

Thermal and Cardiorespiratory Newborn Adaptations During Hot Tub Bath: a Randomized Clinical Trial

ORIGINAL

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Abstract

Objective: To evaluate thermal and cardiorespiratory adaptation during hot tub bath and shower in healthy newborns in the first hours of life. Study design: This is a randomized blind controlled trial, registered in ReBEC (No. RBR-4z26f3) with 184 newborns divided into hot tub group (n=84) and shower (n=100). Newborns from intervention group were immersed in a hot tub with warm water up to the neck, without exposure to air flow, and control group received traditional shower. Heart rate, respiratory rate and temperature were measured before and immediately after bath by an investigator blinded to the type of bath.

Results: Groups were similar in gender, gestational age, birth weight, Apgar score at 5th minute and hours of life, $p \Rightarrow 0.05$. To analyze thermal and cardiorespiratory adjustments, difference between post-bath variables and pre-bath was calculated. In this analysis, it was found statistically significant difference between two types of bath regarding heart rate, respiratory rate and temperature. Hot tub bath decreases heart and respiratory rates and increases temperature, whereas shower provides the opposite effect (0.0001).


Conclusion: This study demonstrates that hot tub baths and shower, in healthy newborns, promote thermal and cardiorespiratory adaptations, reflecting thermal, cardiac and respiratory positive reactions after hot tub bath.

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Introduction

Despite bath stimulates circulation to skin providing comfort feelings and well-being and is associated as cultural activity, aimed at cleaning and protecting the outer covering of the body, it may cause thermal and cardiorespiratory changes in the newborn, as changes in heart rate, body temperature, respiratory rate and oxygen saturation. Such changes come from pain sensation caused by the procedure [1, 2].

However, among several non-pharmacological procedures to control neonatal pain, immersion in hot water, used in neonatal hot tub bath, might be used as physiologic stability tool [3, 4].

In the hot tub bath, the newborn (NB) is immersed in warm water up to the neck, without exposure to air flow, and restrained to avoid flexor pattern wrapped in towel-diaper, so as to avoid stress, motor clutter and energy expenditure and provide relaxation and pleasure to the NB [5].

Immersion in warm water promotes body heat gain and increases blood supply to the muscles. Besides improving venous return and increase respiratory rate, it also promotes muscle relaxation, decreases sensitivity in nerve terminals and heart rate due to depth of immersion [6].

The hypothesis in this study is that hot tub bath decreases cardiorespiratory and thermal variation of the newborn when compared to traditional shower. In this perspective, this study aimed to evaluate thermal (body temperature) and cardiorespiratory adaptations (heart and respiratory rates) during hot tub baths and shower in healthy newborns in the first hours of life.

Method

From May to September 2015, a randomized blind controlled clinical trial was held in the rooming unit of University Hospital Ana Bezerra, approved by the Ethics Committee of Federal University of Rio Grande do Norte - UFRN/FACISA (No. 352.851). Full stu-

dy protocol is available at ReBEC platform - Brazilian Registry of Clinical Trials - ReBEC (No. RBR-4z26f3).

After agreement term signed, newborns were divided into two groups, hot tub bath and shower. To determine allocation between groups, hot tub or shower, a simple randomization was performed. Newborn's mother chose between two sealed envelopes in the bathroom. The envelopes had the same color, size and weight, and contained only one option, hot tub or shower.

Participants

Sample calculation was performed considering mean and standard deviation of physiological parameters used Vignochi et al. [7] study, with immersion bath. Thus, it was adopted alpha value of 0.05, statistical power of 80% and a sample loss up to 5%. According to the presented calculation, 200 healthy infants were selected with gestational age ≥ 37 weeks, birth weight between 2500-3500g, clinically stable (without use of oxygen therapy, vasoactive drugs, anticonvulsants, antibiotics, sedatives and analgesics) hospitalized in the rooming unit of University Hospital Ana Bezerra, RN, Brazil. Newborns with changes in body temperature, lesions or skin infections were not included.

However, in data analysis, 16 newborns from hot tub group were excluded due to incomplete data collection. Final sample consisted of 184 newborns.

Instruments and Procedures

Hot tub bath was performed by the main investigator (SAP) using a transparent plastic bucket Sanremo[®] Brand, Model Zyk&Zuk. The bucket was placed on a bench support routinely used by the nursing staff and sanitized with chlorhexidine and 70% alcohol.

During baths in hot tub, NBs were wrapped in a towel with body semiflexed and gently placed in the water, to maintain body organization according to the action of buoyancy and flexion position in the

Figure 1: Bathtub and shower respectively.



A: Hot tub bath: newborn wrapped in a towel, body semiflexed and placed gently inside the bucket, in the water, in order to keep body organization under action of buoyancy and flexed leg position in the bucket.

B: Shower: newborn suspended by the caregiver's hand in ventral decubitus position and placed under the shower water jet. Baby's hygiene was held under the same patterns as in the bucket bath according to the following order: cleaning the head, trunk, limbs and cleaning genitals at the end

hot tub (**Figure 1**). For three minutes, NB was moved into the hot tub with soft and slow movements in semicircles, pendulum and voluntary movements caused by buoyancy and water flotation. In the last two minutes, cleaning was performed with neutral soap liquid, used routinely by nursing staff. At the end of the procedure, newborns were wrapped in dry towel and sent to the room.

For shower, we chose to keep the hospital routine, with the procedure run by NB's mother or caregiver. For shower, the routinely technique used by staff was applied (Figure 1). The newborn was suspended by the hand of the caregiver in prone position and placed under the shower water jet. Cleaning was carried out in the same hot tub bath standard procedures according to the following order: cleaning the head, trunk, limbs and genitals at the end. (**Figure 1**)

For both procedures, water temperature was maintained at 36.5-37°C (measured by bath thermometer Ibimboo®). Temperature, heart and respiratory rates were evaluated before and after bath immediately before or after with a range of up to 30 seconds, by an investigator blinded to the type

of bath. This investigator remained in NB's room during evaluation.

HR variable was measured with a portable monitor Risingmed® - RMS-500L, RR was the sum of thoracic movements for one minute and for temperature measures, a digital thermometer G-Tech® was used positioned in the left armpit.

All statistical analyzes were performed with SPSS® software, version 19 for Windows®. To check data normality, Kolmogorov test was performed and to observe effect of experimental factors (hot tub and shower) before and after, as well as their interactions, Student t test was used. We adopted a significance level $\alpha \leq 0.05$.

Results

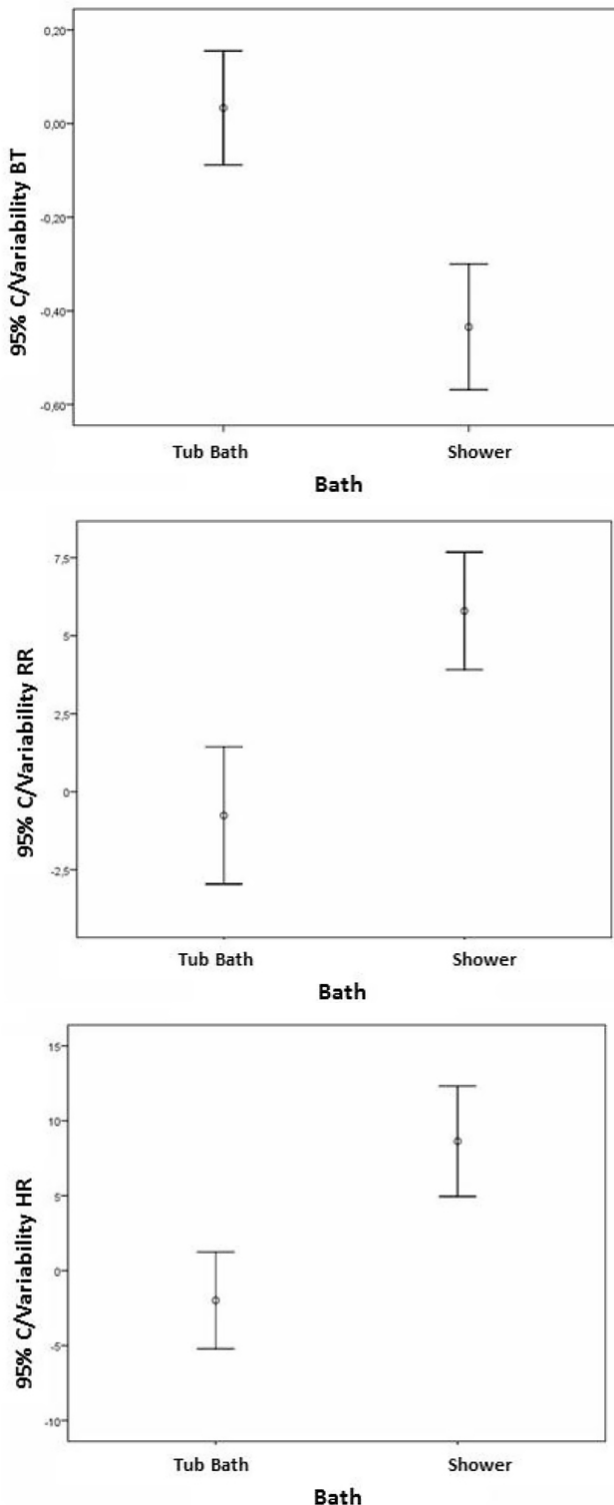
Two hundred infants were evaluated and 184 were included in the study, 84 in hot tub group and 100 in shower group. Groups were similar in gender, gestational age, birth weight, Apgar score at 5th minute and hours of life, $p \Rightarrow 0.05$. Table 1 shows sample characteristics. (**Table 1**)

Table 1. Summary about two groups.

	Hot bath tub group		Shower group		p
	N	%	N	%	
Sex					
Male	39	46	51	51	0.817
Female	45	54	49	49	
Gestacional Age	39±1.48		39±1.67		0.847
Birth weight	3052±446.86		3068±386.00		0.768
Apgar 5 minutes	9±0.6		9±0.5		0.839
Hours of life	18±10.87		19±11.71		0.238
$p \leq 0.05$ = statistical differences.					

For hot tub group, mean HR ranged before and after bath, from 115±16.97 beats per minute (beats/min) to 113±17.74 (beats/min), RR from 47±9.72 breaths per minute (bpm) to 47±11.63 (bpm) and T from 36.1±3.43° to 36.29±0.62 o. However, chan-

Figure 2: Differences between post-bath and pre-bath temperature (a), RR (b) and HR (c), showing statistically significant difference between two types of bath (0.0001)..



ges in HR, RR and T, pre and post shower was from 111 ± 15.64 (beats/min) to 120 ± 21.67 (beats/min), from 48.44 ± 13.93 (bpm) to 54.04 ± 13.28 (bpm) and from 36.3 ± 0.53 to 35.86 ± 0.74 , respectively.

To analyze thermal and cardiorespiratory changes, difference between post-bath and pre-bath temperature, RR and HR, for two procedures was calculated. In this analysis, RR and HR decreased with hot tub bath, -0.83 ± 11.00 bpm and -1.98 ± 16.17 beats/min and increased with shower, 5.80 ± 9.13 bpm and 8.63 ± 17.89 beats/min. Temperature increased $0.033 \pm 0.60^\circ$ in hot tub bath, and decreased $-0.043 \pm 0.65^\circ$ in shower, showing a statistically significant difference between two types of bath, for all studied variables (0.0001). (Figure 2).

Discussion

This study demonstrates that hot tub baths and shower promote thermal and cardiorespiratory adaptations in healthy newborns, reflecting thermal, cardiac and respiratory positive reactions after hot tub bath.

If we consider that temperature decrease impairs cardiorespiratory and thermal organization of the newborn, resulting in undesirable effects by increasing hospitalization time and, consequently, health care costs [8], and that maintenance of body temperature is one of the determining factors for success of cardiovascular and respiratory adaptation in the newborn, our results reinforce indication of hot bath and reject shower in healthy newborns.

Darmstadt and Dinulos [9] report that while shower has cultural and aesthetic conception and interpersonal benefits, it might induce crying, lead to hypothermia, higher oxygen consumption and destabilize vital signs, which does not favor physical and physiological well-being of the newborn, justifying our data.

Although newborn behavioral state was not assessed during baths, we believe that shower may result in behavioral stress. Shower increased heart

and respiratory rates and decreased temperature, which shows physiological change and explains a possible behavioral stress.

These data corroborate results of Edraki et al. study, a randomized double-blind clinical trial with 50 preterm newborns divided into immersion bath and shower. Authors demonstrate that loss of body temperature during shower may be associated with newborn exposure to air flow [5].

Despite there is also heart rate increase during immersion in hot tub bath, as a result of lung blood flow increase, cardiac output and energy consumption [10], in this study, it was associated only to shower, confirming stress caused by handling and overexposure [8].

Bath should be pleasurable for the mother and child and should provide opportunities for interaction. It must be focused on humanization and the staff put efforts to include families in all its aspects [11].

In fact, it is believed that hot tub bath is a situation that provides these exchanges and interactional adjustments between mother and child, providing comfortable touch and relaxation [12]. This relaxation was reflected by decrease in respiratory rate observed only in hot tub bath.

Souza & Medeiros [13], in an observational study with 35 preterm to compare the effects of immersion bath and shower, report that immersion bath generates appropriate stimulus for the NB providing better organization and adaptation to the environment, the study evaluated responses from autonomic subsystems such as skin color, heart and respiratory rates and regular visceral signs. The authors also stated that although the bath is a procedure with high level of manipulation, it was not found heat loss or increase in infection cases [13].

The main study limitation was the performance of different people between two types of bath. In the attempt to create a human environment during the bath, it was decided to keep the routine already used in the hospital as a comparative effect to the

proposed change in the protocol, so that we kept the mother handling the shower and included a new routine with hot tub bath performed by the main investigator of this study.

Conclusion

Hot tub baths and shower promote thermal and cardiorespiratory adaptations in healthy newborns, reflecting thermal, cardiac and respiratory positive reactions after hot tub bath.

List of Abbreviations

ReBEC= Brazilian Registry of Clinical Trials

HR= heart rate

RR= respiratory rate

T= temperature

NB = newborn

UFRN= Federal University of Rio Grande do Norte

FACISA= Faculty of Health Sciences of Trairi

Beats/min= beats per minute

Bpm= breaths per minute

Conflicts of Interest

The other authors declare no conflicts of Interest

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