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## Association between Breastfeeding and Dentocraniofacial Growth and Development among 3-5 Years Old Children in Two Ethnic Group of North Sumatera

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### Abstract

**Introduction:** Babies need big energy so that mom's breastmilk could come out during the sucking process. The movement of lips, cheek, tongue and lower jaw during the sucking of breastmilk, was done with regular rhythm and continuously affect the growth and development of the dentocraniofacial. **Material & Methods:** The type of research which was carried out was observational with retrospective cohort study which aimed to get the correlation of breastfeeding during infancy with the growth and development of the dentocraniofacial region on 3 to 5 years old children of Malay ethnic and the Bataknese. **Results:** On the Malay ethnic, there's a significant correlation between breastfeeding during infancy with all the measurement variables ( $p < 0.05$ ). On the Bataknese, there's a significant correlation between breastfeeding during infancy with the width of the dental arch and the length of the dental arch ( $p < 0.05$ ). There is no significant correlation between breastfeeding during infancy with the circumference of the dental arch and the palatal depth ( $p > 0.05$ ). **Conclusion:** Breastfeeding will affect the growth and development of the dentocraniofacial region which will affect the size of the dental arch and the palatal depth.

**Keywords:** Breastfeeding, Dentocraniofacial, Growth and Development

### 1. Introduction

Breastmilk fulfills all the needs of a baby and it can't be replaced by other milk (Yulianti, 2010). In Indonesia the giving of exclusive breastmilk hasn't increased in the annual report. The result of Sum's research (2015), on 2 to 5 years old children stated that babies who received breastmilk for more than 6 months had positive correlation towards its growth and development of the dental arch in sagittal and trasversal dimension. Breastfeeding also gave positive effect towards growth and development of the craniofacial region (Neiva et al, 2003; Kobayashi et al, 2007; Neto et al, 2012).

Some of the research stated that the positive effect of giving exclusive breastmilk was in the growth of the jaw including the hard palate (Legovic, 1991; Radzi, 2005; Lopez, 2006). During breastfeeding, when the baby sucked the nipple the position of the baby's lips touched the mom's areola while the tongue sucked in the milk from the nipple, the movement of the tongue towards the mouth reached the hard palate. The tongue then sent the signal to oropharing and the mandible slowly moved backwards to aid the swallowing process (Woolridge, 1986; cit Kobayashi et al, 2007).

The result of the research showed that the sucking needed more effort compared with the using of a bottle. The energy needed was bigger although it's in low scale so that this matter gave important effect towards the growth and development of the facial muscle and teeth. The sucking of the baby while breastfeeding needed more strength of the muscle than using bottle (Kobayashi et al, 2007). The process of the growth and developmental took place since prenatal period to postnatal. The growth and development of the craniofacial region involving the growth of the occlusion, dental arch and the mandible and maxilla bone and its correlation towards craniofacial growth. Dentocraniofacial analysis will be applied for diagnostic needs, determining the treatment plan and prognosis of the malocclusion and the dentofacial deformity (Hayati, 2003).

Human had diversity in its growth. Craniofacial was a specific part of the body because of the physical characteristic in the facial region was more prominent here. Diversity from physical characteristic was the interaction of the genetic and environment. The types of head would affect the facial form, palate and the dental arch (Rahardjo, 2011). Dentocraniofacial growth in this research was known towards vertical cephalic index, the arch of the primary dentition and the palatal depth which was done in the Malay ethnic which represented the Deutro-Melayu and Bataknese which represented the Proto-Melayu. The researcher wanted to examine the advantage of giving exclusive breastmilk from the dental point of view as an effort to avoid malocclusion.

### 2. Material And Methods

The research which was carried out was observational with retrospective cohort study with the aim to know the association of breastfeeding with the growth and development of 3 to 5 years old children.

The research took place in North Sumatra province namely Kedai Sianam village, Batubara Kabupaten in which was composed mostly of Malay ethnic and in Tarutung, North Tapanuli Kabupaten which mainly was composed of the Bataknese.

Inclusion criteria: 4 to 5 years old children, teeth which were needed in the dental arch examination were complete in the oral cavity, teeth needed were free from caries, children of Malay ethnic and Bataknese, no hereditary abnormality history, willing to be taken impression of the teeth and examination of the teeth with the parents' permission.

#### Material

Questionnaires, Stationary, arch caliper, digital caliper, stainless steel ruler, 0.14 mm stainless steel wire, impression trays, rubber bowl and spatle, correct quick impression materials, xantalgin and molastone dental stone.

#### Methods of Collecting Data

The vertical cephalic index was gathered by measuring to the cephalic height and cephalic length of the child's directly. The measurement was done 3 times by different person.

- Cephalic height was measured by using digital caliper, placing the respective end of the caliper on the nasion and gnation point. The distance of both end of the caliper was noted.
- Cephalic length was measured by using the arch caliper, placing the respective end of the caliper on glabella and inion point. The distance of both end of the caliper was measured with ruler and the result was noted.
- The value of the vertical cephalic index was gained from this formula:

$$\text{Vertical Cephalic Index} = \frac{\text{Cephalic height}}{\text{Cephalic length}} \times 100$$

- 11 Nasion (n) : The most anterior point midway between the frontal and nasal bones on the frontonasal suture
  - Gnation (gn) : It is the most anterior-inferior point on the symphysis of the chin. It is constructed by intersecting a line drawn perpendicular to the line connecting menton and pogonion
  - Glabella (g) : It is the most prominent point of the forehead in the mid-sagittal plane
  - Inion (i) : It is a point on the median-sagittal plane, cutting the linea nuchae-superior (Rakosi, 1982)
- The measurement of the dental arch and the height of palate was taken on the upper arch impression on the children.

- 27 Maxillary arch width was measured as maxillary canine arch width from cusp tip to cusp tip and intermolar arch width was measured between the mesiobuccal cusp tips of the right and left second primary molars.
- 1 Maxillary arch depth was measured at two levels: anterior arch depth (canine arch depth) was defined as the length of line running perpendicularly from the midpoint between the central incisors to a line connecting the distal contact points of the right and left canines, and posterior arch depth (molar arch depth) was defined as the length of a line perpendicularly from the midpoint between the central incisors to a line connecting the most distal points of the right and left second primary molars.
- 7 Maxillary arch length was measured as segments on the right and left sides as follows: the anterior segment, from the contact area of the central incisors to the contact area between the canine and the first primary molar, and the posterior segment from the contact between the canine and the first primary molar to the most distal point of the primary second molar.
- 4 Palatal depth was measured as the length of a line from the deepest point in the palate to a line connecting the mesiolingual cusp tips of the primary second molars (Warren and Bishara, 2002).

#### ANALYSIS DATA

Univariant analysis, to see the distribution frequency of the retrospective variable. Bivariant analysis, to analyze the association of independent variable and dependent variable so the Fisher's Exact was taken.

#### 3. Results

The average distribution frequency of the vertical cephalic index, dental arch and the palatal depth of the Malay ethnic and Bataknese on 3 to 5 years old children.

The average cephalic height, cephalic length and the vertical cephalic index of the Malay ethnic and Bataknese children whom were given breastmilk were greater than those who didn't receive breastmilk, except for the anterior segment arch length and the palatal depth. Table 1

**Table 1 Distribution Frequency of the Average Vertical Cephalic Index, Dental Arch and the Palatal Depth of Batakese Children from Age 3 to 5**

Variable	Malay Ethnic (X = SD)		Batakese (X = SD)	
	No Breastmilk	Breastmilk	No Breastmilk	Breastmilk
	Cephalic height	8,29 ± 0,29	8,78 ± 0,36	7,96 ± 0,26
Cephalic length	16,30 ± 0,38	15,50 ± 0,39	16,90 ± 0,70	16,00 ± 0,79
Vertical cephalic index	50,38 ± 1,66	51,70 ± 3,68	51,63 ± 1,60	51,63 ± 2,58
Maxillary canine arch width	28,52 ± 1,82	31,03 ± 2,12	21,34 ± 2,14	30,24 ± 1,70
Maxillary molar arch width	45,52 ± 1,77	47,06 ± 2,08	44,25 ± 1,80	45,71 ± 1,83
Maxillary canine arch depth	11,19 ± 1,76	12,06 ± 1,73	8,92 ± 1,30	10,40 ± 1,54
Maxillary molar arch depth	27,70 ± 1,96	28,65 ± 2,27	26,73 ± 1,68	27,64 ± 2,29
Anterior segment arch length	31,80 ± 3,99	33,56 ± 2,54	34,34 ± 3,02	38,14 ± 2,40
Posterior segment arch length	43,24 ± 5,53	43,19 ± 4,52	33,90 ± 1,96	36,00 ± 2,21
Palatal depth	13,48 ± 1,06	14,36 ± 1,49	14,00 ± 0,82	15,39 ± 1,44

The Association of Giving Breastmilk during Infancy with the Vertical Cephalic Index on 3 to 5 Years Old Children

On the Malay ethnic, children who were given breastmilk during infancy reached 58.8% had cephalic height of >8.68 cm, 55.3% with cephalic length of >16.7 cm and 60.0% with vertical cephalic index of >51.41 cm. The result of the research showed that there's significant correlation between breastfeeding of the baby with the vertical cephalic index ( $p < 0.05$ ). On the Batakese, children who given breastmilk during infancy reached 62.2% had cephalic height of >8.68 cm, 48.6% with cephalic length of >16.7 cm and 51.4% with vertical cephalic index of >51.63 cm. The result showed that there's no significant correlation between breastfeeding of the baby with the vertical cephalic index ( $p > 0.05$ ). Table 2

**Table 2 The Association between Breastfeeding with the Vertical Cephalic Index on 3 to 5 Years Old Children**

VARIABLE	MEASUREMENT	MALAY ETHNIC				MEASUREMENT	BATAKESSE			
		Status of breastmilk			p value		Status of breastmilk			p value
		No Breastmilk	Breastmilk	Total			No Breastmilk	Breastmilk	Total	
CEPHALIC HEIGHT	≤ 8.68	23	33	58	0.000	18	27	45	0.000	
		80.6%	39.8%	50.9%		90.0%	37.5%	48.9%		
	> 8.68	6	50	56		2	45	47		
	19.4%	60.2%	49.1%	10.0%		62.5%	51.1%			
Total	31	83	114	Total	20	72	92			
		100.0%	100.0%	100.0%		100.0%	100.0%	100.0%		
CEPHALIC LENGTH	≤ 16.7	25	38	63	0.000	17	38	56	0.006	
		80.6%	44.7%	54.3%		80.9%	53.5%	60.9%		
	> 16.7	6	47	53		3	23	26		
	19.4%	55.3%	45.7%	15%		46.5%	39.1%			
Total	31	85	116	Total	21	71	92			
		100.0%	100.0%	100.0%		100.0%	100.0%	100.0%		
VERTICAL CEPHALIC INDEX	≤ 51.41	24	33	57	0.000	10	36	46	0.600	
		77.4%	39.3%	49.6%		50.0%	50.0%	50.0%		
	> 51.41	7	51	58		10	36	46		
	22.6%	60.7%	50.4%	50.0%		50.0%	50.0%			
Total	31	84	115	Total	20	72	92			
		100.0%	100.0%	100.0%		100.0%	100.0%	100.0%		

The Association of Breastfeeding with the Maxillary Arch Width on 3 to 5 Years Old Children

The children of Malay ethnic who were given breastmilk, showed that most of them (61.25%) had maxillary canine arch width and 55.3% with maxillary molar arch width greater than those who didn't receive breastmilk. The result of the research showed significant correlation between receiving breastmilk in baby with maxillary

canine arch width and maxillary molar arch width ( $p < 0.05$ ).

The same result was also seen on Batakese children, 56.8% children who were given breastmilk during infancy had wider maxillary canine arch width and wider maxillary molar arch width than those who didn't receive breastmilk. The result of the research showed significant correlation between giving breastmilk during infancy with the maxillary canine arch width and maxillary molar arch width ( $p < 0.05$ ). Table 3

**Table 3 The Association of Breastfeeding during Infancy with the Maxillary Arch Width on 3 to 5 Years Old Children**

VARIABLE	MEASUREMENT	Malay Ethnic				p value	MEASUREMENT	Batakese			
		Status of breast milk			p value			Status of breast milk			p value
		No Breast milk	With Breastmilk	Total				No Breast milk	With Breastmilk	Total	
MAXILLARY CANINE ARCH WIDTH	$\leq 29.59$	25	32	58	0.000*	$\leq 30.57$	16	32	48	0.007*	
		80.6%	38.8%	50.0%			76.2%	43.2%	50.0%		
	$> 29.59$	6	32	38		$> 30.57$	5	42	47		
		19.4%	61.2%	50.0%			23.8%	56.8%	49.3%		
	<b>Total</b>	31	85	116		<b>Total</b>	21	74	95		
		100.0%	100.0%	100.0%			100.0%	100.0%	100.0%		
MAXILLARY MOLAR ARCH WIDTH	$\leq 45.39$	20	38	58	0.046*	$\leq 46.45$	16	32	48	0.007*	
		64.5%	44.7%	50.0%			76.2%	43.2%	50.0%		
	$> 45.39$	11	47	58		$> 46.45$	5	42	47		
		35.5%	55.3%	50.0%			23.8%	56.8%	49.3%		
	<b>Total</b>	31	85	116		<b>Total</b>	21	74	95		
		100.0%	100.0%	100.0%			100.0%	100.0%	100.0%		

The Association of Breastfeeding during Infancy with the Maxillary Arch Depth on 3 to 5 Years Old Children

Malay ethnic children who were given breastmilk, 60.0% had maxillary canine arch depth and 57.6% had greater maxillary molar arch depth than those who didn't receive breastmilk. Thus also on the Batakese children, 55.4% with maxillary canine arch depth and maxillary molar arch depth greater than those who didn't receive breastmilk. The result of the research showed that there's significant correlation between breastfeeding during infancy with maxillary canine arch depth and Maxillary molar arch depth in Malay ethnic children and Batakese children ( $p < 0.05$ ). Table 4

**Table 4 The Association of Breastfeeding during Infancy with the Maxillary Arch Depth on 3 to 5 Years Old Children**

VARIABLE	MEASUREMENT	MALAY ETHNIC				p value	MEASUREMENT	BATAKENESE			
		Status of breastmilk			p value			Status of breastmilk			p value
		No breast milk	With breast milk	Total				No breast milk	With breast milk	Total	
ANTERIOR ARCH DEPTH	$\leq 10.11$	24	24	48	0.000*	$\leq 11.91$	10	32	42	0.026*	
		77.4%	40.0%	50.0%			71.4%	44.0%	50.0%		
	$> 10.11$	7	31	38		$> 11.91$	8	41	49		
		22.6%	60.0%	50.0%			28.6%	56.0%	49.5%		
	<b>Total</b>	31	55	86		<b>Total</b>	18	73	91		
		100.0%	100.0%	100.0%			100.0%	100.0%	100.0%		
POSTERIOR ARCH DEPTH	$\leq 17.55$	22	38	60	0.006*	$\leq 19.04$	10	32	42	0.026*	
		71.0%	42.4%	50.0%			71.4%	44.0%	50.0%		
	$> 17.55$	9	49	58		$> 19.04$	8	41	49		
		29.0%	57.6%	50.0%			28.6%	56.0%	49.5%		
	<b>Total</b>	31	87	118		<b>Total</b>	18	73	91		
		100.0%	100.0%	100.0%			100.0%	100.0%	100.0%		

The Association of Breastfeeding with the Maxillary Arch Length on 3 to 5 Years Old Children

The research showed that there's significant correlation between giving breastmilk and the anterior segment arch length and the posterior segment arch length on Malay ethnic ( $p < 0.05$ ). Whereas the result of the research on Batakese children showed that there's no significant correlation on giving breastmilk infancy with the anterior segment arch length and posterior segment arch length ( $p > 0.05$ ). Table 5



breastmilk.

The research of Ganesh et al (2005) on 153 samples 3 to 5 years old children in Canara who were given breastmilk, there's an average maxillary canine arch width of  $29.82 \pm 1.53$ , maxillary molar arch width of  $39.82 \pm 1.53$ . The research of Vitoria (2007) in Brazil on 3 years old children (cit Neto, 2012), maxillary canine arch width of  $30.3 \pm 1.9$ , maxillary molar arch width of  $43.5 \pm 2.3$ , palatal depth of  $12.8 \pm 1.3$ . The result of this research if we compared the average size of maxillary canine arch width or either the maxillary molar arch width of Malay ethnic and the Bataknese were smaller.

The result of Warren et al's research, (2002) on 372 children of 4 to 5 years old who received breastmilk for 6 months, the anterior arch length was 28.9, posterior arch length width of 41.4, anterior arch length length of 10.1, posterior arch length of 26.1 and the height of palate 14.7.

The result of Putri's research (2010) in Jakarta on 3 to 5 years old children with breastfeeding history, it was known that the maxillary canine arch width  $31.49 \pm 1.72$ , maxillary molar arch width of  $46.07 \pm 2.12$ . Anterior segment arch length of  $8.10 \pm 1.33$ , posterior segment arch length of  $28.66 \pm 1.76$ . In this research, the children were chosen without seeing the ethnicity.

#### 4.2 The Association of Breastfeeding during Infancy with the Vertical Cephalic Index on 3 to 5 Years Old Children

The result of the research gained that 60.2% of the group who received breastmilk on Malay ethnic had the cephalic height of  $>8.68$  cm, 55.3% with the length of head  $> 16.7$  cm and 60.7% with the vertical cephalic index  $>51.41$  cm. The analysis showed that there's a significant correlation between breastfeeding during their infancy with the cephalic height, the length of head and vertical cephalic index ( $p<0.05$ ).

Breastfeeding for the babies also stimulated the growth and development of the craniofacial region. The process of sucking breastmilk also made orofacial development became better (Ganesh et al. 2005; Radzi, 2005; Luz et al; cit Narbutyte et al. 2013; Salone, 2013; Agarwal et al, 2014).

The Bataknese, 62.5 % of the children who received breastmilk had bigger value in the measurement of the cephalic height ( $>8.22$  cm). Thus also the measurement of the cephalic length, 46.5% children who were given breastmilk had bigger result than those who didn't receive breastmilk ( $>16$  cm). Vertical cephalic index of the children who received breastmilk with those who didn't receive breastmilk had the same measurement result ( $>51.63$  cm). The result of the analysis showed that there's significant correlation between giving breastmilk during infancy with the cephalic height and cephalic length ( $p<0.05$ ). On the vertical cephalic index measurement, the result of the research showed that there's no significant correlation between giving breastmilk during infancy with vertical cephalic index.

The Bataknese (Proto Melayu) genetically had relatively longer face shape (oval/ *dolichocephalic*) and the measurement result showed that children who didn't receive breastmilk during infancy, 50% of them had bigger vertical cephalic index (51.63 cm). This matter was which causing there's no significant association between breastfeeding during infancy with vertical cephalic index.

#### 4.3 The Association of Breastfeeding during Infancy with Dental arch and the Palatal Depth on 3 to 5 Years Old Children

The result of this research showed that there's significant correlation between breastfeeding during infancy with the maxillary canine arch width, maxillary molar arch width, maxillary canine arch depth, maxillary molar arch depth, anterior segment arch length, posterior segment arch length and palatal depth on Malay ethnic children ( $p<0.05$ ). On Bataknese, the result of the analysis showed that there's significant association between giving breastmilk during infancy with maxillary canine arch width, maxillary molar arch width, maxillary canine arch depth and maxillary molar arch depth ( $p<0.05$ ) and it was known that there's no significant association between breastfeeding during infancy with the anterior segment arch length, posterior segment arch length and the palatal depth ( $p>0.05$ ).

The shape of head needed to be known because the shape of head had correlation with the shape of face, palate and dental arch. There are 3 head shapes namely *dolichocephalic* (long and narrow), *mesocephalic* (average) and *brachycephalic* (wide and short). It was said that the *dolichocephalic* would be a narrow, long and protrusive face. The long and narrow anterior fossa of the cranium would produce a narrow upper dental arch and narrow, long and deep palate. Whereas the *brachycephalic* would produce bigger face and less protrusive. On the *brachycephalic* there would be a wide and short anterior fossa cranium which then would produce a wide, short and shallow upper arch and palate (Mukhtar 1974; Rahardjo, 2011).

Based on that matter, the result of this research supported that the Bataknese genetically had long and narrow upper arch and also a narrow, long and deep palate. From the average measurement, it was known that the children who on their infancy didn't receive breastmilk had bigger anterior segment arch length and bigger palate than the Malay ethnic. The result of the analysis also showed that there's no correlation between breastfeeding during infancy with the anterior segment arch length, posterior segment arch length and palatal

depth.

The result which was carried out by Tajik et al (2011), there's a correlation between the shape of head, types of face and the shape of the dental arch. It was said that someone with *brachycephalic* would usually have short face (*euzyprosopic*) with square dental arch. Whereas *dolichocephalic* usually had long and had tapered dental arch. The result of [3] research supported the research and also Rahardjo's opinion (2011), that based on the measurement result, maxillary canine arch width and maxillary molar arch width of the children who received breastmilk during infancy on Malay ethnic had bigger size than those of the Batakese, while the anterior segment arch length and the palatal depth of children who received breastmilk during infancy on the Batakese were bigger than those who received breastmilk on Malay ethnic. It matched that Batakese had *dolichocephalic* and sharp jaw. [3]

The primary dental arch would be the basis of eruption of the permanent teeth. The maxillary canine arch width and maxillary molar arch width would be the consideration of malocclusion cases (Agarwal et al, 2014). Valle et al (2006), done a research in Puerto Rico on 540 samples 6 to 72 months old children who were given exclusive breastmilk. It was said that the giving of exclusive breastmilk gave positive effect to the development of the jaws.

The sucking movement using tongue stripping (Weber et al, 1986 cit Neto et al, 2012; Pollard, 2015). The movement of the tongue moved from anterior part of the mouth to the posterior part and against the up and down movement in babies who received milk using bottle (Radzi, 2005; Salone et al, 2013 [3] Ganesh et al (2005), stated that the period of giving breastmilk gave the tendency towards the increase of the maxillary canine arch width and maxillary molar arch width became bigger.

Sum et al (2015), done a research between the associations of breastfeeding with the three dimension of the primary dental arch (sagittal, vertical and transversal).

The research was carried out in Hongkong on 851 samples 2 to 5 years old children. It was said that the group which were given exclusive breastmilk, the [3]tivity of the buccinators had dominant proportion of the muscle strength. From the transversal (side to side) maxillary canine arch width and maxillary molar arch width who were given exclusive breastmilk were bigger. The result of the research showed that there's a significant correlation between giving exclusive breastmilk with maxillary canine arch width ( $p=0.003$ ). If there's a significant correlation between breastfeeding with the maxillary molar arch width ( $p=0.002$ ).

Maintaining the primary dental arch is very important to prepare place for the permanent teeth. The size and shape of the dental arch are one of the factor in determining the diagnosis. The dental arch length is very affected by the growth and development of the orofacial region. The dental arch is the main factor to reach good occlusion in a harmonious arch based on the increase of the dental arch width which is connected to the growth of the teeth that involve the alveolar processus (Rahardjo et al, 2002).

## 5. Conclusion

- 1) The average cephalic height, cephalic length and the vertical cephalic index of the Malay ethnic children and Batakese children who received breastmilk during infancy are bigger than those who didn't receive breastmilk, except for the anterior segment arch length and the palatal depth.
- 2) The result of the research showed that there's a significant correlation between [4] breastfeeding during infancy with the cephalic height, cephalic length, vertical cephalic index, maxillary canine arch width, maxillary molar arch width, maxillary canine arch depth, maxillary molar arch depth, anterior segment arch length, posterior segment arch length and the palatal depth ( $p>0.05$ ).
- 3) The Batakese children, genetically had *dolichocephalic* head which were followed by a long and narrow upper arch and also a narrow, long and deep palate. The Batakese children who didn't receive breastmilk during infancy would have the tendency to have malocclusion.
- 4) Breastfeeding for the babies will stimulate the growth and development of the dentocraniofacial region, [9] which can affect the size of the dental arch and the palatal depth which are the main factors in reaching good occlusion.

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