

# Pain Reduction of Heel Stick in Neonates: Yakson Compared to Non-nutritive Sucking

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## Summary

The purpose of this study was to test the effect of Yakson (i.e. a traditional Korean touching method) and non-nutritive sucking (NNS) on reducing the pain that neonates experience when undergoing the heel stick procedure for blood testing. Ninety-nine healthy neonates were recruited and assigned into three groups: Yakson ( $n=33$ ), NNS ( $n=33$ ), and control group ( $n=33$ ). Each intervention was provided to the Yakson and NNS groups from 1 min before heel stick until the completion of the heel stick. For the Yakson group, a researcher caressed the belly of a neonate with one hand while supporting the back with the other hand. For the NNS group, a pacifier packed with sterile gauze was put in the neonate's mouth. The oxygen saturation levels in the Yakson and NNS group neonates were maintained significantly better than in the control group neonates. There was no significant difference between the groups with regard to heart rate and neonatal infant pain, measured using the Neonatal Infant Pain Scale. Findings indicate that Yakson can be used during heel stick to help neonates maintain their oxygen saturation level following the procedure.

**Key words:** pain, neonate, Yakson, nonnutritive sucking, heel stick.

## Introduction

Pain management is especially important for neonates who are not able to verbally express their pain. The traditional view that neonates are not capable of perceiving pain has been refuted and there is now no doubt that neonates perceive pain [1]. Researchers also suggest that pain experienced in the neonatal period might cause long-term negative effects later in life, such as an altered response to pain and an exaggerated physiological response to stress [2, 3]. Therefore, the need for better pain management in neonates has recently been even more emphasized in neonatal nursery care. The goal of neonatal pain management is to minimize the intensity, duration and physiological and behavioural costs of pain, while providing interventions that offer the maximum benefit with less risk to the neonate. Multiple doses of opiate analgesia such as morphine can cause significant adverse effects [4]. As a result, the interest around discovering a safe, non-pharmacological pain

management method as an alternative to pharmacological pain medication has increased.

Non-nutritive sucking is one of the most widely studied non-pharmacological interventions for pain relief in neonates [5–8]. Non-nutritive sucking using a pacifier decreased crying time and lowered heart rates in incubated neonates during intravenous catheter insertion [8]. A combination of swaddling and pacifier usage was effective in reducing crying time and heart rate during heel stick procedures [9]. Preterm infants administered swaddling returned to their baseline heart rate and oxygen saturation levels in shorter time periods compared to those in containment [10]. The intervention of a 24% sucrose pacifier combined with holding the newborn infant resulted in less crying and a lower heart rate during heel stick than either of these interventions performed alone [11].

In Korea, there is a tradition in which mothers and grandmothers will caress their sick children with their bare hands, in hopes that their hands can reduce their children's pain with a supernatural healing power. This traditional touching method, which has been handed down for ages, is called 'Yakson,' meaning 'healing hand.' Yakson refers to the pure and natural action in which a mother puts her hand on the aching area of her child and caresses or massages the area to

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relieve her child's discomfort. It can be considered as the most basic and instinctive therapy. Koreans believe that 'Yakson' has instinctive healing effects, not only reducing physical pain but also promoting emotional soothing, which can lead a child to reach a physically relaxed and emotionally stable condition [12].

The purpose of this study was to examine if Yakson is an effective pain management method for neonates during heel stick. It compared the effects of Yakson, non-nutritive sucking and usual care on full-term newborn infants who experienced heel stick. The outcome measurements used were the Neonatal Infant Pain Scale (NIPS), heart rate (HR) and oxygen saturation level ( $\text{SaO}_2$ ).

## Materials and Methods

### Samples

Ninety-nine neonates (i.e. Yakson group,  $n=33$ ; NNS group,  $n=33$ ; control group,  $n=33$ ) participated in the study. Criteria for inclusion were that the neonate was (i) full term (i.e. over 37 weeks of gestation), (ii) physiologically stable and (iii) without neurological abnormalities or anomalies. The neonates under sedation or with neurological or congenital anomalies were excluded from the study due to any possible alteration in behavioural or pain response to the procedural stimulation.

### Procedure

The institutional review board (IRB) of the hospital approved the study protocol. Three university-affiliated hospitals in South Korea were recruited and then randomly assigned to three different groups (i.e. Yakson, NNP and control). To randomly allocate a hospital to a group, three sealed envelopes were prepared and one personnel of each hospital picked one envelop upon the hospital's decision to participate in the study. Ninety-nine neonates were recruited, 33 from each hospital. The neonates from the first hospital received Yakson, those from the second hospital received NNS and those from the last hospital received no intervention.

The neonates were recruited by a research nurse and written informed consent was obtained from all parents. The clinical lab technician performed the heel stick using a lancet. All blood sampling in the study was performed for clinical purposes, such as newborn screening tests. Standard protocol for blood sampling involved swabbing the heel with a small gauze pad with disinfectant, lancing the heel and then gently squeezing the heel intermittently until the amount of blood required for clinical care was collected. The heel stick procedure took approximately 69 s (e.g. Yakson group, mean time = 66.48; NNS group, mean time = 70.39; control group,

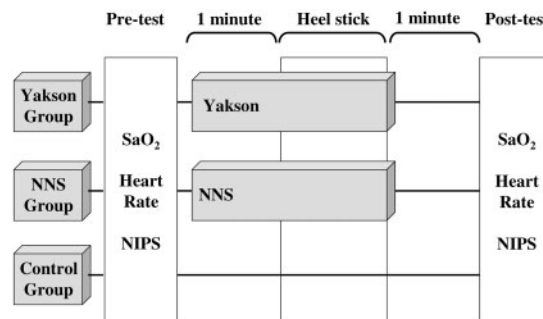


FIG. 1. Data collection procedure.

mean time = 69.12) and there was no significant difference among the groups ( $P=0.78$ ).

In this study, interventions (i.e. Yakson and NNS) were provided for 1 min prior to starting the heel stick procedure and lasted until the completion of the procedure. Before providing the Yakson, the research nurse warmed her hands under the radiant warmer to become  $34.0^{\circ}\text{C}$  ( $93.2^{\circ}\text{F}$ ). The research nurse then approached the neonate from behind and placed her left hand under the back of neonate. Next, the nurse placed her right hand on top of the neonate's abdomen and caressed as if drawing a clockwise circle of approximately 4 cm in diameter every 5 s. During the NNS intervention, the researcher gave each neonate a standard, small, short, hollow soft latex nipple packed with sterile gauze while applying gentle pressure to maintain it in the neonate's mouth. Control group neonates received no intervention during the procedure. Measurements of NIPS, HR and  $\text{SaO}_2$  were taken twice: once before providing intervention (i.e. pre-test) and then again 1 min after completion of the intervention (i.e. post-test). This process is illustrated in Fig. 1.

### Measurements

Pain response was measured by the NIPS, HR and  $\text{SaO}_2$ . The NIPS quantifies the level of pain on a scale from zero to seven based on five behavioural characteristics: facial expressions, crying, movements of arms, movements of legs and the state of arousal. HR and  $\text{SaO}_2$  data were collected via an infrared oximeter placed on the unaffected foot of the neonate and connected to a pulse oximeter (Nellcor Oxisensor II N-25. Nellcor Puritan Bennett Inc).

### Data analysis

All data were managed with confidentiality and analysed using SPSS 14.0. Parametric statistics were used for data analysis after testing for the normal distribution of the data. All values were expressed as means and SDs. Comparisons were made within each group using paired *t*-tests and between groups using

TABLE 1  
Homogeneity test for general characteristics among the groups ( $N=99$ )

Characteristics	Yakson ( $n=33$ ) $N(\%)$ or $M$ (SD)	NNS ( $n=33$ ) $N(\%)$ or $M$ (SD)	Control ( $n=33$ ) $N(\%)$ or $M$ (SD)	$F$ or $\chi^2$	$P$
Gender					
Male	15 (45.45)	16 (48.48)	16 (48.48)	0.96	1.00
Female	18 (54.55)	17 (51.52)	17 (51.52)		
Delivery type					
N/D	15 (45.45)	11 (33.33)	17 (51.52)	0.32	0.37
C/S	18 (54.55)	22 (66.67)	16 (48.48)		
Gestational age (days)	273.8 (9.54)	273.9 (8.1)	272.4 (10.3)	0.27	0.76
Birth weight (gram)	3184.2 (482.1)	3260.6 (512.3)	3179.2 (394.8)	0.32	0.73
Apgar score (1 min)	8.5 (1.1)	8.3 (0.8)	8.5 (1.1)	0.53	0.59
Apgar score (5 min)	9.6 (0.5)	9.5 (0.6)	9.4 (0.7)	0.59	0.55

TABLE 2  
Comparison of pain score, oxygen saturation and heart rate among groups ( $N=99$ )

Group	Pre-test	Post-test	Difference	Within a group		Comparison	Between groups	
	$M$ (SD)	$M$ (SD)	$M$ (SD)	$t$	$P$		$t$	$P$
NIPS								
Yakson	0.70 (1.29)	4.15 (2.76)	3.45 (2.99)	6.636	<0.001	Yak vs. Ctr	0.784	0.379
NNS	0.39 (1.20)	4.06 (2.73)	3.67 (2.94)	7.155	<0.001	NNS vs. Ctr	0.700	0.406
Control	0.88 (1.63)	4.79 (2.50)	3.91 (2.43)	9.247	<0.001	Yak vs. NNS	0.009	0.926
SaO <sub>2</sub>								
Yakson	97.58 (1.68)	96.67 (2.51)	-0.91 (2.75)	-1.896	0.067	Yak vs. Ctr	7.455	0.008
NNS	98.42 (1.44)	97.15 (3.09)	-1.27 (3.22)	-2.268	0.030	NNS vs. Ctr	6.880	0.011
Control	98.61 (1.37)	95.42 (2.80)	-3.18 (2.47)	-7.406	<0.001	Yak vs. NNS	0.117	0.734
HR								
Yakson	133.67 (11.80)	143.64 (15.28)	9.97 (11.51)	4.974	<0.001	Yak vs. Ctr	1.758	0.190
NNS	135.94 (11.65)	144.15 (14.00)	8.21 (14.94)	7.406	0.003	NNS vs. Ctr	2.049	0.157
Control	133.73 (9.55)	147.12 (11.44)	13.39 (9.75)	7.889	<0.001	Yak vs. NNS	0.086	0.770

NIPS: neonatal infant pain scale; HR: heart rate; SaO<sub>2</sub>: Oxygen saturation level.

analysis of covariance (ANCOVA). A two-tailed  $P$ -value less than 0.05 was considered to be significant.

### Results

As shown in Table 1, there were no significant differences among the infants in the three groups based on the demographic variables including sex, gestational age, birth weight and Apgar scores using one-way ANOVA or Chi-square. Overall, neonates were born between 38.8 and 39.1 weeks, weighed between 3.2 and 3.3 kg and their mean Apgar score was 8.3–9.6.

The pain scores (NIPS) of the neonates in the three groups were shown to significantly increase after heel stick compared to before the heel stick. The change of NIPS scores in Yakson and NNS groups was lower than that of the control group; however, this difference was not statistically significant.

The SaO<sub>2</sub> levels of all three groups of neonates decreased after heel stick compared to before heel

stick. The change of SaO<sub>2</sub> levels in Yakson and NNS groups was lower than that of the control group. There was a significant difference in the change of SaO<sub>2</sub> levels between intervention groups (i.e. Yakson or NNS group) and the control group. No difference was found between the Yakson and NNS groups.

The HR of the three groups significantly increased after heel stick compared to before heel stick. The change in HR in the Yakson and NNS groups was lower than that of the control group; however, this difference was not statistically significant (Table 2).

### Discussion

Non-pharmacological pain management strategies were proven to be effective alternatives for dealing with procedural pain, as they can eliminate stress and promote comfort in neonates. This study demonstrated the efficacy of Yakson as an effective pain management method in relieving the procedural pain of heel stick in neonates.

In our study, the SaO<sub>2</sub> levels of both Yakson and NNS intervention group neonates were significantly higher after heel stick than that of the control group neonates. When the SaO<sub>2</sub> levels measured before and after heel stick were compared, the decrease in SaO<sub>2</sub> level was shown to be insignificant only in the Yakson group neonates, suggesting that Yakson helped neonates maintain the level of SaO<sub>2</sub> during a painful heel stick procedure. This finding suggests that both Yakson and NNS have soothing effects on pain. Furthermore, it suggests that the Korean touching method, Yakson, could be considered another alleviating intervention for neonatal pain.

All three groups showed increased HR and higher NIPS scores when measured 1 min after heel stick. This result can be understood to mean that neither Yakson nor NNS could help the neonates maintain their HR and NIPS scores throughout heel stick. However, even if Yakson and NNS could not prevent the pain responses from getting worse during the procedure, those interventions might be helpful in recovering HR and NIPS scores following the procedure. Therefore, further research is required to measure how Yakson and NNS affect a neonate's HR and NIPS score after heel stick. For instance, HR and NIPS scores could be measured every minute after heel stick until those scores return to their pre-heel stick levels. By doing this, we may successfully compare the changing conditions of the neonates following heel stick, as well as test for a significant difference between the durations required for a full recovery after both interventions.

One of the goals of pain management is to sustain physiological and behavioural stability. For that purpose, Yakson was found to be effective at maintaining SaO<sub>2</sub> levels, although it did not show a significant effect on maintaining HR and behavioural state, as assessed using the NIPS. In other words, Yakson can attenuate oxygen saturation decreases in neonates during invasive routine procedures. In addition, Yakson is a non-pharmacological pain management method which can be easily delivered during small, painful procedures in neonates to avoid possible adverse effects caused by pharmacological agents.

There are two limitations in this study which should be considered in further studies. One is that the sample size was not large enough and it limits the external validity of this study. The other is that research nurses who performed NIPS measuring were not blinded to the treatment group, which could bring a potential bias. Despite these limitations, this study introduced a Korean traditional touch intervention and demonstrated that Yakson may be an effective pain management intervention on infants. Therefore, this study could provide health professionals with a research-based intervention.

The management of pain in neonates has improved over the last decade in response to advancements in

the understanding of pain and pain relief [13, 14]. One of the major challenges is assessing the degree of experienced pain in the absence of verbal indications [13]. The complex nature of pain in neonates suggests that pain is best assessed by more than a single indicator [15, 16]. A multidimensional measurement approach can be accomplished by using a composite measure that includes a variety of physiological and behavioural indicators [17, 18]. Further research is needed to test the effect of Yakson on reducing the pain that neonates experience by using other pain measurements (e.g. respiratory rate, blood pressure, release of hormone including cortisol and other facial/behavioural pain scale) in addition to oxygen saturation, HR and NIPS.

Additional information on mechanisms of action would be beneficial and further clinical studies including term neonates are needed. Comparison studies with oral sucrose and non-pharmacological analgesic methods of pain reduction are also required. Future study can also include using Yakson in preterm neonates during heel stick procedures to see if Yakson would have similar effects. This study demonstrates that Yakson, a simple non-invasive technique, performed prior to heel sticks is free of apparent adverse responses and reduces the manifestations of pain in vulnerable patients, including neonate infants.

Some painful, invasive procedures, such as heel sticks, are commonly performed in neonates, as they are necessary for care. Neonate infants are as sensitive to painful stimuli as adults are and pain experienced in the neonatal period might have long-term effects later in life [2, 3]. Therefore, pain management and pain relief in the infant is an important issue in neonatal health care. We suggest that the single or combined use of Yakson and a pacifier is effective in reducing pain responses in neonates undergoing heel stick and the use of these simple pain relieving interventions should be considered.

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