperature of children without the need to expose children specially school age children because it causes embarrassment for them.

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