



## ORIGINAL ARTICLE

A method for the assessment of facial hedonic reactions in newborns<sup>☆</sup>Caroline Ayres<sup>a,b,\*</sup>, Charles F. Ferreira<sup>a,b,c</sup>, Juliana R. Bernardi<sup>a,b,d</sup>,  
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Received 25 November 2015; accepted 20 June 2016

## KEYWORDS

Newborn;  
Facial expression;  
Sucrose

## Abstract

**Objective:** This study describes a quantitative and qualitative methodology to assess hedonic responses to sweet stimulus in healthy newborns.**Methods:** A descriptive, cross-sectional, observational study, with healthy newborns (up to 24 h of life), between 37 and 42 gestational weeks, vaginally born and breastfed previously to all tests. The evaluation of the newborns reactions was performed by hedonic facial expression analysis, characterized by facial expressions with rhythmic serial tongue protrusion after neutral or sweet solution intake. Initially, 1 mL of water solution was provided to the newborn, followed by a 1-minute recording. Afterwards, the same amount of 25% sucrose solution was provided, performing a second recording. The concordance between researchers was analyzed by the Bland-Altman statistical method.**Results:** A total of 100 newborns ( $n = 49$  males,  $n = 51$  females; mean lifetime = 15 h 12 min  $\pm$  6 h 29 min) were recorded for neutral and sucrose solution intake, totaling 197 videos ( $n = 3$  missing in the water treatment). These videos were double-blind analyzed and the test revealed a 90% concordance between the two trained researchers, in relation to both solutions. The intraclass correlation coefficient was 0.99 for both solutions, with a significant increase in frequency of hedonic expressions evoked by sucrose solution intake.<sup>☆</sup> Please cite this article as: Ayres C, Ferreira CF, Bernardi JR, Marcelino TB, Hirakata VN, Silva CH, et al. A method for the assessment of facial hedonic reactions in newborns. J Pediatr (Rio J). 2016. <http://dx.doi.org/10.1016/j.jpmed.2016.06.011>

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E-mail: [nutricarolayres@hotmail.com](mailto:nutricarolayres@hotmail.com) (C. Ayres).<http://dx.doi.org/10.1016/j.jpmed.2016.06.011>0021-7557/© 2016 Sociedade Brasileira de Pediatria. Published by Elsevier Editora Ltda. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

**PALAVRAS-CHAVE**

Recém-nascido;  
Expressão facial;  
Sacarose

**Conclusions:** These results confirm that the proposed method has an efficient power to detect significant differences between neutral and sucrose stimuli. In conclusion, this evaluation method of hedonic facial reactions in newborns reflects the response to a specific taste.

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**Método para a avaliação de reações faciais hedônicas em recém-nascidos****Resumo**

**Objetivo:** Descrever quantitativamente e qualitativamente uma metodologia para avaliar as respostas faciais hedônicas, em recém-nascidos saudáveis, ao estímulo doce.

**Métodos:** Trata-se de um estudo descritivo, transversal e observacional, com recém-nascidos saudáveis (com até 24 horas de vida), entre 37-42 semanas gestacionais, nascidos por parto vaginal e alimentados previamente aos testes. A avaliação das reações hedônicas dos recém-nascidos foi considerada pelas expressões faciais com séries rítmicas de protrusões de língua após a ingestão de solução neutra ou doce. Inicialmente, 1 mL de solução neutra (água) foi fornecida para o recém-nascido, seguido de uma filmagem de 1 minuto. Sequencialmente, a mesma quantidade de solução de sacarose 25% foi fornecida, realizando-se uma segunda gravação. A concordância entre os pesquisadores foi analisada pelo método estatístico de Bland-Altman.

**Resultados:** Um total de 100 recém-nascidos ( $n = 49$  do sexo masculino,  $n = 51$  do sexo feminino, tempo de vida média = 15 h 12 min  $\pm$  6 h 29 min) foram registrados para a ingestão de solução neutra e de sacarose, totalizando 197 vídeos ( $n = 3$  perdas para o tratamento água). Estes vídeos foram analisados em duplo-cego e o teste revelou uma concordância de 90%, para ambas as soluções, entre os pesquisadores treinados. O coeficiente de correlação intraclasse foi de 0,99 para as duas substâncias, com um aumento significativo nas frequências das expressões faciais hedônicas evocadas pela ingestão de sacarose.

**Conclusões:** Estes resultados confirmam que o método proposto possui poder estatístico eficiente para detectar diferenças entre estímulos neutros e sacarose. Em conclusão, este método de avaliação de reações faciais hedônicas em recém-nascidos reflete a resposta para um gosto específico.

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**Introduction**

Evidence suggests that affective reactions reflect the quality of pleasant or unpleasant events, since newborns have essentially two patterns of facial expressions to taste: positive emotional reaction – hedonic, or negative emotional reaction – disgust. The sweet taste of sugar usually draws positive affective patterns, such as a “nozzle” lip-shape and a rhythmic series of tongue protrusion movements. These movements are accompanied by relaxation of facial muscles.<sup>1</sup> Some studies have reported that the experience of a taste during intrauterine life could improve the acceptance of foods with the same taste in childhood.<sup>2-5</sup> The automatic responses to stimulus can be innate, such as in sweet taste,<sup>6</sup> and may change during the course of life, depending on the type of *in utero* exposure, among other factors before and after birth.<sup>2,7</sup> The child’s facial expression resulting from a sweet taste is an example of a positive affective reaction behavior.<sup>1,8</sup> In addition, hedonic expressions reflect the activity of specific mesolimbic systems,<sup>9</sup> which are also activated after visualization of tasty foods.<sup>10</sup> As variations in this circuit’s responsiveness may predict the

risk for weight gain,<sup>11</sup> behavioral alterations could also indicate a risk for overeating and/or overweight in the future.

There are different methods in the literature to evaluate the hedonic responses to gustatory stimuli in children. In the early 1970s, Steiner was the pioneering author in studies about affective reactivity with the publication of illustrations of the facial reactions in newborns evoked by the sweet, salty, sour, and bitter tastes.<sup>8,12</sup> In 1976, Crook and Lipsitt conducted four experiments about the effects of brief intraoral fluid stimulation upon the non-nutritive sucking rhythm of newborns.<sup>13</sup> Beauchamp and Moran, in 1982, studied the sucrose preference at birth determined by allowing *ad libitum* consumption of sucrose and water solutions during brief presentations, according to the dietary record.<sup>6</sup> Ganchrow et al., in 1983, evaluated newborns’ facial expressions recorded by video after oral stimulation with distilled water and sucrose, urea, and quinine hydrochloride.<sup>14</sup> In 1988, Rosenstein and Oster evaluated videotaped facial expressions based on the Facial Action Coding System adapted for infants (Baby FACS) evoked by sucrose, sodium chloride, citric acid, and quinine hydrochloride.<sup>15</sup> In 1993, Porges and Lipsitt analyzed the

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