

# Measurement of the palpebral fissure and the vermilion border of the upper lip in newborns with gestational ages of 25 to 43 weeks

Medida da fissura palpebral e da borda vermelha do lábio superior de recém-nascidos com idade gestacional de 25 a 43 semanas

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## ABSTRACT

**Objective:** To prepare percentile curves for measurements of palpebral fissure and the greatest width of the vermilion border of the upper lip in newborns at a public maternity ward in the City of São Paulo. **Methods:** A descriptive cross-sectional study was carried out from August 2006 to January 2008. In the first 24 to 72 hours of life, the palpebral fissure and the greatest width of the vermilion border of the upper lip were measured in 1,964 newborns with gestational ages from 25 to 43 weeks. Percentile curves corresponding to these measurements were prepared according to gestational age. **Results:** The average measurement of palpebral fissure was 1.98 cm, ranging from 0.80 to 3.00 cm, standard deviation  $\pm 0.24$  cm. The average measurement of the width of the vermilion border of the upper lip was 0.51 cm, ranging from 0.20 to 0.90 cm, standard deviation  $\pm 0.11$  cm. These measurements allowed designing the percentile curves (10th, 50th, and 90th) relative to gestational age. **Conclusions:** Measurement curves of palpebral fissure and of the greatest width of the vermilion border of the upper lip may be useful to evaluate the presence of facial dimorphism in newborns.

**Keywords:** Infant, newborn; Measurement curve; Palpebral fissure; Lip

## RESUMO

**Objetivo:** Elaborar curvas de percentis das medidas da fissura palpebral e da maior largura da borda vermelha do lábio superior de recém-nascidos em maternidade pública da cidade de São Paulo. **Métodos:** Estudo descritivo transversal realizado de Agosto de 2006 a Janeiro de 2008. Nas primeiras 24 a 72 horas de vida, foram feitas medidas da fissura palpebral e da maior largura da borda vermelhada lábio superior de 1.964 recém-nascidos com idade gestacional de 25 a 43 semanas. Curvas de percentil correspondentes a essas medidas foram elaboradas de acordo com a idade gestacional. **Resultados:** A média da medida da fenda palpebral foi de 1,98 cm, variando de 0,80 a 3,00 cm, com desvio padrão de  $\pm 0,24$  cm. A maior largura

da borda vermelha do lábio superior teve uma medida média de 0,51 cm, variando de 0,20 a 0,90 cm, com desvio padrão de  $\pm 0,11$  cm. Essas medidas permitiram a elaboração de curvas de percentil (10, 50 e 90) em relação à idade gestacional. **Conclusões:** As curvas elaboradas das medidas da fissura palpebral e da maior largura da borda vermelha do lábio superior podem ser úteis na avaliação da presença de dismorfias faciais de recém-nascidos.

**Descritores:** Recém-nascido; Curva de crescimento; Fissura palpebral; Lábio

## INTRODUCTION

Some characteristics of eyelids and lips, such as their measurements, are data that cannot be omitted from analysis in the physical examination of newborns.

Towards the 48<sup>th</sup> day of the embryo, formation of the upper lip is completed through fusion of the two upper maxillary and the two nasomedial processes emerging from the first arch<sup>(1)</sup>.

By the 6<sup>th</sup> week, small folds of ectoderm with mesenchymal core appear just cranially and caudally to the developing cornea. These upper and lower primordial eyelids rapidly grow toward each other, meeting and fusing by the 8<sup>th</sup> week. The eyelids separate again between the 5<sup>th</sup> and 7<sup>th</sup> months<sup>(2)</sup>.

The palpebral fissure develops more quickly than the eye<sup>(3)</sup>. However, the length of the palpebral fissure directly correlates with the size of the ocular globe<sup>(4,5)</sup>. The development of the palpebral fissure does not depend solely on the development of the eye<sup>(3)</sup>. Since the eye is a neuronal organ, the length of the palpebral fissure may indirectly reflect a neurological

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growth problem<sup>(4)</sup>. Nevertheless, an alteration in the measurements of the palpebral fissure may also be related to abnormalities in the development of the soft tissue around the eyes<sup>(4)</sup>.

Many syndromes present with congenital malformations in the eyelids and/or thinner upper lips, such as the fetal alcohol syndrome (FAS), Kabuki syndrome, trisomy 13, trisomy 18, among others<sup>(6)</sup>. FAS, the most frequent, is a permanent birth defect caused by maternal consumption of alcohol during pregnancy and it currently represents a major public health issue worldwide<sup>(7-9)</sup>. The estimated prevalence of FAS varies from 0.5 to 2 cases/1,000 live births<sup>(9,10)</sup>. Based on this prevalence, the Center for Disease Control and Prevention (CDC) expects there will be 1,000 to 6,000 children with FAS born every year, with approximately 4 million children born with prenatal alcohol exposure. These rates are higher than those found for other common developmental disabilities such as Down's syndrome or spina bifida<sup>(10)</sup>.

The well-known adverse effects of prenatal exposure to alcohol, however, are underdiagnosed, since healthcare professionals are unprepared to make this diagnosis and because social prejudice in pregnancy causes women to hide their alcohol-consuming habits<sup>(10,11)</sup>. The diagnosis of FAS in the newborn implies the presence of three facial characteristics: small palpebral fissure, thin upper lip, and smoothness of the philtrum, plus intrauterine growth restriction and abnormalities of the central nervous system in multiple ways<sup>(7,10)</sup>. Consequently, early identification and diagnosis of FAS in affected newborns recognized by the abovementioned characteristics are essential in order to provide health, education, and social services that may guarantee optimal well-being to these children and their families<sup>(10)</sup>.

Even though some international publications describe the measurement of palpebral fissures in newborns, no reports of these measurements regarding the Brazilian population in the newborn period were found in any study. The same is true in relation to the greatest width of the vermilion border of the upper lip.

Therefore, the construction of percentile curves for the measurements of palpebral fissure and vermilion border of the upper lip in the Brazilian population must be a valid goal for neonatologists.

## OBJECTIVE

To construct percentile curves for measurements of palpebral fissure length and the greatest width of the vermilion border of the upper lip in newborns at the Hospital e Maternidade-Escola Municipal Dr. Mário de Moraes Altenfelder Silva da Vila Nova Cachoeirinha (HMEVNC).

## METHODS

This is a descriptive cross-sectional study carried out from August 13, 2006 to January 21, 2008 at HMEVNC, a public hospital in the City of São Paulo, located in the Northern area of the city, in Brasilândia district. This maternity hospital serves a low-income and highly mixed race population. It is a reference tertiary hospital for high-risk pregnancies, and also treats normal pregnant women belonging to this specific geographical area.

During this period, there were 7,447 live births at the hospital and 33 live children who were admitted to hospital after birth. For operational reasons, due to availability of one of the researchers (MAM), the live newborns admitted during the above-mentioned period, between 00:01 AM on Sundays and 11:59 PM on Mondays, were included. Newborns who presented with a genetic syndrome, died, were transferred to another hospital or discharged prior to their physical examination, whose mother died, who were not the first born in case of twins, or who were children of women refusing to participate in the study were excluded.

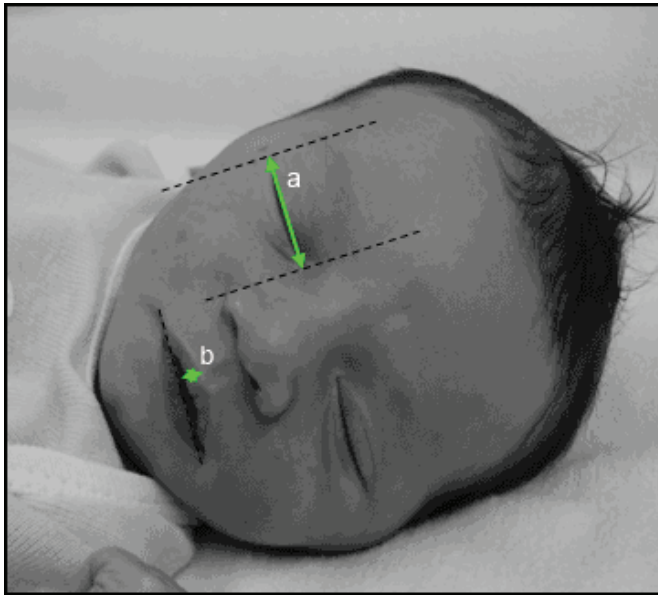
Data were collected on gestational age and measurements of the palpebral fissure and greatest width of the vermilion border of the upper lip of the newborns.

Gestational age was estimated by using the last menstrual period calculated by Naegeles' rule<sup>(12)</sup>, by using the New Ballard Score<sup>(13)</sup> obtained between the 6<sup>th</sup> and the 48<sup>th</sup> hour of life, or by the Capurro method<sup>(14)</sup> carried out during the first hour of life, when the newborn clinical condition precluded examination to be done using the New Ballard Score. The gestational age was determined through the New Ballard Score or the Capurro method when the mothers last menstrual period was unknown. Preterm newborns were defined as those whose gestational age was less than 37 weeks, term newborns as gestational age of 37 complete weeks to 41 weeks 6/7 days, and post-term newborns as gestational age equal to or above 42 weeks<sup>(15)</sup>.

The vermilion border is the exposed mucous membrane or red portion of the upper lip, and the palpebral fissure length is the distance from the eye endocanthion to its exocanthion<sup>(16)</sup>.

The palpebral fissure and the greatest width of the vermilion border of the upper lip were measured with a rigid plastic ruler marked with 1 mm intervals. The measurement of the palpebral fissure was taken with the ruler at the greatest horizontal axis between the eye endocanthion and its exocanthion. The greatest width of the vermilion border of the upper lip was obtained with the same type of ruler at the greatest vertical axis, between the labial commissure and the upper border of the upper lip. Measurements were registered in centimeters and

were taken with the patient's eyes closed, due to the difficulty of children this age opening their eyes, and with their lips sealed (Figure 1).



"a" = palpebral fissure length and "b" = vermillion border width

**Figure 1.** Measurements of palpebral fissure and vermillion border of superior lip

Measuring of the palpebral fissure and the vermillion border of the upper lip was carried out at between 24 and 72 hours of life, so that the subcutaneous edema from labor and birth would not induce error. The newborn was lying on the crib, in supine position, in either a state of quiet sleep or quiet alert.

Data collection and anthropometric measurements of the newborns were carried out by only one of the researchers (MAM).

The measurements of palpebral fissure and greatest width of the vermillion border of the upper lip of these children, together with their gestational age, allowed the construction of the respective percentile curves for these measurements. For each curve, the 10th, 50th, and 90th percentiles were determined according to gestational age.

The newborn participation in the study was consented to after their mothers had read and signed the Parental or Legal Guardian Consent Form.

The study was approved by the HMEVNC Research Ethics Committee under protocol number 009/2006.

**RESULTS**

During the study period, 7,480 live children were born, with 7,447 hospital births and 33 births outside the hospital. Of this total, 2,035 were eligible to participate in the research because they were born between 00:01 AM on Sundays and 11:59 PM on Mondays. However,

6 (0.29%) were excluded from the study for the presence of syndromes, 11 (0.54%) because they died before having their physical examination, 7 (0.34%) for having been discharged from hospital before their physical examination, 1 (0.05%) due to the fact of being transferred to another hospital before the physical examination, 1 (0.05%) because the mother died before the physical examination, and 9 (0.44%) because their mothers refused to participate. Of the 2,000 (98.28%) children who remained, 36 were of twin pregnancies and the second twin was not considered. Thus the sample for analysis consisted of 1,964 newborns (96.51%).

With regard to gestational age, of the 1,964 newborns, 312 (15.90%) were premature, 1,631 (83.04%) were full term and 21 (1.06%) were post-term. The average gestational age was 38.55 weeks, ranging from 25.0 to 43 weeks and a standard deviation of 2.49 weeks. The mean birth weight was 3,048.51 g, range of 540 g to 5,680 g, and a standard deviation of 613.32 g, and 92% of the children (n = 1,807) were appropriate for gestational age.

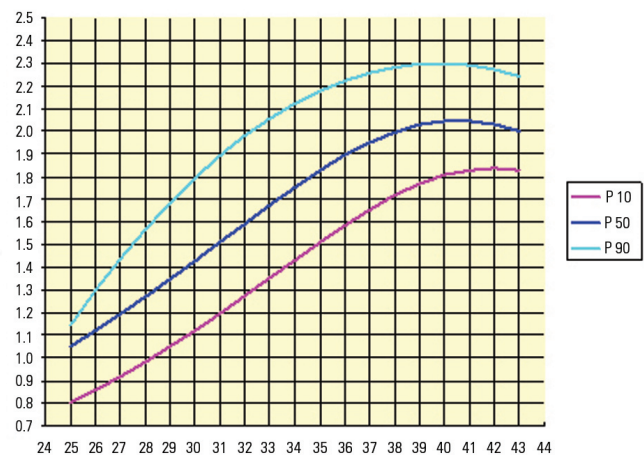
Table 1 shows the average measurement of the palpebral fissure, its variation and standard deviation, as well as the measurement of the greatest width of the vermillion border of the upper lip with its variation and standard deviation.

**Table 1.** Anthropometric measurements of newborn

	Minimum	Maximum	Average	Standard deviation
PF (cm)	0.80	3.00	1.98	0.24
VBUL (cm)	0.20	0.90	0.51	0.11

PF: palpebral fissure; VBUL: vermillion border of the upper lip.

Figures 2 and 3 show the percentile curves (10th, 50th, and 90th percentiles) obtained with the measurements of palpebral fissure and the greatest width of the vermillion border of the upper lip according to gestational age.



**Figure 2.** Percentile curve of measurement of palpebral fissure



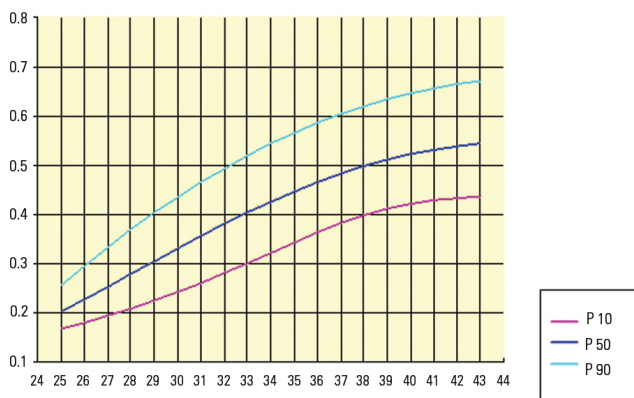


Figure 3. Percentile curve of measurement of vermillion border of upper lip

## DISCUSSION

Facial characteristics, among them the length of the palpebral fissure and the aspect of the upper lip, are essential components of the neonatal physical examination, and the presence of deviations from a normal pattern allows early detection of many syndromes<sup>(6)</sup>. FAS, for instance, stands out for its prevalence, and its diagnosis implies finding the three dysmorphic facial features: smooth philtrum, thin vermillion border, and small palpebral fissures<sup>(10)</sup>.

Nevertheless, it is important to emphasize that each of these characteristics may differ according to race, geographical area, and can change with age<sup>(16-19)</sup>. Growth and facial anthropometry are specific for each population, and the sensitivity and specificity of the evaluation will be low if the appropriate instrument for evaluation is not used. Herein lies the importance of local standardized curves for identifying congenital abnormalities<sup>(19-22)</sup>.

The population comprised in this study belongs to the outskirts of a large city where miscegenation is very high, hindering the identification of a “pure” representative of any race; therefore, the construction of specific percentile curves for the measurements of the palpebral fissure and the width of the upper lip according to gestational age in this population may be mandatory.

The measurement of the palpebral fissure has been thoroughly studied by different authors. Various studies that measured the palpebral fissure of newborns, covering gestational ages from 29 to 43 weeks<sup>(20,21,23-26)</sup> and fetuses from 15.5 to 41 weeks of gestation<sup>(27)</sup> were published by authors from the United States<sup>(23,26)</sup>, Hungary<sup>(20)</sup>, China<sup>(24)</sup>, Bulgaria<sup>(25)</sup>, Nigeria<sup>(19, 21)</sup>, and France<sup>(27)</sup>. One North American study constructed a curve of the palpebral fissure measurement of children from 29 weeks of gestation to 14 years of age<sup>(26)</sup>. The average measurement of the palpebral fissure found in this study

is comparable to that found by Denis et al.<sup>(27)</sup>, who refer a mean of 1.85 cm in fetuses aged 39 weeks of gestation, and it is also similar to the values found by Leung et al.<sup>(28)</sup>, who described a mean of 2.0 cm for White children and 2.3 cm for Black children from Cardiff.

None of the studies mentioned above, however, included the measurements of the palpebral fissure of children with ethnic characteristics similar to the population in this study. Furthermore, no study was found that analyzed the palpebral fissure measurement in the Brazilian population in order to allow comparison of data. The only Brazilian study that describes small palpebral fissures refers to children with SAF<sup>(29)</sup>.

Astley and Clarren created an illustrated guide of the upper lip and nasal philtrum (University of Washington Lip-Philtrum Guide) that helps evaluating these structures in the children of White, North American women who consume alcoholic beverages<sup>(30)</sup>. But no study was found – whether national or international – in which the greatest width of the vermillion border of the upper lip had been measured for different gestational ages as was done in this study.

According to data found in literature, there is no significant difference between the measurements of the left and right eyelids. Thus, either one of them may be measured isolatedly<sup>(20,23)</sup>. In the current study only the left palpebral fissure of each newborn was measured, as it was easier for the examiner to be positioned in relation to the patient. An important aspect for the measurement of the palpebral fissure is related to the state of contraction of the orbicular muscles of the eyelids, which leads to a reduction in length of the palpebral fissure, hence this measurement should be obtained when the child is relaxed<sup>(23,26)</sup>. In this study, the children were either quietly sleep or quietly alert.

Some authors stated that the measurement of the palpebral fissure is greater in male than female newborns<sup>(24,25)</sup>. However, the majority of authors assured that there is practically no difference in the length of the palpebral fissure with regard to gender<sup>(20,21-23,27)</sup>. Therefore, in this study, the child sex was not considered separately in relation to this measurement.

Finally, it is worth mentioning that the palpebral fissure length is predominately independent of the occipitofrontal circumference in children<sup>(31)</sup>, so it was not considered for analysis in this article.

Nevertheless, this study has limitations. Only one examiner measured the variables studied, but the large number of children that were examined could compensate for error. The percentile curves for the measurements of palpebral fissure length and upper border of the superior lip according to gestational age may be appropriate for the children born in this particular municipal maternity hospital in the

city of São Paulo because of racial characteristics. However, further studies on the theme should be done and we dare say that this may be a first step towards stimulating the construction of other percentile curves in other centers, according to the characteristics of their own populations. This study did not show comparisons of these curves to others in literature, as this was not its objective.

## CONCLUSION

The percentile curves for the measurements of the palpebral fissure length and the greatest width of the vermilion border of the upper lip according to gestational age, in a population of a maternity hospital in the city of São Paulo, were presented in this study.

These data can be useful in the physical evaluation of newborns in this population, as in the early diagnosis of dysmorphic characteristics and syndromic anomalies. They allow for a more precise and objective quantitative description of these structures, avoiding subjective evaluations.

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