Original Article

https://doi.org/10.1590/2317-6431-2020-2413

Audiology Communication Research
ISSN 2317-6431

Effects of gustatory stimulation on oral readiness and behavioral states of newborns

Efeitos da estimulação gustativa na prontidão oral e estados comportamentais de recém-nascidos

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ABSTRACT

Purpose: To investigate and compare specific oral readiness behavior and behavioral states of term newborns (TNB) and preterm newborns (PTNB) based on taste stimulation (water and sucrose). **Methods:** Experimental, analytical, double-blind, case-control study: 152 newborns from a public maternity hospital participated, 68 of them were term newborns and 84,preterm , divided according to taste stimulus (water or sucrose). The test lasted 15 minutes, divided into three periods of 5 minutes. We evaluated behavioral states and specific behaviors. **Results:** We observed significant difference by comparing stimulations and longer periods of right (p=0.042) and left (p=0.037) hand suction for mouth behavior, shorter sleeping periods (p=0.019) in TNB stimulated with sucrose. In PTNB, we observed longer periods of right hand (p=0.043) and left hand (p=0.001) suction, suction (p<0.001) and alert state (p=0.025) when stimulated with sucrose. We found a decrease in agitation (p=0.018) in PTNB stimulated with water. The TNB were asleep for longer periods of time than PTBN (p=0.032). Sucrose stimulation in alert state is more evident in PTNB (p=0.047). **Conclusion:** Sucrose elicited motor responses related to food readiness and favorable behavioral status for food regardless of gestational age. The findings are important for the speech therapy clinic, enabling broader feeding stimulation approaches.

Keywords: Newborn; Infant premature; Taste perception; Sucrose; Sucking behavior

RESUMO

Objetivo: investigar e comparar comportamentos específicos de prontidão oral e estados comportamentais de recém-nascidos a termo (RNT) e pré-termo (RNPT), a partir da estimulação gustativa (água e sacarose). **Métodos:** estudo experimental, analítico, duplo-cego, caso controle. Participaram 152 recém-nascidos de uma maternidade pública, sendo 68 a termo e 84 pré-termo, subdivididos conforme estímulo gustativo (água ou sacarose). O teste durou 15 minutos, dividido em três períodos de cinco minutos. Foram analisados estados comportamentais e comportamentos específicos. **Resultados:** foram observadas diferenças significativas, comparando os estímulos, com maior tempo nos comportamentos mão-boca direita (p=0,042) e esquerda (p=0,037), e diminuição no tempo de sono (p=0,019) nos RNT estimulados com sacarose. Nos RNPT houve maior tempo de sucção de mão direita (p=0,043) e esquerda (p=0,001) e de sucção (p<0,001), com aumento no tempo de alerta (p=0,025), quando estimulados com sacarose. Houve diminuição de tempo de agitação (p=0,018) em RNPT estimulados com água. RNT apresentaram maior tempo em sono do que os RNPT (p=0,032). A estimulação da sacarose no estado alerta foi mais evidente em RNPT (p=0,047). **Conclusão:** A sacarose eliciou respostas motoras referentes à prontidão para alimentação e estado comportamental favorável para alimentação, independentemente da idade gestacional. Os achados são importantes para a clínica fonoaudiológica, possibilitando ampliar condutas de estimulação da alimentação.

Descritores: Recém-nascido; Recém-nascido prematuro; Percepção gustatória; Sacarose; Comportamento de sucção

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Conflict of interests: No.
Authors' contribution: AMCM was responsible for the conception and design of the study, data analysis and interpretation, article review and final approval of the version to be published; VNS and FBS were responsible for data collection, tabulation and analysis, final review of the article; TPLS was responsible for data collection, analysis and interpretation, writing and final review of the article; IDCB and LRA were responsible for the statistical treatment, analysis and interpretation of the manuscript data and the final review of the article; SAA and RKBN were responsible for the data, analysis and interpretation of the results of the manuscript and final review of the article; RQG was responsible for the study design and final review of the article's data analysis. All authors read and approved the final version of the article.
Funding: None.
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Received: September 01, 2020; Accepted: March 26, 2021

INTRODUCTION

Human beings have a vast behavioral repertoire at birth, showing learning capacities and social interaction at an extremely early age[1]. Studies have investigated the existence of functional systems initiated in the intrauterine period [1,2], considering the development of the senses still in pregnancy[3,4].

Behaviors such as putting your hands into your mouth appear in the intrauterine period. Since the 15th week of gestation, fetuses have been observed sucking the right thumb and showing oromanual integration, preferably on the right side of the body[5]. Taste activation starts around the 30th week of pregnancy[6].

Considering that it has been reported as preferential[2], sweet taste stimuli is addressed when investigating early-life development[7]. A study shows that the calming effect of sucrose reflects in the function of central stress regulating systems, which are dependent on opioids[8].

Studies have demonstrated various effects caused by stimulation with sucrose, from evoking facial patterns and smiles to sucking and protruding tongue movements in newborns (NBs)[9,10]. There is an effect on the incidence of hand-mouth contact[11], with higher frequency and suction strength of preterm newborns (PTNB), in latex or not, comparing with newborns who were not stimulated with a sweet taste[12,13].

In addition, sweet stimulus has also been used as a treatment to minimize pain in newborns in the context of different types of procedures[13–15]. From a neurophysiological point of view, evidence point out that glucose oral administration in newborns interferes with the response associated with pain at the cortical level by attenuating it[16]. (A study shows or studies shows [in general]) Study shows that the soothing effect of sucrose lingers on the behavioral state even after behaviors of sucking and putting hands in mouth cease[17].

Actions such as bringing your hands into your mouth and sucking them in the face of gustatory stimulation, as well as sucking and protruding tongue movements, point respectively to the existence of an integrated sensorimotor system[11] and a feeding system[1,11] present at an early age. Such behaviors can be influenced by the behavioral state[18] and the type of sensory stimulation[1,11].

The behavioral state considered as a central factor in the readiness for feeding and suction performance[18] is correlated with the tone of the NB and ability to respond to the environment. NBs can respond by changing their behavioral state according to external or internal stimuli[19].

When related to hunger, crying may indicate readiness for food. A study shows an increase in the suction of newborns who started feeding after crying versus those who were in a sleep state[20]. Authors point out that healthy full-term newborns (TNB) are ready to suck in the first hours of life showing good suction frequency when in an active behavioral state[21].

Previous research found that gustatory stimulation decreases the occurrence of behavioral states of agitation and crying[22] related to stress[23], leading to higher occurrence of alertness, the behavioral state that most favors interaction[23] and consequently readiness for feeding[18].

The study hypothesis is that regardless of the corrected gestational age (CGA), newborns may present a higher frequency of readiness behaviors for feeding upon a behavioral state regarded as favorable for feeding (alert) in the presence of sweet eliciting taste stimulus (sucrose).

Our objective was to investigate the specific behaviors related to oral readiness and behavioral states present in TNB and PTNB by establishing a comparison from gustatory stimulation with water and sucrose.

METHODS

Participants

This is an experimental, analytical, double-blind, case-control study carried out with 152 newborns, preterm (N=84) and term (N=68), of both genders, divided according to corrected gestational age (CGA) at the time of assessment, and subdivided according to the taste stimulus offered (sucrose or water).

We followed the prematurity classification by the Brazilian Ministry of Health [23], which classifies as term newborns born with gestational ages between 37 to 42 weeks and as preterm those born between 28 to 36 weeks and 6 days [23].

Procedure

Gustatory stimulation was performed within the first 36 hours of life for newborns, while PTNBs were tested within a 35-week CGA hospital stay (ranging from 30 to 36 weeks).

After being randomly chosen to receive stimulation, 34 newborns received water, while the remaining 34 received sucrose. 44 out of the 84 PTNBs received water and 40 were stimulated with sucrose. The bottles were numbered by a single researcher, who did not managed the substance.

The study followed the same methodological design proposed by Medeiros[1,11,24]. Inclusion criteria were: intrauterine growth curve suitable for gestational age (GA), clinical stability at the time of testing, and consent of the person responsible for the test.

Exclusion criteria were: newborns with respiratory support who used an orogastric tube at the time of the test and presence of a clinical history of major neurological and/or cardiac complications and syndromes and/or malformations diagnosed or to be clarified. Newborns who entered into a state of intense crying without ceasing due to gustatory stimulation were also disregarded.

Since no specific data were collected on the newborns' feeding, we were not able to state whether they had any previous feeding experience. However, both groups showed similar results in this regard; in addition, we were careful to consider the diet schedule before performing the test to avoid regurgitation.

The stimulation was proceeded by positioning the newborn in a transport cradle, supine, with a naked body and free upper limbs. The procedure was recorded by a digital camera (Panasonic Compact - VHS Palmcorder) positioned on a tripod, keeping the face and upper limbs properly framed.

Different researchers, who had no prior knowledge of the solution offered (double-blind procedure), administered water or sucrose , only the number of the bottle used for each participant was known. The researchers had been trained by the research coordinator to homogenize the procedure.

Sucrose was used as an agent that elicits motor behaviors and water as a control stimulus. It is worth mentioning that the data were collected from the database previously organized by Medeiros[1,11,18,24].

The test duration was 15 minutes, divided into three periods of five minutes. The first five minutes corresponded to the initial baseline (BL1), without gustatory stimulation and with the NB resting without receiving any stimulation.

In the intermediate five minutes, gustatory stimulation was performed using a disposable syringe (without a needle) with 12% sucrose solution or water. During this period, the examiner administered 0.2 ml of solution every one minute, totaling 1 ml per newborn tested. As in other studies[12], we chose to use a syringe and not a pacifier, since the maternity hospital in study follows the precepts of the Baby Friendly Hospital Initiative (BFHI).

In the final baseline (BL2), referring to the last five minutes, once again no stimulation was applied (as in the initial baseline) or any intervention occurred.

It is worth mentioning that during the test, the behavioral states and specific behaviors presented by the newborns were not observed or analyzed, which only occurred later on, by filming. Three independent judges analyzed the occurrence of these behaviors per second , recording was performed only upon agreement between at least two of them.

Behavioral states

The observation of behavioral states was adapted from the classification of Medeiros[24] and Brazelton's Neonatal Behavioral Assessment Scale[25].

- Sleep (includes deep sleep, light sleep, and sleepy sleep): eyes should be closed and immobile or half-open and open, without any specific appearance. Spontaneous motor activity is usually absent or mild, with the presence of short-term spasms, such as jerks and/or tremors. There may be an occasional reaction to stimuli.
- Alert: Eyes open with the presence of a bright look, or eyes closed with clear activity of concentration. Demonstrates attention to the source of stimulation. Being concentrated, the global motor activity is low, and there is a reaction to stimuli.
- Agitation (includes agitation, irritation, and crying): Eyes can be open, closed, or narrowed. High level of global motor activity with spasms and frequent impulsive movements in the extremities. Occurrence of grumbling, vocalizations or crying.

Specific behaviors

We described the specific oral readiness behaviors based on the characterization of Medeiros[24]. The oral region ranged lips (red zone), delimited by the red margin, mouth cavity, tongue and mouth cavity floor.

- Hand over mouth (HOM) - right (RHOM) or left (LHOM): contact of one hand in the oral region; the hand may have been placed or only supported on the oral region; there is no type of suction movement.
- Hand suction (HS) - right (RHS) or left (LHS): contact of one hand or both with the oral region, simultaneously or alternately, concomitant with the presence of suction movements; the lips are usually open; often rhythmic movements are observed in the buccal region (cheeks) and protruding movements and jaw retraction; the movements observed can occur in an intense or subtle way, at a short or prolonged duration.
- Suction (SU): occluded or rounded lips; visualization of the retracted angle of the mouth, corresponding to the buccinator muscle action; rhythmic oral movements (cheeks), with or without jaw protrusion and retraction.
- Tongue protrusion (TP): lips not occluded (separated); visualization of the tongue apex between the upper and lower lips; presence of tongue movement back and forth.

Ethical procedures

This study was approved by the Research Ethics Committee of the Federal University of Sergipe, under No. CAAE 0027.0.107.000-11. Those responsible for the newborns signed the Free and Informed Consent Form (FICF).

Statistical analysis

We described the categorical variables as absolute and relative percentage frequency and the counting variables as means and standard deviations.

When assessing the experiment, we used a mixed generalized linear model with zero inflated negative binomial distribution [26]. Dependent variables refer to the number of seconds in which the NB performed the specific behaviors (RHOM, LHOM, RHS, LHS, SU and TP), while independent variables are the CGA (TNB or PTNB) and type of gustatory stimulation (water or sucrose) as fixed effects and stages (BL1, stimulation phase, and BL2), as well as behavioral states (sleep, alertness, and agitation) as random effects.

In all models, at least 90% of test power was achieved[27]. We used the level of significance of 5% and the lme4 package of the R Core Team 2020 software to analyze the models.

RESULTS

The group stimulated with water corresponded to 51% of the sample, while the group stimulated with sucrose represented 49%. The TNB and PTNT groups corresponded to 45% and 55%, respectively.

Specific behaviors

In BL1, preterm infants in the sucrose group already had a higher SU time percentage than those in the water group.

At the stimulation stage, PTNBs from the sucrose group had longer RHS, LHS, and SU behaviors than those from the water group. TNBs from the sucrose group, at the same stage, had a higher percentage of time for hand-mouth behaviors – RHOM (5.64) and LHOM (1.46).

In BL2, PTNB in the sucrose group continued to show a higher percentage of SU behavior time than those in the water group. TNB from the sucrose group maintained a higher percentage of RHOM and LHOM time.

Table 1 shows the descriptive statistics of the average time percentage characterization in which the NBs performed each specific behavior, grouped by stage, CGA and stimulus.

Behavioral state

In BL1, TNB in the water group already presented longer time range on alert and agitation than those in the sucrose group.

Comparing with the BL1, the comparison between stages indicated higher percentage of alert time (+ 10%) and less sleep time (-14%) in the newborns stimulated with sucrose during the stimulation stage. In addition, PTNBs stimulated with water had lower percentage of agitation time (-6%) at step BL1 for stimulation.

Table 2 shows the descriptive statistics of the average time percentage characterization in which the NBs were in each behavioral state, grouped by stage, CGA, and stimulus.

Stimulation and corrected gestational age

In relation to the offered stimulus, significant results were observed regarding LHS and SU, in which the sucrose group had a longer average time than the water group.

As for gestational age, we found that the LHOM time in TNB was shorter than in PTNB (B<1). In turn, the behaviors of RHS, LHS, and SU showed an inverse relationship, since TNB executed these behaviors for a longer time range.

When observing the interaction between stimulus and gestational age, we found significantly less SU and LHS time in the sucrose group comparing with water in TNB versus PTNB. This means that sucrose stimulation in the specific behaviors of SU and LHS was more evident in PTNB.

Table 3 shows the mixed generalized linear model for the number of seconds of specific behavior as a function of corrected gestational age and controlled stimulus for stage and behavioral state.

Behavioral status as a function of stimulus, CGA, and stage

We observed that the TNB had longer sleep time than the PTNB. By comparing TNB and PTNB for the interaction between stimulus and gestational age, we found shorter alert time in the sucrose group than in the water group, that is, sucrose stimulation in the alert state was more evident in PTNB.

Table 4 shows the models involving behavioral status as a function of the stimulus, gestational age (fixed effects) and stage (random effects).

Table 1. Characterization of the percentage of specific behavior time per stage, corrected gestational age and stimulus

Stage	CGA	Stimulus	RHOM Mean (SD)	LHOM Mean (SD)	RHS Mean (SD)	LHS Mean (SD)	TP Mean (SD)	SU Mean (SD)
BL1	Preterm	Sucrose	3.04 (8.65)	3.19 (11.54)	0.13 (0.50)	0.44 (1.29)	4.42 (12.51)	3.93 (6.46)
		Water	2.52 (6.05)	2.34 (4.98)	0.14 (0.64)	0.10 (0.52)	6.32 (16.63)	0.70 (1.52)
		p-value	0.519	0.235	0.127	0.231	0.695	0.004£
	Term	Sucrose	2.07 (4.26)	0.84 (3.80)	2.25 (6.33)	0.05 (0.21)	2.70 (4.19)	3.21 (6.72)
		Water	3.11 (12.20)	0 (0)	7.52 (14.86)	0.88 (3.63)	4.27 (5.91)	6.10 (11.8)
		p-value	0.182	*	0.078	0.092	0.450	0.264
Stimulation	Preterm	Sucrose	5.85 (14.34)	4.68 (10.7)	2.13 (5.81)	1.33 (2.85)	5.28 (12.95)	18.18 (17.48)
		Water	3.12 (6.08)	2.58 (5.83)	0.58 (2.11)	0.11 (0.41)	5.44 (8.26)	3.84 (4.52)
		p-value	0.074	0.458	0.043£	0.001£	0.661	<0.001£
	Term	Sucrose	5.64 (12.96)	1.46 (5.28)	5.75 (11.77)	1.71 (3.92)	5.38 (6.80)	7.21 (8.75)
		Water	1.39 (3.22)	0.17 (0.72)	5.56 (11.30)	1.44 (4.35)	5.38 (8.34)	11.34 (13.92)
		p-value	0.042£	0.037£	0.685	0.091	0.624	0.108
BL2	Preterm	Sucrose	6.93 (18.84)	3.45 (7.60)	0.58 (1.35)	1.56 (7.21)	4.04 (8.92)	8.26 (11.86)
		Water	4.02 (7.03)	2.52 (6.53)	0.11 (0.41)	0.05 (0.35)	3.95 (8.62)	1.66 (2.31)
		p-value	0.270	0.505	0.119	0.262	0.949	<0.001£
	Term	Sucrose	5.77 (12.21)	0.92 (2.96)	4.96 (8.40)	2.04 (8.26)	3.34 (4.46)	3.71 (4.54)
		Water	0.82 (1.94)	0.02 (0.11)	4.66 (8.89)	1.47 (6.72)	4.04 (5.85)	6.96 (11.18)
		p-value	0.040£	0.047£	0.637	0.861	0.583	0.161

Zero inflated Negative Binomial Generalized Linear Model; £ p<0,05

Subtitle: CGA = Corrected Gestational Age; BL1 = Baseline 1; BL2 = Baseline 2; RHOM = Right Hand over Mouth; LHOM= Left Hand over Mouth; RHS = Right Hand Suction; LHS = Left Hand Suction; TP = Tongue protrusion; SU = Suction; SD = Standard Deviation

Table 2. Characterization of the percentage of behavioral state time per stage, corrected gestational age and stimulus

Stage	CGA	Stimulus	Sleep Mean (SD)	Sleep/Stage (p-value)	Alert Mean (SD)	Alert/Stage (p-value)	Agitation Mean (SD)	Agitation / Stage (p-value)
BL1	Preterm	Sucrose	56.07 (43.68)	ref	29.17 (36.22)	ref	14.77 (26.71)	ref
		Water	47.89 (44.11)	ref	33.70 (38.73)	ref	18.41 (27.55)	ref
		p-value	0.884		0.859		0.352	
	Term	Sucrose	78.37 (27.59)	ref	11.01 (23.23)	ref	10.62 (17.29)	ref
		Water	60.76 (40.77)	ref	18.65 (29.54)	ref	20.59 (23.73)	ref
		p-value	0.325		0.043£		0.040£	
Stimulation	Preterm	Sucrose	47.40 (43.37)	0.753	44.87 (40.16)	0.757	7.73 (15.42)	0.359
		Water	40.30 (43.1)	0.844	47.30 (38.88)	0.511	12.40 (22.72)	0.018£
		p-value	0.520		0.889		0.800	
	Term	Sucrose	64.31 (37.83)	0.019£	21.21 (30.64)	0.025£	12.13 (20.14)	0.812
		Water	61.70 (42.99)	0.586	24.28 (36.68)	0.896	14.02 (19.07)	0.392
		p-value	0.353		0.405		0.931	
BL2	Preterm	Sucrose	50.48 (41.30)	0.917	36.90 (36.89)	0.829	12.63 (24.02)	0.938
		Water	42.73 (41.77)	0.813	38.10 (35.37)	0.646	19.17 (30.15)	0.649
		p-value	0.577		0.677		0.432	
	Term	Sucrose	68.28 (35.05)	0.162	17.74 (26.70)	0.189	13.98 (18.17)	0.650
		Water	61.45 (42.69)	0.432	24.65 (36.35)	0.859	13.90 (15.34)	0.254
		p-value	0.617		0.131		0.747	

Zero inflated Negative Binomial Generalized Linear Model; £ p<0,05

Subtitle: BL1 = Baseline 1; BL2 = Baseline 2; SD = Standard Deviation; ref = Reference Stage

Table 3. Mixed generalized linear model for the number of seconds of specific behavior as a function of corrected gestational age and controlled stimulus for stage and behavioral state

	Stimulus Sucrose/Water	CGA Term/ Preterm	Stimulus/CGA
	B (p-value)	B (p-value)	B (p-value)
RHOM	1.758 (0.057)	0.688 (0.259)	0.986 (0.976)
LHOM	1.522 (0.114)	0.181 (0.014) £	3.960 (0.083)
RHS	2.040 (0.227)	3.687 (0.011) £	0.431 (0.205)
LHS	4.750 (0.004) £	7.084 (<0.001) £	0.136 (0.004) £
TP	0.993 (0.977)	0.642 (0.056)	0.946 (0.871)
SU	3.662 (<0.001) £	2.317 (<0.001) £	0.179 (<0.001) £

£ p<0,05

Subtitle: CGA = Corrected Gestational Age; RHOM = Right Hand over Mouth; LHOM= Left Hand over Mouth; RHS = Right Hand Suction; LHS = Left Hand Suction; TP = Tongue protrusion; SU = Suction; B = Multiplicative Regression Coefficient

Table 4. Mixed generalized linear model for the number of seconds of behavioral status as a function of corrected gestational age and controlled stimulus for stage

	Stimulus Sucrose/Water	CGA Term/ Preterm	Stimulus/CGA
	B (p-value)	B (p-value)	B (p-value)
Sleep	1.093 (0.399)	1.262 (0.032)	0.884 (0.413)
Alert	1.040 (0.762)	1.013 (0.936)	0.644 (0.047)
Agitation	0.821 (0.230)	0.787 (0.124)	1.119 (0.630)

£ p<0,05

Subtitle: CGA = Corrected Gestational Age; B = Multiplicative Regression Coefficient

DISCUSSION

The analysis of the results allowed to observe that the gustatory stimuli elicited behaviors related to the oral readiness, both in the TNB and PTNB.

TNBs stimulated with sucrose showed longer time range with hand over mouth (RHOM and LHOM) than those stimulated with water, even after the stimuli ceased (BL2), showing the influence of the sweet on the hand-mouth coordination[11]. Sucrose had an effect on both sides, but with a higher incidence of behavior on the body right side, indicating manual preference for that side, as reported in the literature[5,11,18].

PTNBs already had a higher frequency of sucking behavior in BL1 even before receiving gustatory stimulation. Even so, sucrose proved to be an elicitor of suction behaviors, not only in line with previous reports in the literature[9,10,12,28], but with an increase in this behavior, both in isolated form (SU) and in oromanual coordination (RHS and LHS) during the stimulation, still maintaining an increase in SU after the stimulus supply ceases (BL2). The higher suction frequency for both sides indicates that the preterm newborns population in this study did not have preference for laterality.

It is worth mentioning that for both PTNB and TNB, sucrose was more effective than water at eliciting readiness behaviors for feeding, which corroborates previous research[1,22] and our hypothesis regarding the influence of the sweet taste stimulus on the frequency of readiness behaviors for food, regardless of CGA.

Regarding the behavioral states, the newborns in the sucrose group showed lower percentage of time in the sleep state and higher in the alert state at the stimulation stage, corroborating studies addressing sucrose as eliciting states of greater attention[1,18,22]. When stimulated with water, PTNBs had a lower percentage of agitation time than BL1, with no significant correlation to sucrose, demonstrating that oral stimulation had an effect on the preterm infants studied here, regardless of the stimulus used, as found in previous research[1,22].

Regardless of gestational age, stimulation with sucrose provided LHS and SU for a longer time (on average) than water, confirming studies that address the sweet stimulus as eliciting motor responses[9–12,17,28]. It is worth emphasizing the importance of this finding, since sucking is an important function already present at birth and serves to guarantee not only breastfeeding, but also to contribute to the newborns' self-regulating behavior(29).

When comparing TNB and PTNB regarding specific behaviors, we observed that TNB spent less time with LHOM than PTNB, probably because newborns display, in general, more hand behaviors on the right side of the body (RHOM and RHS)(5,11,18), due to their lateral preference, whereas PTNB did not show such preference.

In addition, TNBs spent more time performing RHS, LHS and SU than PTNBs, possibly due to the complexity of this behavior, since sucking hands is more complex than just bringing them to the mouth, demonstrating that TNB are probably more competent in this sense than PTNB.

Sucrose stimulation in the specific behaviors of SU and LHS appeared more clearly in PTNB, as observed in a previous study(1), since the sweet stimulus proved to be an important elicitor of sucking behaviors(9,10,12,28). However, as already mentioned, the right lateral preference in the TNB may have influenced the smaller number of responses of this behavior on the left side.

The results showed that TNB spent more time in a sleep state than PTNB. A previous study reports that TNBs usually sleep 16 to 18 hours a day, which is positive for neurological development. According to the authors, longer sleeping time reflects the crucial role that sleep plays in promoting optimal development, cognition, and behavior for the brain(30).

Sucrose stimulation in the alert state was more evident in PTNB, as observed in previous research, in which this stimulus was effective at keeping the premature infants in a behavioral state considered favorable – alert –, and decreasing the presence of less favorable states – agitation, irritation and crying(22) –, demonstrating a possible calming effect of sucrose(13–15,17).

Among the limitations of this study, it is worth mentioning that the experiment could not be performed on newborns who were using an orogastric tube at the time of the test, since this circumstance *per se* would already be configured as an intraoral proprioceptive stimulus.

Further research should be carried out in this scope to expand the profile of the population studied and include different clinical conditions, such as inadequation of neonates regarding the growth pattern for gestational age, or even those who present neurological changes that do not interfere with the risk of oral stimulation.

CONCLUSIONS

This study demonstrated that sucrose is a gustatory stimulus that elicits motor responses at an early age, since it increased behaviors for food readiness in all newborns, regardless of CGA. It can interfere with the behavioral states of newborns, providing a longer sleep time range and a shorter alertness time range, which is important to promote interaction and readiness for food. The influence of sucrose appeared more clearly in preterm infants in the alertness state, demonstrating the stimulus effect when keeping preterm infants in a favorable behavior state.

Our findings are important to deepen the current understanding and develop intervention with neonates regarding the speech-language aspects involved, especially orofacial motricity, thus enabling to expand guidelines for feeding stimulation.

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