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BENEFITS OF NON-PHARMACOLOGICAL INTERVENTIONS IN NEWBORNS AND INFANTS

SYSTEMATIC REVIEW

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ABSTRACT

Introduction: Needle procedures are those to which newborns and infants are most frequently submitted. Pain control during these procedures is especially important in this vulnerable population.

Objective: to identify and synthesize the benefits of non-pharmacological interventions in needle procedures in newborns and infants.

Methods: followed the review methodology and quality assessment of studies of the Joanna Briggs Institute. We included studies that analyzed non-pharmacological interventions in newborns and infants in the following procedures: heel puncture, venipuncture and injectable vaccine administration. We conducted a survey of the EBSCO and PubMed databases, with the time interval between 2013 and 2017. 186 articles were identified and 14 randomized controlled trials were included in the review.

Results: a reduction in the degree of pain is highlighted as a major benefit, it also checks reduction of crying time, improvement in hemodynamic parameters and decrease in irritability and stress signals.

Conclusion: non-pharmacological interventions with needle procedures have notable benefits, being more effective when used in combination.

Keywords: Systematic review (MeSH); non-pharmacological interventions; newborns (MeSH); infants (MeSH); painful procedures (MeSH).

INTRODUCTION

Painful procedures, whether diagnostic or therapeutic, are the most frequent cause of pain in a child who uses health services. Pain associated with procedures is caused by actual or potential tissue damage and is an unpleasant sensory and emotional experience, usually accompanied by fear and anxiety[1].

Pain control in the child becomes even more important and is a duty of health professionals and a children's rights. Children undergoing painful procedures where pain control is not adequate make the child more vulnerable to pain[2].

Uncontrolled pain takes on special prominence in the beginnings child's life, in infants presumed to cause changes in pain response and in preterm newborns may compromise brain development[2]. Repeated pain stimuli have short-term consequences such as hemodynamic, immune and respiratory changes and long-term consequences, namely,

changes in brain development, somatizations, regressions, coordination difficulties, and behavioral changes that may persist in later life[3,4].

Currently in Portugal 8 in 100 children are born prematurely[5]. Preterm newborns because of their condition, are subjected to extended periods of hospitalization in neonatal intensive care and many painful procedures daily[4,6]. In this context, the most frequently performed painful procedures are heel stick and venipuncture[4].

On the other hand, the administration of injectable vaccines stands out as the major source of iatrogenic pain in childhood, is repeated several times throughout childhood, with a higher incidence in the first year of life, and constitutes a source of stress for the child. It is estimated that 25% of adults are afraid of needles and most of that fear will have been developed in childhood[7].

Therefore, needle procedures are the most performed and more frequently in newborns and infants, such as heel stick, venipuncture and administration of injectable vaccines[6].

There is currently a range of non-pharmacological interventions with proven efficacy that can safely be applied, reducing pain and anxiety caused by the majority of invasive procedures in infants[1].

Non-pharmacological pain relief interventions indicated for newborns and infants include sugary solutions, breastfeeding, non-nutritive sucking, maternal kangaroo, distraction and facilitated tucking or swaddling[1,3,6,7,8].

The purpose of these interventions is to reduce pain sensation and/or perceived pain, decrease stress behaviors and promote self-control[3,6,9]. The use of non-pharmacological interventions during painful procedures also reduces parental stress, can be independently adopted by nurses, and does not incur significant costs to institutions[9]. Its effectiveness is greater when used together, thus allowing the combination and coordination of pain relief strategies[7].

Due to the need to control pain in procedures, non-pharmacological interventions have been the target of several studies over the last years, thus allowing a better understanding of its mechanism of action, its efficacy and applicability. Its use in a vulnerable population such as newborns and infants requires a thorough and systematized knowledge of its benefits and recommendations.

Therefore, this review aims to identify and systematize the benefits of non-pharmacological interventions in needle procedures in newborns and infants, comparing with the same procedures without the application of these interventions. Thus,

based on evidence-based research, it was formulated as research question guiding this review: what are the benefits of non-pharmacological interventions in needle procedures in newborns and infants?

METHOD OF SYSTEMATIC REVIEW

The elaboration of this systematic review followed the methodology indicated by Joanna Briggs Institute[10]. In this sense, the research question was elaborated according to the PICOD methodology (Participants, Intervention, Comparisons, Outcomes, Design). Considering the research question, inclusion criteria were outlined in order to select the studies:

- Population: newborns and infants (up to 12 months of age);
- Intervention: non-pharmacological interventions in needle procedures (heel stick, venipuncture and intramuscular vacines administration);
- Outcomes: benefits of non-pharmacological interventions;
- Design: experimental randomized controlled trials.

The research was carried out in the databases that make up the search engine EBSCO and in PubMed, using as a lower limit the year of 2013 and maximum limit the year of 2017 and took place between October and November of 2017. They were considered for inclusion in this review studies written in Portuguese, English and Spanish. The following keywords and booleans were used: *non-pharmacological interventions* AND *pain procedures* AND *infant* AND *newborn; non-pharmacological interventions* AND *needle procedures* AND *infant; venipuncture* AND *pain procedures* AND *infant* AND *newborn; immunization* AND *pain management* AND *infant*.

The selection process took place in three stages, initially the titles of the articles found were analyzed. The process of inclusion/exclusion of articles was continued through the reading of the abstract. Those whose abstract fit the review´s goals and that were in accordance with the defined inclusion criteria were analyzed in full. The references of all articles examined in full were analyzed in order to identify additional studies, which led to the inclusion of studies from other sources in this systematic review (figure 1).

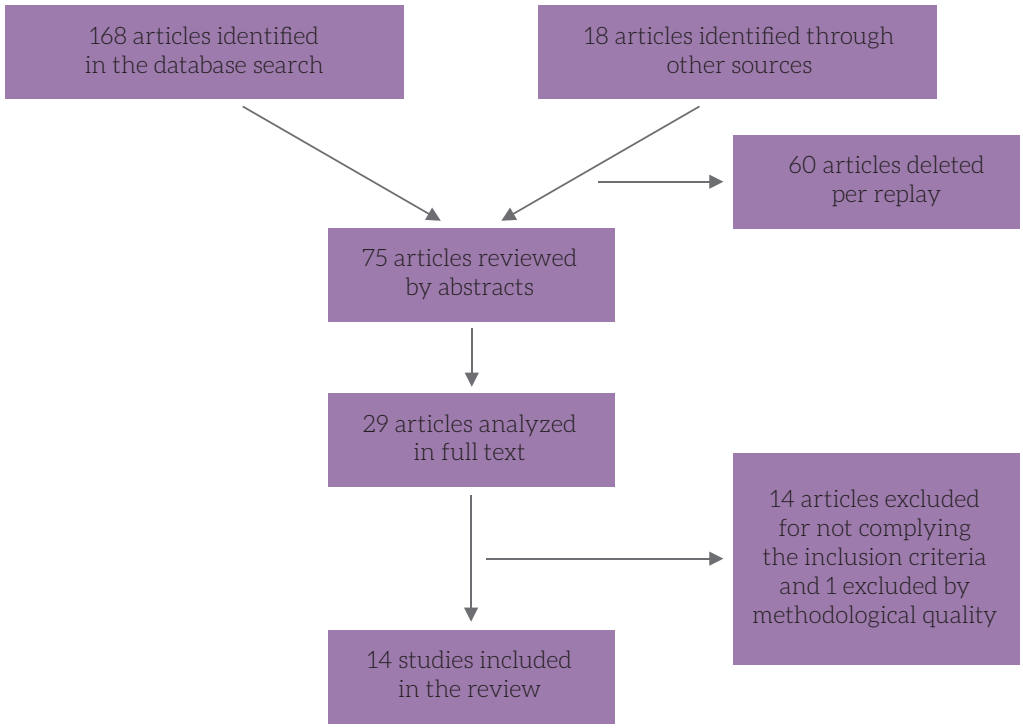

Figura 1 – Flow chart of the study selection process.

The methodological quality of the studies included in the review was evaluated using the critical evaluation tools of the Joanna Briggs Institute - Critical Appraisal Checklist for Experimental Studies[10], considering as a factor of inclusion in the review the positive response to at least eight of the points evaluated in this grid. The assessment of methodological quality of studies was done by two reviewers independently.

The data extraction and synthesis process was performed using tables to facilitate the analysis of the studies, which included the following aspects: study identification, country and date, study objective, study design, number and type of participants, intervention or phenomenon of interest, results and main conclusions. At this stage of the review process there was also the contribution of two reviewers.

Finally, synthesis of the results obtained, namely the benefits of non-pharmacological interventions in the studied procedures are described in narrative summary format.

RESULTS

After the process of selection and analysis of the studies, 14 studies were included for presentation and discussion of results. The studies included were developed in several countries and are distributed as follows: India (4 studies), Taiwan (3 studies), China (2 studies), Turkey, Canada, Hong Kong, Iran and Spain (1 study each).

Relative to study participants, the size of the samples included in this review varied between 20 and 617 participants. The characteristics of the participants ranged from preterm newborns in 8 studies, term newborns in 4 studies, and infants in 2 studies.

Regarding the needle procedures studied, heel stick was the procedure most often found in the included studies (10 studies), followed by the administration of injectable vaccines (3 studies) and, less frequently, venipuncture (1 study).

In the methodological aspect, all studies included are experimental randomized controlled trials and in all there comparison between variables. In 12 studies, in the control group the absence of non-pharmacological intervention is verified and in 2 studies a comparison is made between the different non-pharmacological interventions.

Table 1 presents a summary of the extracted data in order to systematize, visualize and compare the results.

Table 1 - Methodological characteristics of included studies and main results.

Identification of the study	Drawing and Participants	Interventions/Phenomena of Interest	
S1 Liaw J, Yang L, Lee C, Fan H, Chang Y, Cheng L. Effects of combined use of non-nutritive sucking, oral sucrose, and facilitated tucking on infant behavioural states across heel-stick procedures: A prospective, randomised controlled trial International Journal of Nursing Studies [serial on the Internet]. 2013; 50, 883-894. Available from: http://dx.doi.org/10.1016/j.ijnurstu.2012.08.021	- Controlled randomized prospective trial - 110 preterm newborns (Gestational age (GA) between 26 and 37 weeks)	- Heel Stick	- Four combinations of non-pharmacological interventions: non-nutritive sucking (nns) + oral sucrose + facilitated tucking; snn + oral sucrose; facilitated tucking+ oral sucrose; snn + facilitated tucking; versus routine care (none of these interventions).
	RESULTS: The four combinations of non-pharmacological interventions studied reduce agitation during heel stick, obtained less irritability and crying compared to the control group. The groups that received the combinations of nns + sucrose + facilitated tucking and nns + sucrose showed more periods of quiet sleep, respectively 52.8% and 42.6%, in the recovery phase after the procedure. The combined use of sucrose + facilitated tucking, nns + sucrose and nns + sucrose + facilitated tucking are effective in reducing irritability and crying during heel stick, compared to the absence of these interventions.		
S2 Thakkar P, Arora K, Goyal K, Das R, Javadekar B, Aiyer S, Panigrahi S. To evaluate and compare the efficacy of combined sucrose and non-nutritive sucking for analgesia in newborns undergoing minor painful procedure: a randomized controlled trial. Journal of Perinatology. [serial on the Internet]. 2015; 1-4. Available from: https://www.ncbi.nlm.nih.gov/pubmed/26583940	- Controlled randomized trial - 180 term newborns	- Heel Stick	- Newborns allocated in 4 groups. Non-pharmacological interventions studied: 30% sucrose, non-nutritive suction and the combination of sucrose + non-nutritive suction.
	RESULTS: The mean value of pain obtained through the application of the PIPP (Premature Infant Pain Profile) scale decreases significantly in all of the interventions. The combination of sucrose + non-nutritive suckling presented the lower mean value in the PIPP scale in relation to the two groups in which the interventions were applied alone. The duration of crying (in seconds) is lower in the group where the combination of oral sucrose + non-nutritive suction was applied. In the control group the duration of crying is significantly higher.		

Table 1 - Methodological characteristics of included studies and main results.

Identification of the study	Drawing and Participants	Interventions/Phenomena of Interest	
S3 Hsieh Ksieh K, Chen S, Tsao P, Wang C, Huang C, Lin C, et al. The analgesic effect of non-pharmacological interventions to reduce procedural pain in preterm neonates. Pediatrics and Neonatology. [serial on the Internet]. 2017; xx, 1-6. Available from: https://www.ncbi.nlm.nih.gov/pubmed/28736177	- Prospective experimental trial - 20 preterm newborn (GA between 26 and 35 weeks)	- Heel Stick	- Each participant underwent four non-consecutive heel stick. Interventions studied: breast milk administration, 10% dextrose, distilled water (placebo) and no intervention (control group).
	RESULTS: The degree of pain assessed with the PIPP scale is significantly lower when breast milk is administered at all observation phases, compared to the placebo group and the control group. There is also a significant difference in reducing the degree of pain between the 10% dextrose group and the control group. There is no significant difference in the degree of pain in the following combinations: breast milk / 10% dextrose, 10% dextrose / placebo and placebo / control group. Administration of breast milk and 10% dextrose appears to be effective in reducing the degree of pain, maternal milk administration show slightly lower pain scores as compared to 10% dextrose.		
S4 Gao H, Xu G, Gao H, Dong R, Fu H, Wang D. et al. Effect of repeated Kangaroo Mother Care on repeated procedural pain in preterm infants: A randomized controlled trial. International Journal of Nursing Studies. [serial on the Internet]. 2015; 52, 1157-1165. Available from: https://www.ncbi.nlm.nih.gov/pubmed/25912524	- Randomized controlled trial - 75 preterm newborns	- Heel Stick	- Each newborn group was submitted to 4 non-consecutive heel stick and divided into 2 groups (control and intervention). In intervention group, neonates were subjected to the first heel stick without any non-pharmacological intervention and the following 3 heel sticks were subjected to skin to skin contact (maternal kangaroo) 30 minutes before, during and after the procedure.
	RESULTS: heart rate (HR), crying duration and facial expression (includes expressions of pain such as brow furrowing, ocular force and nasolabial sulcus) are significantly lower in the group submitted to maternal kangaroo compared to the control group in the three phases of observation (before heel stick, during blood collection and recovery period). In the recovery period, the maternal kangaroo group returned to the HR values present before starting the procedure, while the control group maintained HR significantly higher than the baseline value.		
S5 Desjardins M, Gaucher N, Curtis S, LeMay S, Lebel D, Gouin S. A Randomized controlled trial evaluating the efficacy of oral sucrose in infants 1 to 3 months old needing intravenous cannulation. Academic Emergency Medicine. [serial on the Internet]. 2016; 23(9), 1048-53. Available from: https://www.ncbi.nlm.nih.gov/pubmed/27098499	- Randomized controlled trial - 87 infants (between 1 and 3 months of age)	- Venous puncture	- Infants allocated in 2 groups: in the intervention group received 2ml oral sucrose before the procedure; in the control group infants received 2 ml of water (placebo).
	RESULTS: The degree of pain assessed by NIPS (Newborn Infant Pain Scale) and FLACC (Face, Legs, Activity, Cry and Consolability) scales which revealed no significant difference between the two groups. Variations in HR are also similar in the two groups. Only the mean duration of crying time revealed significant differences, being substantially lower in the sucrose group (17 seconds) than in the placebo group (41 seconds).		

Table 1 - Methodological characteristics of included studies and main results.

Identification of the study	Drawing and Participants	Interventions/Phenomena of Interest	
S6 Ho L, Ho S, Leung D, So W, Chan C. A feasibility and efficacy randomised controlled trial of swaddling for controlling procedural pain in preterm infants. Journal of Clinical Nursing. [serial on the Internet]. 2015; 25, 472-482. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1111/jocn.13075	- Randomized controlled trial - 54 preterm newborns (GA between 30 and 37 weeks)	- Heel stick	- In the intervention group, swaddling was done to the newborns a few minutes before starting the procedure; the control group did not receive any pain control intervention.
	RESULTS: the degree of pain was evaluated through the PIPP scale, which is significantly lower in the group submitted to swaddling. Changes in HR and oxygen saturation values are significantly lower in the swaddling group. The group submitted to swaddling returns to baseline values 2 minutes after the procedure, whereas in the control group this is only verified 6 minutes after the procedure.		
S7 Leng H, Zheng X, Zhang X, He H, Tu G, Fu Q, et al. Combined non-pharmacological interventions for newborn pain relief in two degrees of pain procedures: a randomized clinical trial. Eur J Pain. [serial on the Internet]. 2016; 20, 989-997. Available from: https://onlinelibrary.wiley.com/doi/abs/10.1002/ejp.824	- Randomized controlled trial - 617 term newborns	- Heel Stick (Shallow and deep)	- Newborns divided into 4 groups, each group submitted to non-pharmacological interventions for pain relief: oral sucrose, oral sucrose + non-nutritive suction, oral sucrose + swaddling and oral sucrose + non-nutritive suction + swaddlling.
	RESULTS: The oral sucrose + nns + swaddlling group had the lowest pain grade, evaluated through the Revised Neonatal Facial Coding System (RNFC). A significant analgesic synergistic effect is observed between the oral sucrose + non-nutritive suction group and the oral sucrose + swaddling group in the shallow and deep heel stick. In the deep heel stick the sucrose + nonnutritive suction group presented a significant difference in a lower increase in HR and a decrease in oxygen saturation than in the oral sucrose group, but this difference is not observed in the shallow heel stick. No differences were observed between the oral sucrose and oral sucrose + swaddling groups in the physiological parameters.		
S8 Goswami G, Upadhyay A, Gupta N, Chaudhry R, Chawla D, Sreenivas V. Comparison of Analgesic Effect of direct Breastfeeding, Oral 25% Dextrose Solution and Placebo during 1st DPT Vaccination in Healthy Term Infants: A Randomized, Placebo Controlled Trial. Indian Pediatrics. [serial on the Internet]. 2013; 50, 649-653. Available from: https://www.ncbi.nlm.nih.gov/pubmed/23502661	- Randomized controlled trial - 120 infants (between 6 weeks and 3 months of age)	- Intramuscular (IM) vaccine administration	- Infants divided into 3 groups: infants breastfed before, during and after the procedure; infants who were given 2 ml of 25% dextrose before the procedure and control group which was given 2 ml of distilled water before the procedure.
	RESULTS: The duration of crying was significantly lower in the breastfed group and in the 25% dextrose group compared to control group. The degree of pain assessed by MFCS (Modified Neonatal Facial Coding Score) at 1 st and 3 rd minute was significantly lower in the breastfed group and in the 25% dextrose group, compared to the control group.		

Table 1 - Methodological characteristics of included studies and main results.

Identification of the study	Drawing and Participants	Interventions/Phenomena of Interest	
S9 Nimbalkar S, Chaudhary N, Gadhavi K, Phatak A. Kangaroo Mother Care in Reducing Pain in Preterm Neonates on Heel Prick. Indian J Pediatr. [serial on the Internet]. 2013; 80(1), 6-10. Available from: https://www.ncbi.nlm.nih.gov/pubmed/22544676	- Randomized controlled trial - 50 preterm newborns (GA between 32 and 36 weeks)	- Heel Stick	- Newborns divided into 2 groups: group submitted to the procedure during maternal kangaroo initiated 15 minutes before and control group, submitted to the procedure without any intervention of pain control.
	RESULTS: The degree of pain assessed through the PIPP scale was significantly lower in the maternal kangaroo group. All components evaluated in PIPP were significantly lower in the group submitted to maternal kangaroo, with the exception of oxygen saturation that did not have significant alterations in the two groups. The short-lived kangaroo seems to be effective in controlling pain during heel stick.		
S10 Modarres M, Jazayeri A, Rahnama P, Montazer A. Breastfeeding and pain relief in full-term neonates during immunization injections: a clinical randomized trial. BMC Anesthesiology. [serial on the Internet]. 2013; 13:22. Available from: https://bmcanesthesiol.biomedcentral.com/articles/10.1186/1471-2253-13-22	- Randomized controlled trial - 130 term newborns	- IM vaccine administration	- Newborns divided into 2 groups: in the intervention group, were breastfed before, during and after administration of the vaccine; at the control group, the newborns were only held in mother's arms.
	RESULTS: The breastfed group presented a significantly lower pain grade than in the control group, pain assessed through the DAN (Douleur Aigue du Nouveau-Né) scale. The three parameters evaluated in the DAN scale, facial expression, limb movements and vocal expression presented significantly lower values in the breastfed group.		
S11 Gabriel M, Mendoza B, Figueroa L, Medina V, Fernández B, Rodríguez M, et al. Analgesia with breastfeeding in addition to skin-to-skin contact during heel prick. Arch Dis Child Fetal Neonatal Ed. [serial on the Internet]. 2014; 98, 499-503. Available from: http://fn.bmj.com/content/early/2013/07/08/archdischild-2012-302921	- Randomized controlled trial - 136 term newborns	- Heel Stick	- Newborns randomly divided into 4 groups: breastfed group with skin to skin contact; sucrose group + skin-to-skin contact; skin to skin contact group and sucrose group.
	RESULTS: Breastfeeding in conjunction with skin to skin contact showed significantly lower values of pain assessed on the NIPS scale, compared to the other groups. The percentage of newborns with moderate-severe pain was also lower in the breastfeeding + skin-to-skin contact group. Both groups (breastfeeding + skin-to-skin contact and sucrose + skin-to-skin contact) achieved a lower percentage of crying duration compared to the skin-to-skin contact group.		

Table 1 - Methodological characteristics of included studies and main results.

Identification of the study	Drawing and Participants	Interventions/Phenomena of Interest	
S12 Kucukoglu S, Aytekin A, Celebioglu A, Celebi A, Caner I, Maden R. Effect of White Noise in Relieving Vaccination Pain in Premature Infants. Pain Management Nursing. [serial on the Internet]. 2016; 17(6), 392-400. Available from: https://www.ncbi.nlm.nih.gov/pubmed/27751753	- Randomized controlled trial - 75 preterm newborns (GA between 28 and 32 weeks)	- IM vaccine administration	- Newborns randomly divided into two groups. Experimental group was exposed to white noise near the crib, one minute before vaccination; group was not exposed to any intervention.
	RESULTS: HR was significantly lower in the experimental group, compared to the control group. Respiratory rate is lower in the experimental group after vaccination. The degree of pain assessed with the PIPP scale was significantly lower in the experimental group.		
S13 Sundaram B, Shrivastava S, Pandian J, Singh V. Facilitated tucking on pain in pre-term newborns during neonatal intensive care: A single blinded randomized controlled cross-over pilot trial. J Pediatr Rehabil Med [serial on the Internet]. 2013; 6(1), 19-27. Available from: https://www.ncbi.nlm.nih.gov/pubmed/23481888	- Randomized controlled trial - 20 preterm newborns	- Heel Stick	- Newborns randomly assigned to two groups: experimental group used facilitated tucking; control group without any intervention.
	RESULTS: There was a significant difference in the reduction of the degree of pain assessed in the PIPP scale in the group submitted to facilitated tucking in all moments evaluated (at 30, 60, 90 and 120 seconds).		
S14 Yin T, Yang L, Lee T, Li C, Hua Y, Liaw J. Development of atraumatic heel-stick procedures by combined treatment with non-nutritive sucking, oral sucrose, and facilitated tucking: A randomised, controlled trial. Int J Nurs Stud. [serial on the Internet]. 2015; 52(8),1288-99. Available from: https://www.ncbi.nlm.nih.gov/pubmed/25939641	- Randomized controlled trial - 110 preterm newborns	- Heel Stick	- Newborns allocated in 5 groups with different combinations of interventions: non-nutritive suction + facilitated tucking; oral sucrose + facilitated tucking; non-nutritive suction + sucrose; non-nutritive suction + sucrose + facilitated tucking; control group.
	RESULTS: the frequency of stress behaviors significantly decreases when newborns receive combinations of non-pharmacological interventions before heel stick procedures. Specifically, frequency of facial expression (grimace) decreased significantly in newborns who received non-pharmacological interventions, and in the non-nutritive sucking + sucrose + facilitated tucking group where the greatest decrease was observed. Moreover, the frequency of signs of stress such as squirming or limb extension decreased significantly in the non-nutritive + sucrose + facilitated tucking group compared to those receiving routine care.		

INTERPRETATION OF RESULTS

Different non-pharmacological interventions were studied in two ways, either alone or in combination. The administration of sugary solutions was the most frequently studied intervention, being present in 8 studies (S1, 2, S3, S5, S7, S8, S11, S14). Non-nutritive sucking was analyzed in 4 studies (S1, S2, S7, S14), breastfeeding was analyzed in 3 studies (S10, S8, S11) and breast milk administration (by syringe) was evaluated in only one study (S3). Regarding containment, facilitated tucking was evaluated in 3 studies (S1, S13, S14) and swaddling in 2 studies (S6, S7). Skin-to-skin contact, also described as maternal kangaroo, was evaluated in 3 studies (S4, S9, S11) and distraction was analyzed only in one study (S12).

The studies analyzed in this systematic review identified several benefits in the use of non-pharmacological interventions in needle procedures in newborns and infants.

The decrease in the degree of pain obtained by the application of non-pharmacological interventions appears as the benefit most often found in the studies analyzed. It was verified in 9 studies that there is a lower degree of pain in the groups where non-pharmacological intervention was applied, compared to the control group, with a statistically significant difference (S2, S3, S6, S7, S8, S9, S10, S12, S13). Two other studies (S11, S7) also obtained similar results, that is, decrease of the degree of pain through the application of non-pharmacological interventions, however, in these studies the comparison was made between different interventions and not with control group, emphasizing, the combination of breastfeeding with skin-to-skin contact in the first study, and the combination of oral sucrose, non-nutritive sucking and swaddling in the second study were the most effective interventions for reducing pain associated with the heel stick procedures.

The results that point to the reduction of pain through the application of non-pharmacological interventions are in agreement with the results obtained by Pillai et al. [11], in a systematic review on the subject. From the studies included in this review, only one (S5) showed no statistically significant reduction of the degree of pain by applying the non-pharmacological intervention (sucrose) in the venipuncture procedure. It should be noted that this procedure was studied only in one of the studies included in the review, and therefore, there is a difficulty in the generalization of results and the need to continue the investigation in this procedure.

The reduction in crying time during and after the procedure found in six trials (S1, S2, S4, S5, S8, S11) revealing also as one of the benefits of applying non-pharmacological interventions. Other findings in the current literature are in agreement with these results, Harrison et al.[12], also reported benefits in reducing crying time, namely when breastfeeding was used as a non-pharmacological intervention.

Another of the benefits indicated by non-pharmacological interventions is at the level of hemodynamic parameters. The use of these interventions shows minor changes in heart rate, either at the time of the procedure or in the recovery period (S4, S6, S7, S12). Regarding oxygen saturation, it was verified that the use of non-pharmacological interventions decreases the oscillations of this value during needle procedures (S6, S7). Kucukoglu et al.[13] also reported benefits in respiratory rate, in their study (S12) revealed that this parameter is lower after the procedure when distraction is used as a non-pharmacological intervention. In contrast, in the study of Nimbalkar et al.[14], no significant oscillations in oxygen saturation were reported with the application of non-pharmacological intervention (S9).

However, comparing with data found in the current literature, the benefits in the physiological parameters seem to be evident, as Johnston et al.[15] show in a systematic review focusing on skin-to-skin contact.

The facial expression in the newborn is one of the pain indicators most used by health-care professionals, including the presence of signals as groove above and between the eyebrows, palpebral fissure compression, nasolabial folds and chin tremor[16]. There are benefits in the facial expression of the newborn in two of the studies analyzed (S14, S4), namely with the application of skin-to-skin contact and the combination of non-nutritive suction, sucrose and facilitated tucking.

Other benefits of non-pharmacological interventions, such as decreased irritability and sleep improvement after the procedure (S1) and decreased signs of stress (S14), were also investigated.

It seems to be evident from the results obtained that the use of non-pharmacological interventions in combination has greater benefit than its use alone. The studies analyzed emphasize combinations of oral sucrose and non-nutritive suction (S2), oral sucrose, non-nutritive suction and swaddling (S7), breastfeeding and skin-to-skin contact (S11) and sucrose, non-nutritive suction and facilitated tucking (S14).

Another aspect that deserves attention after the analysis is related to the different sugar solutions used. In the studies analyzing the benefit of sugar solutions different solutions were used with various concentrations, namely, 20% sucrose (S1; S14), 30% sucrose (S2), 88% sucrose (S5), 24% sucrose (S7, S11), 10% dextrose (S3) and 25% dextrose (S8). However, despite these variations in all studies the benefits of its use were evident. These data allow us to infer that the type and concentration of the solution is not directly related to its benefit. Corroborating this conclusion, Kassab et al.[17] confirm that no conclusive data are available on the most effective type of sugar solution concentration.

The studies included in this systematic review are all randomized controlled trials, which according to the Joanna Briggs Institute are the ones with the highest level of evidence[10]. Regarding the characteristics of the sample, the reviewed studies are mostly samples of convenience, this type of sample includes the subjects available on the place at the time of data collection, however these may have different characteristics from the target population of the study.

Being objective of this review study the benefits of non-pharmacological interventions in newborns and infants, it is verified that only in two studies the sample is composed of infants aged between 1 and 3 months. This constitutes a limitation, in relation to evaluation of the benefits of non-pharmacological interventions in infants between 4 and 12 months.

About the procedures studied, there is also a gap, venipuncture procedure is only studied in one of the included studies, making it difficult to generalize the results found.

Finally, the last limitation identified is due to the heterogeneity of the pain assessment scales used. Four different pain assessment scales were used, the PIPP scale was the most frequently mentioned, being present in six studies (S2, S3,S6,S9,S12,S13). The NIPS pain assessment scale was used in two studies (S5, S11). The FLACC (S5), DAN (S10) and MFCS (S8) scales were used in only one study, each. This fact translates limitations in the revision and it hinders the generalization of results.

CONCLUSION

Differences in the variables studied and in the forms of assessment used in each study do not allow an exact comparison of all data, however it seems evident that one of the major benefits of using non-pharmacological interventions in needle procedures is the decrease in the degree of pain. Improvements in crying duration and hemodynamic stability of newborns and infants undergoing this type of procedure are also evident. There are also benefits in reducing irritability and signs of stress.

It is also evident from the analysis of the studies included in this review that the use of non-pharmacological interventions has greater benefit when they are used in combination, and therefore, health professionals should be encouraged to use these interventions in combination during needle procedures.

With this review it was noted that non-pharmacological interventions in newborns and infants has been a topic widely studied in recent years, but most studies are concentrated in the first months of life, it is necessary to study the second half, between 6 and 12 months. Regarding needle procedures, venipuncture is the least studied procedure in this age group, and further investigations should be conducted in this area.

The results obtained with this review confirm and demonstrate the benefits for newborns and infants in the use of non-pharmacological interventions in needle procedures and their practice should be implemented.

Knowledge of health teams about non-pharmacological interventions and its benefits is fundamental to the provision of quality care. Knowing the gap between the available evidence on non-pharmacological interventions and the frequency of their use by health professionals, it is expected that this review add contributions that promote the use of these interventions and hence the improvement of care for this vulnerable population.

REFERENCES

1. DGS. Orientações técnicas sobre o controlo da dor em procedimentos invasivos nas crianças (1mês a 18 anos). Circular normativa 022/2012. Lisboa: DGS; 2012. Available from: https://www.dgs.pt/directrizes-da-dgs/orientacoes-e-circulares-informativas/orientacao-n-0222012-de-18122012.aspx

2. Harrison *et al*. Too Many crying babies: a systematic review of pain management practives during immunizations on Youtube. BMC Pediatrics. [serial on the Internet]. 2014; 14:134. Disponível em: https://bmcpediatr.biomedcentral.com/articles/10.1186/1471-2431-14-134

3. AAP. Prevention and Management of Pain in the Neonate: An Update. Pediatrics. [serial on the Internet]. 2016; 137 (2), 1-13. Disponível em: http://pediatrics.aappublications.org/content/118/5/2231

4. Batalha L. Intervenções não farmacológicas no controlo da dor em cuidados intensivos neonatais. Revista de Enfermagem Referência. [serial on the Internet]. 2010; III Série - n.º 2, pp. 73-80. Available from: http://www.scielo.mec.pt/scielo.php?script=sci_arttext&pid=S0874-02832010000400008&lng=pt&tlng=pt.

5. INE. Estatísticas demográficas 2016. Lisboa: Instituto Nacional de Estatística; 2016. Available from: https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_publicacoes&PUBLICACOESpub_boui=277094583&PUBLICACOESmodo=2

6. Cordero M, Garcia L, López A, Villar N, Castillo R, Garcia I. Procedimientos no farmacológico para disminuir el dolor de los neonatos: revisión sistemática. Nutr Hosp. [serial on the Internet]. 2015; 32(6), pp. 2496-2507. Available from: https://www.ncbi.nlm.nih.gov/pubmed/26667696

7. Taddio A. *et al*. Reducing the pain of childhood vaccination: an evidence-based clinical practice guideline. CMAJ REVIEW. [serial on the Internet]. 2010. Available from: www.cmaj.ca/content/early/2010/11/22/cmaj.101720

8. DGS. Orientações técnicas sobre controlo da dor nos recém-nascidos (0 a 28 dias). Circular normativa 024/2012. Lisboa: DGS; 2012. Available from: https://www.dgs.pt/directrizes-da-dgs/orientacoes-e-circulares-informativas/orientacao-n-0242012-de-18122012.aspx

9. Wente S. Nonpharmacologic Pediatric Pain Management in Emergency Departments: a Systematic Review of the literature. Journal of Emergency Nursing. [serial on the Internet]. 2013; Volume 39, pp. 140-150. Available from: https://www.ncbi.nlm.nih.gov/pubmed/23199786

10. JBI. Joanna Briggs Institute Reviewers' Manual. Adelaide Austrália: JBI; 2014. Available from: https://joannabriggs.org/assets/docs/sumari/ReviewersManual-2014.pdf

11. Pillai R, Racine N, Gennis H, Turcotte K, Uman L, Horton R, *et al.* Non--pharmacological management of infant and young child procedural pain (Review). Cochrane Database of Systematic Reviews [serial on the Internet]. 2015; Issue 12. Art. No.: CD006275. Available from: https://www.ncbi.nlm.nih.gov/pubmed/26630545

12. Harrison D, Reszel J, Bueno M, Sampson M, Shah V, Taddio A, *et al.* Breastfeeding for procedural pain in infants beyond the neonatal period. Cochrane Database of Systematic Reviews. [serial on the Internet]. 2016; Issue 10. Art. No.: CD011248. Available from: http://cochranelibrary-wiley.com/doi/10.1002/14651858.CD011248/abstract

13. Kucukoglu S, Aytekin A, Celebioglu A, Celebi A, Caner I, Maden R. Effect of White Noise in Relieving Vaccination Pain in Premature Infants. Pain Management Nursing. [serial on the Internet]. *2016*; 17(6), 392-400. Available from: https://www.ncbi.nlm.nih.gov/pubmed/27751753

14. Nimbalkar S, Chaudhary N, Gadhavi K, Phatak A. Kangaroo Mother Care in Reducing Pain in Preterm Neonates on Heel Prick. Indian J Pediatr. [serial on the Internet]. 2013; 80(1), 6-10. Available from: https://www.ncbi.nlm.nih.gov/pubmed/22544676

15. Johnston C, Campbell-Yeo M, Fernandes A, Inglis D, Streiner D, Zee R. Skin-to-skin care for procedural pain in neonates. Cochrane Database of Systematic Reviews. [serial on the Internet]. 2014; Issue 1. Art. No.: CD008435. Available from: http://cochranelibrary-wiley.com/doi/10.1002/14651858.CD008435.pub2/pdf/

16. Batalha L. Dor em Pediatria Compreender para Mudar. Lousã: Lidel; 2010.

17. Kassab M, Foster JP, Foureur M, Fowler C. Sweet-tasting solutions for needle-related procedural pain in infants one month to one year of age (Review). Cochrane Database of Systematic Reviews. [serial on the Internet]. 2012; Issue 12. Art. No.: CD008411. Disponível em: https://www.ncbi.nlm.nih.gov/pubmed/23235662

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