Breastfeeding and mucosal and cutaneous colonization by *Staphylococcus aureus* in atopic children *

Aleitamento materno e colonização mucocutânea pelo *Staphylococcus aureus* na criança com dermatite atópica

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Abstract: BACKGROUND: Studies on the effects of breastfeeding on the development of Atopic Dermatitis (AD) have shown controversial results. The importance of this condition deserves further studies; in particular, it remains unclear whether colonization of atopic patients by *Staphylococcus aureus (S. aureus)* through breastfeeding is relevant to the development of AD.
OBJECTIVE: To examine the potential relation between breastfeeding and colonization by *S. aureus* in atopic patients.
METHOD: Transversal study of atopic patients, aged from 4 to 24 months, both genders, receiving outpatient care and 72 mothers. Data on infant breastfeeding practices and on clinical-epidemiological profile were registered. Swabs of the infants' nares and skin (cubital fossa) and swabs of the mothers' nares were collected. For univariate analysis, X2 (chi-square) and Fischer Exact's test were used.
RESULTS: Among breastfed children, *S. aureus* was isolated from 8 (25.8%) infants' nares swabs and from 4 (12.9%) skin swabs. Among not breastfed children, *S. aureus* was isolated from 10 (20.8%) infants' nares swabs and from 11 (22.9%) skin swabs. Sixteen mothers (22.2%) had *S. aureus* isolated from their nares swabs. There was no significant association between breastfeeding and *S. aureus* colonization (child skin and/or nares). However, there was a degree of concordance for *S. aureus* carriage among mothers and infants. Among 72 pairs, 56 (77.8%) were concordant.
CONCLUSION: Breastfeeding was not associated with *S. aureus* muco-cutaneous colonization in atopic infants.
Keywords: Breast feeding; Dermatitis, atopic; *Staphylococcus aureus*

Resumo: FUNDAMENTOS: Não há consenso quanto ao efeito do aleitamento materno no desenvolvimento da dermatite atópica. É necessário aprofundar conhecimentos sobre possíveis fatores envolvidos nessa relação, como a influência do aleitamento materno na colonização do paciente atópico pelo *Staphylococcus aureus* (*S. aureus*).
OBJETIVO: Avaliar uma potencial associação entre aleitamento materno e colonização pelo *S. aureus* nas crianças atópicas.
MÉTODOS: Estudo transversal envolvendo 79 crianças atópicas de 4-24 meses, de ambos os sexos, em acompanhamento no Ambulatório de Dermatologia Sanitária de Porto Alegre, e 72 mães. Registraram-se dados clinicoepidemiológicos e de alimentação das crianças. Pesquisou-se a presença do *S. aureus* em swab nasal e cutâneo nas crianças e swab nasal das respectivas mães. Para análise dos dados, realizaram-se os testes qui-quadrado de Pearson e exato de Fischer.
RESULTADOS: Entre as crianças amamentadas, *S. aureus* foi encontrado nas cavidades nasais de oito (25,8%) e na pele (fossas cubitais) de quatro (12,9%). Entre as não amamentadas, encontrou-se *S. aureus* nas cavidades nasais de dez (20,8%) e na pele de 11 (22,9%). Entre as mães, 16 (22,2%) apresentaram crescimento de *S. aureus* no material proveniente do swab nasal. Não se observou associação significativa entre aleitamento materno e colonização pelo *S. aureus* das cavidades nasais ou da pele das crianças. Entretanto, houve concordância entre a colonização pelo *S. aureus* nas cavidades nasais das mães e nas cavidades nasais e/ou na pele dos filhos. Das 72 duplas, houve concordância em 56 (77,8%).
CONCLUSÃO: O aleitamento materno parece não influenciar a colonização mucocutânea pelo *S. aureus* em crianças com dermatite atópica.
Palavras-chave: Aleitamento materno; Dermatite atópica; *Staphylococcus aureus*

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INTRODUCTION

Atopic dermatitis (AD) is one of the most common skin disorders in childhood, occurring in 10 to 30% of children, and which has an upward trend. [1,2] Its etiopathogenesis is complex and multifactorial. Environmental factors such as diet in the first few months of life and skin colonization with *Staphylococcus aureus (S. aureus),* associated with genetic predisposition, are involved in disease development. [3,4]

Some population-based prospective studies have indicated that breastfeeding is a protective factor against AD. [4-7] Exclusive breastfeeding apears to prevent the early development of AD, asthma and allergic rhinitis, as well [5,6] as reduce the risk of AD at 4 years of age [7].

However, some studies have not confirmed this protective effect of breastfeeding. [8-12] Others, paradoxically, suggest that breastfeeding may promote disease development. [9,12] These conflicting findings suggest that the presence of factors not yet fully understood are implicated in the development and progression of AD, such as colonization of the atopic child with bacteria through breastfeeding, among them *S. aureus.* [13,14]

This bacterium has been recognized as the microorganism most frequently associated with AD, playing an important role in the exacerbation and prolongation of this dermatosis. [15-17] Thus, efforts to reduce the mucocutaneous colonization of atopic patients with this bacterium might contribute to the reduction of the signs and symptoms of atopy.

After an electronic search (PubMed and EMBASE) for articles in English published between March/2007 and June/2009, using the key words "(breastfeeding OR breast milk) AND (atopic dermatitis OR eczema)", studies evaluating the association betweeen breastfeeding and colonization with *S. aureus* of children with atopic dermatitis were not found.

The understanding of a potential association between these factors is a key component in the search for preventive measures that can assist in the treatment of atopic children. This study sought to evaluate a potential association between breastfeeding and colonization with *S. aureus* of children with AD.

POPULATION AND METHOD

This is a cross-sectional study whose population consisted of breastfed infants diagnosed with atopic dermatitis in the Sanitary Dermatology Outpatient Clinic / State Department of Health, Porto Alegre - Rio Grande do Sul

To estimate the sample size we considered a statistical power of 80%, confidence level of 95%, prevalence of colonization with *S. aureus* in unexposed children (without breastfeeding) of 20%, and a difference to be detected of 30%. The minimum number of children to be reached was 78.

From September 2007 to December 2008, children between 4 and 24 months of age seen in pre-assigned shifts and diagnosed with AD were included in the study as long as they did not present any of the following conditions: use of antibiotics or oral corticosteroids 30 days prior to collection of the material for the study; immunosuppression (AIDS, type I diabetes mellitus, chronic use of immunosuppressive drugs); other diseases that compromise the skin barrier, and hospitalization 30 days prior to collection of the material for the study. For analysis purposes, children were classified as breastfed and non-breastfed. Breastfed infants were those who, at the time of data collection, were receiving breast milk, regardless of volume and supplementation with other liquid or solid food. [18]

The diagnosis of AD was confirmed by the main researcher (dermatologist) if the child showed symptoms and signs of the disease at clinical examination and/or history of recurrent eczema with typical location. [19, 20] The severity of atopic dermatitis was not considered in the diagnosis .

After the parents or guardians of the child agreed to participate in the study, they completed a questionnaire with demographic and clinical information about the child and its family. Next, the researcher collected material from the nostrils and cubital flexures of the child, where there was no visible lesion, using sterile *swabs* (moistened with sterile saline solution 0.9%), which were immediately placed in a transport medium with charcoal (Amies) for laboratory analysis. The same procedure was used to collect the nasal *swab* sample of the child's mother when she was present at the visit.

The material was sent to the Central Laboratory of the State of Rio Grande do Sul, a reference laboratory, within a maximum of 4 hours after collection. The samples were cultured on 5% bovine blood agar and placed in a bacteriological incubator at 37 ° C, with readings taken within 24 to 48 hours by two preselected biochemical pharmacists. The catalase test was used to differentiate *Streptococcus* from *Staphylococcus* and the coagulase test was performed to differentiate between coagulase-negative and positive *Staphylococcus* .

Continuous variables with normal distribution were described as mean and standard deviation and the others, as mode or median.

Pearson's Chi-square test was used in the

analysis of qualitative variables. Fisher's Exact test was used to evaluate a possible association between the presence of *S. aureus* in the nose and/or skin of the child and the presence of *S. aureus* in the maternal nasal cavity. A p-value < 0.05 was considered statistically significant.

The database was created in Excel and the *Statistical Package for Social Sciences (SPSS)* software, version 13 for *Windows*, was used in the analysis.

The study protocol was approved by the Ethics and Research Committee of the Public Health School of RS and by the State Foundation in Production and Health Research of RS.

RESULTS

The study included 79 children and 72 mothers, because seven children were brought to the visit by other guardians (father or grandparent). There were no refusals to participate. Most children were in their second year of life, with a mean age of 13.6 ± 6.7 months. Table 1 shows other clinical and epidemiological data from the sample.

The prevalence of colonization with S. aureus in the sample of children studied was 31.6%. Among breastfed children, *S. aureus* was found in the nasal cavity of 8 (25.8%) and skin (cubital fossa) of 4 (12.9%). Among those who were not receiving breast milk, *S. aureus* was found in the nasal cavity of 10 (20.8%) and skin of 11 (22.9%). Among the mothers, 16 (22.2%) showed growth of *S. aureus* in the nasal swab material.

Just over a third of the children (31 - 39.2%) were being breastfed at the time of the study.

There was no significant association between breastfeeding and colonization with *S. aureus* in the nasal cavity or skin of the child, whose relative prevalence (prevalence ratio) was 0.87 (Table 2). However, there was agreement between colonization with *S. aureus* in the nasal cavity of the mothers and the nasal cavity and/or skin of their children. Of the 72 pairs, there was agreement (presence or absence) in 56 (77.8%) (Table 3). The concordance between breastfed and non-breastfed children was the same (77.8)%.

DISCUSSION

The influence of breastfeeding on the development and progression of atopic diseases has been controversial. This study has the merit of perhaps being the first to explore the association between breastfeeding and mucocutaneous colonization with *S. aureus* of children with AD.

In the general population of children, breastfeeding is suggested as one of the possible factors associated with nasal colonization with *S. aureus*. [13,14,21,22] In this study, however, breastfeeding did not contribute to increase the prevalence of mucocutaneous colonization with *S. aureus* in the population of atopic children under 2 years old. The low prevalence of colonization with *S. aureus* in this population (31.6%) compared with the population of other studies, which reported prevalences of up to 90%, draws attention. [1,23,24] Differences in the clinical condition of the children may be involved in these discrepant findings. Unlike the children in this study, children from other studies had severe AD, with great exacerbation of eczema, often needing to be hospitalized. The children in this study had a profile similar to that of the population receiving basic health care: children with less severe disease, mostly with no history of treatment or hospital admission. That would

Table 1: Clinical characteristics of patients and their relatives (n = 79)

Characteristics	
Demographic data	
Age (months)	
4-6	15 (19.0%)
7-12	24 (30.4%)
13-24	40 (50.7%)
Gender – male	37 (46.8%)
Skin color – white	48 (60.8%)
First child or only child	36 (45.6%)
Data about the disease	
Pruritus	74 (93.7%)
Typical distribution of lesions	63 (79.7%)
Chronic and recurrent dermatitis	68 (86.1%)
Dermatitis lesions present at visit	75 (94.9%)
Erythema	67 (84.8%)
Scaling	50 (63.3%)
Induration	23 (29.1%)
Excoriation	33 (41.8%)
Liquenification	16 (20.3%)
Exudation	21 (26.6%)
Presence of crusts	21 (26.6%)
> 20% of body lesions	14 (17.7%)
> 10% os lesions in noble parts of the body	26 (32.9%)
Personal and/or familial history of atopy	73 (92.4%)
Atopic mother	48 (60.8%)
Atopic father	40 (50.6%)
Atopic sibling(s)*	29 (67.4%)
Child's diet	
Exclusive breastfeeding	3 (3.8%)
Mixed breastfeeding	3 (3.8%)
Breastfeeding and complementary nutrition	3 (3.8%)
Mixed breastfeeding and complementary nutrition	22 (27.8%)
No breastfeeding	48 (60.8%)

* Children without any siblings were excluded (n=43).

Table 2: Breastfeeding and mucocutaneous colonization with *S. aureus*

Breastfeeding	*S. aureus**		
	Positive n (%)	Negative n (%)	Total n (%)
Yes	9 (29.0)	22 (71.0)	31 (100.0)
No	16 (33.3)	32 (66.7)	48 (100.0)
Total	25 (31.6)	54 (68.4)	79 (100.0)

* *S. aureus* refers to the presence of *S. aureus* in the nasal mucosa and/or skin of the child. p= 0.878 (Pearson's Chi-square test).

Table 3: Colonization with *S. aureus*: agreement between mothers and children

S. aureus mother	*S. aureus* child* n (%)	
	Positivo	Negative
Positive	11 (68.7)	5 (31.3)
Negative	11 (19.6)	45 (80.4)

* *S. aureus* refers to the presence of *S. aureus* in the nasal mucosa and/or skin of the child. p<0.001 (Fischer's exact test).

explain why the prevalence of colonization with *S. aureus* in this study is similar to that found in a low-income British population of atopic children, who had not received previous treatment or been hospitalized and who had a similar socioeconomic status. [25] The proportion of mothers with positive nasal culture for *S. aureus* was consistent with the average in the general population observed in other studies. [26,27]

Similarly to what has been observed by other authors.[13] this study found a positive association between the presence of *S. aureus* in the maternal nasal mucosa and the skin or nasal mucosa of children, with almost 80% of agreement. Breastfeeding does not appear to have contributed to this finding, given that agreement is similar among breastfed and non-breastfed infants. Considering that this was a cross-sectional study conducted in a single location with a small sample of children seen in a dermatology outpatient clinic with its own characteristics, caution must be exercised in generalizing the findings.

The results of this study should be considered exploratory and potentially hypothesis-generating.

Further studies, preferably with a prospective design, are needed. In addition, more sensitive methods for detection of *S. aureus,* such as those used in molecular microbiology (polymerase chain reaction and pulsed field gel electrophoresis) could be useful to prove that the *S. aureus* present in both mother and child has the same origin.

CONCLUSION

This study evaluated the possible role of breastfeeding in the colonization with *S. aureus* of children with AD. No association was found between breastfeeding and colonization with *S. aureus.* However, we found that of the 16 mothers (22.2% of total sample) who were positive for *S. aureus* in nasal swab, only five had children who were negative for *S. aureus* (swab of the nasal cavity or the skin with visible lesion). Moreover, among the 56 mothers (77.8% of total sample) with negative results, 45 had children with negative results as well (nasal cavity or skin without visible lesion). Thus, the presence of *S. aureus* in the maternal nasal cavity was associated with the presence of the bacteria in the nasal cavity or skin of the patient. Questions such as whether the environment and/or genetics of mother and child have some influence, or the role that breastfeeding plays in this scenario, are potential generators of hypotheses.

In conclusion, due to the important and controversial relationship between colonization with *S. aureus,* breastfeeding and AD, future research is appropriate. The understanding of a potential association between these factors - not yet reported in the literature - is a key component in the search for preventive measures that will assist in the future treatment of patients with AD. ❑

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