

Prevalence of Blue Spot among Mongolian Newborn Infants

Suvd Batbaatar¹, Enkhtur Yadamsuren², Lkhamsuren Sonom³, Oyunchimeg Unshigbayar³, Myagmarjav Sharkhuu⁴, Burmaajav Badrakh⁵

¹National Center for Public Health, Ulaanbaatar, Mongolia; ²Department of Dermatology, School of Medicine, Mongolian National University of Medical Sciences, Ulaanbaatar, Mongolia; ³National Center for Maternal and Child Health, Ulaanbaatar, Mongolia; ⁴National Dermatology Center, Ulaanbaatar, Mongolia; ⁵Mongolian Academy of Medical Sciences, Ulaanbaatar, Mongolia;

Submitted: July 14, 2017
Revised: September 29, 2017
Accepted: October 16, 2017

Corresponding Author
Burmaajav Badrakh, MD, PhD, DSc
Mongolian Academy of Medical
Sciences, Ulaanbaatar 14200,
Mongolia
Tel: +976-9981-7218
E-mail: burmaajav55@gmail.com

This is an Open Access article distributed under the terms of the Creative Commons Attribution Non-Commercial License (<http://creativecommons.org/licenses/bync/4.0/>) which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited. Copyright© 2017 Mongolian National University of Medical Sciences

Objectives: The aim of this study was to determine the prevalence and characteristics of Mongolian spots in Mongolian infants. **Methods:** This hospital-based, descriptive cross-sectional study was conducted nationwide among 2641 newborn infants in Ulaanbaatar and in 21 provinces hospitals within 96 hours postpartum in 2015. **Results:** The prevalence of Mongolian spots in Mongolian infants was 91.3%. The prevalence of spots in females was 92.1% and in male newborns it was 90.6% ($p>0.05$). The prevalence of Mongolian spots in the Western provinces was lower than in the rest of other provinces (98.3% and 95% CI: 96.4-99.4). For of infants with Khalkha parentage, 92.7% had Mongolian spots, while 64.7% of infants with Kazakh parentage had Mongolian spots. The Mongolian spots are commonly located in infant's lower back (88.3%) and had an average length of 3.7 ± 2.7 cm, width of 2.7 ± 1.9 cm and an average area of 14.2 ± 23.3 cm². The appearance of Mongolian spots on the infant's legs, face, chest, hands, feet, knee, and cheeks were less frequent. **Conclusion:** The prevalence of Mongolian spots among Mongolian infants was 91.3% [95%CI: 87.2-95.3] and significant difference was observed between Mongolian and Kazakh infants.

Keywords: Birthmark, Mongolian Spot, Infants

Introduction

Mongolian spot is a type of dermal melanocytosis, which presents at birth as an ill-defined area of slate gray to deep blue pigmentation over the lumbosacral area [1, 2]. The Mongolian spot is blue, grey-blue birth mark and it is revealed immediately after birth or a week following delivery. A German Professor Baelz in 1885 identified it in Japanese newborns and named

it the Mongolian spot. He believed that Mongolian spot was a distinct characteristic of the Mongols and other non-Caucasian races [3, 4].

Studies of "Mongolian spot" prevalence have been conducted in many countries, namely in USA (Native Americans), Korea, China, Japan, Nigeria, Iran, India, Taiwan, Brazil, Australia, Italy, Arab, Turkey [5- 20]. Those studies determined the specific prevalence among newborns and general population. According

to the study conducted in the United States, 90% of Native Americans, 80% of Asian population, 70% of Spanish and 10% of white infants are born with Mongolian spots [3]. The Gordova study found that Mongolian spots correlated with genetics and was found to occur mostly in Asian children, also 80.0% of Eastern Africa, 46.0% of Spanish and 1-9% of white children [21]. Since 1700's, the history of Mongolian spots is interwoven with myths, and beliefs about geographical uniqueness, along with information on its prevalence, genetics, ethnic groups, characteristics of neonatal (weight, height, gestational age), and health significance [21, 22]. Today, approximately 1,700,000 items of information on this topic are available on the internet. Until now, there has been no substantial study on the prevalence, ethnography, and history of Mongolian spots done in Mongolia. While majority of the Asian infants are expected to be born with Mongolian spots, it is necessary to study and determine the precise percentage of Mongolians with blue spots. Although this spot named as a "Mongolian spot", there is no data in relation to its genetics and history in Mongolia. Moreover, we are not able to find any data on the prevalence of the Mongolian spots among Mongolians. Therefore, the goal of the study was to determine the prevalence of Mongolian spots in Mongolian infants and its geographic variation throughout Mongolia.

Materials and Methods

1. Study Design and Method

This hospital-based, descriptive cross-sectional study was conducted nationwide. The prevalence of the Mongolian spots within 96 hours of birth was determined on newborn infants, whose mothers were in the maternity ward after delivery.

2. Sampling and sample size of the study

The study subjects were selected from Ulaanbaatar city and each of the provinces of Mongolia. The target population of the study was Mongolian infants and mothers, who were giving birth in Mongolia. Study error of 2% was assumed with a confidence interval of 1.96%. Since, no study had been conducted on prevalence of infants born with Mongolian spot, a lowest parameter of 50% was used to calculate the sample size, which was determined as 2401, who could represent the population. In line with the calculation of errors on data collection, sample size was increased by 10% (264 infants). Therefore, a total of 2641

newborn infants were considered as adequate sample size for this study and 1220 (46.2%) of them were recruited from the capital city of Ulaanbaatar.

3. Methods of data collection

Data were collected by a researcher using a standardized questionnaire that consisted of 31 closed and semi-open questions. The gender, gestational age, anatomical sites of the Mongolian spot, as well as birth weight, height, parental consanguinity, and maternal age were recorded. Each child was carefully examined for the presence of Mongolian spots, during a systematic physical examination by a researcher with the assistance of neonatologist within 96 hours of birth. If a spot was observed, localization, size, color, and shape were documented.

4. Determination of surface area of Mongolian spot

Surface area size of the Mongolian spot was calculated by the length and width of the biggest Mongolian spot, converting size of the spot into a rectangular shape. Mosteller RD108 formula was used to determine the body surface area (BSA) of the infant.

$$BSA = \frac{\sqrt{W \times H}}{3600} = 0.016667 \times W^{0.5} \times H^{0.5}$$

Thereby, the percentage of Mongolian spot on the infant's body surface area was determined.

5. Statistical analysis

Statistical analysis was done by using of SPSS version 21 (SPSS Inc., Chicago, IL, USA). Each infant was considered an independent sample. To make the data representative of the entire country, these sample data were then weighted for each hospital based on the number of births at that hospital in 2012. The data were managed in a database and were carefully prepared for data processing. Sample weighting was performed by using a Sampling 1.0 software. Collected data was exported from MS Excel 2010 to SPSS 21.0 software's database and each information was analyzed thoroughly. The prevalence and general tendency of Mongolian spot and outcome measures (prevalence and mean variance) and differences between groups (gender, gestational age, weight, height, location, and ethnicity) was calculated with 95% confidence intervals (95% CI). Prevalence of Mongolian spot was calculated using the parameters of averages and frequency. Mann-Whitney U test

and Kruskal-Wallis test were used to analyze parametric and non parametric data and ANOVA was used to compare mean and median parameters. We used the Kolmogorov–Smirnov test for testing normality of variance and Chi square test was used to compare categorical variables. Spearman correlation test was used to define factors that might be correlated with the size of the Mongolian spot.

6. Ethical considerations

The survey methodology was reviewed and approved by the Medical Ethical Committee of the Ministry of Health, Mongolia on July 8, 2011 (Resolution No 08). Since this was a cross sectional study, we collected data only after informed consents were obtained from the surveyed participants.

Results

1. General characteristics of infants

Of the infants studied, 54.3 percent (95% CI: 52.4-56.2) were male, average weight was 3400±482.2 grams, birth height was 51.0±2.4 cm and average gestational age was 39.3±1.5 weeks. The average surface area of the infant body was 0.22 ± 0.19 m².

Of the infants studied, 8.3 percent [95% CI: 7.2-9.3] were twins and 93.2% [95% CI: 92.2-94.2] were born at an average of 40±1.4 weeks gestation. There were 2 main different ethnicities (Mongolian and Kazakh) and several other ethnic groups (Khalkha, Durvud, Buriad, Zakhchin, Kazakh, and Khoton) residing in Mongolia. Mongolian percentage was found in 95% (95% CI: 94.3-95.8) of the infants from the maternal side and 94.7% (95% CI: 93.8-95.5) from their paternal side.

2. Prevalence of Mongolian spots among infants

The study revealed that prevalence of Mongolian spots in Mongolian infants was 91.3% [95% CI: 90.2-92.3]. In female infants 92.1% [95% CI: 90.6-93.6] had spots while 90.6% [95% CI: 89.1-92.2] of male infants were born with Mongolian spots, but this small difference was not statistically significant. The prevalence of Mongolian spots in the Western Provinces was lower than the rest of the areas, while the prevalence of Mongolian spots in the Eastern Provinces were higher (98.3% and 95% CI: 96.4-99.4) (Table 1). Figure 1 shows prevalence of Mongolian spot by each province.

In of infants with Khalkha parentage, 92.7 percent had Mongolian spots, while 64.7% of infants with Kazakh parentage had Mongolian spots.

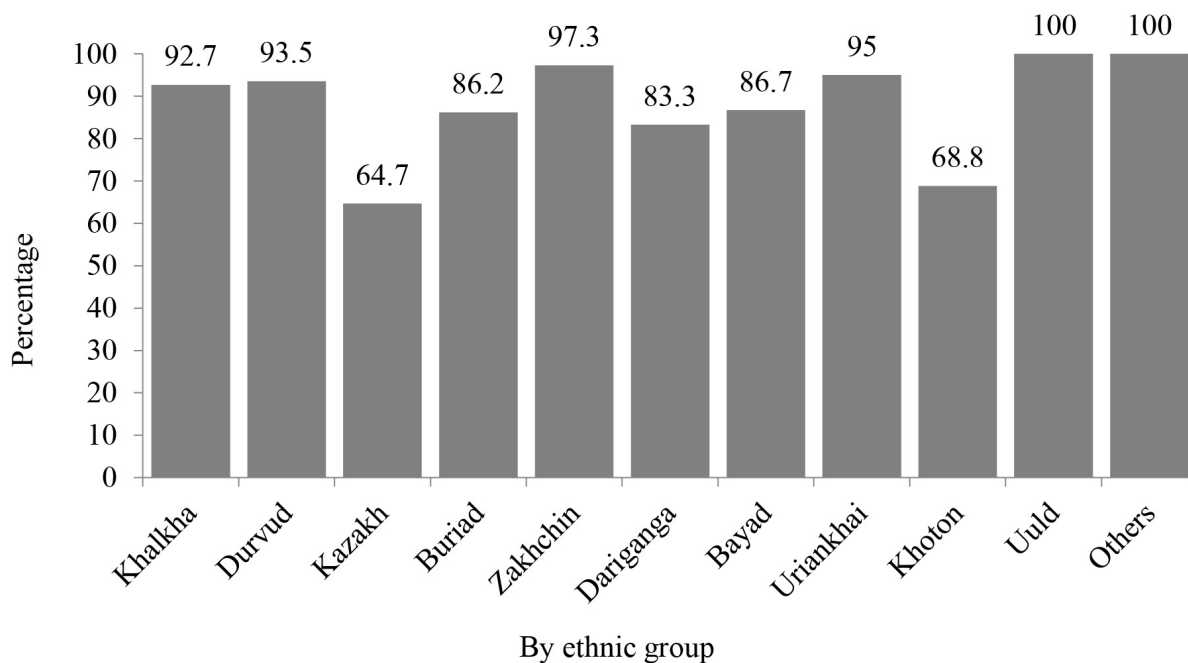


Figure 1. Prevalence of blue spots in Mongolian infants, by ethnic groups

Table 1. Prevalence of Blue spot in Mongolian Newborn, by province and region

Region	Name of aimag	Prevalence n (%)	95%CI	Sex	
				Male	Female
Western region	Bayan-Ulgii	65 (67.0)	63.7-70.3	30 (65.2)	35 (68.6)
	Gobi-Altai	49 (94.2)	90.9-97.5	29 (96.7)	20 (90.9)
	Zavkhan	65 (97.0)	93.7-100.0	33 (100.0)	32 (94.1)
	Uvs	71 (89.9)	86.6-93.2	29 (85.3)	42 (93.3)
	Khovd	77 (91.7)	88.4-94.9	40 (93.0)	37 (90.2)
	Total	327 (86.3) $\chi^2=44.95$ $p=0.00001$	83.0-89.6	161 (86.6) $\chi^2=25.61$ $p=0.001$	166 (86.0) $\chi^2=20.31$ $p=0.007$
Khangai region	Arkhangai	74 (94.9)	92.6-97.2	31 (93.9)	43 (95.6)
	Bayankhongor	74 (98.7)	96.4-100.0	42 (97.7)	32 (100.0)
	Bulgan	39 (100.0)	98.7-100.0	22 (100.0)	17 (100.0)
	Orkhon	73 (77.7)	75.4-79.9	38 (77.6)	35 (77.8)
	Uburkhangai	105 (94.6)	92.3-96.9	61 (95.3)	44 (93.6)
	Khuvsgul	115 (100.0)	98.7-100.0	62 (100.0)	56 (100.0)
Total	483 (93.8) $\chi^2=42.39$ $p=0.0001$	91.5-96.1	256 (93.8) $\chi^2=28.12$ $p=0.0002$	227 (93.8) $\chi^2=17.58$ $p=0.001$	
Central region	Gobisumber	15 (100.0)	98.3-100.0	10 (100.0)	5 (100.0)
	Darkhan-uul	91 (91.9)	90.3-93.5	58 (93.5)	33 (89.2)
	Dornogobi	50 (96.2)	94.6-97.8	20 (90.9)	30 (100.0)
	Dundgobi	32 (91.4)	89.8-93.0	17 (94.4)	15 (88.2)
	Umnugobi	42 (97.7)	96.1-99.3	23 (95.8)	19 (100.0)
	Selenge	69 (90.8)	89.2-92.4	39 (86.7)	30 (96.8)
	Tuv	32 (100.0)	98.2-100.0	16 (100.0)	16 (100.0)
Total	331 (94.0) $\chi^2=3.1$ $p=0.21$	92.4-95.6	183 (92.9) $\chi^2=5.9$ $p=0.45$	148 (95.5) $\chi^2=13.45$ $p=0.04$	
Eastern region	Sukhbaatar	45 (97.8)	93.7-100.0	23 (95.8)	22 (100.0)
	Khentii	56 (100.0)	98.2-100.0	30 (100.0)	26 (100.0)
	Dornod	71 (97.3)	93.2-100.0	45 (95.7)	26 (100.0)
	Total	172 (98.3) $\chi^2=2.25$ $p=0.34$	94.2-100.0	98 (97.0) $\chi^2=3.61$ $p=0.43$	74 (100.0) $\chi^2=2.06$ $p=0.35$
	Ulaanbaatar	1098 (90.0)	85.9-94.0	594 (88.8)	504 (91.5)
Mongolia	2411 (91.3)	87.2-95.3	1292 (90.6)	1119 (92.1)	

3. Distinguishing characteristics of infant Mongolian spot

The Mongolian spots were most commonly located in infant's lower back (2127, 88.3%). Mongolian spots on the infant's legs, face, chest, hands, feet, knee, and cheeks were less common (Table 2). Furthermore, majority of infant's Mongolian spots

were deep blue in color (1441, 59.8%). The Mongolian spots commonly located in infant's lower back had an average length of 3.7 ± 2.7 cm, width of 2.7 ± 1.9 cm, and an average square area of 14.2 ± 23.3 cm². Relatively large Mongolian spots were found on the infant's ankle (22.0 cm²), left shoulder (19.6 cm²) and the left hand (12.0 cm²) (Table 3). In 28.3% of the infants

Table 2. Percentage of Newborn with Blue spot, by location of Blue spot, Mongolia

Location of Blue spot	n ^a	Percentage of Newborn with Blue spot		
		% [95%CI]	Male, n (%)	Female, n (%)
Lumbar area	2127	88.3 [87.0-89.5]	88.0 [86.2-89.7]	88.6 [86.5-90.4]
Back	864	35.9 [33.9-37.8]	36.8 [34.2-39.5]	34.7 [31.8-37.3]
Right shoulder	121	5.4 [4.6-6.3]	4.6 [3.6-5.9]	6.3 [4.8-7.6]
Left shoulder	58	2.4 [1.8-3.1]	1.5 [0.9-2.1]	3.5 [2.5-4.5]
Right hand	53	2.2 [1.6-2.8]	2.4 [1.6-3.3]	2.0 [1.2-2.8]
Left hand	39	1.6 [1.1-2.2]	2.1 [1.4-2.9]	1.1 [0.5-1.8]
Ankle	38	1.6 [1.1-2.1]	1.7 [1.0-2.4]	1.4 [0.8-2.2]
Hip	29	1.2 [0.8-1.7]	0.9 [0.4-1.4]	1.6 [0.9-2.4]
Thighs	19	0.8 [0.4-1.1]	1.0 [0.5-1.6]	0.5 [0.2-1.0]
Sole of foot	6	0.2 [0.1-0.5]	0.3 [0.1-0.6]	0.2 [0.0-0.5]
Shoulder Blade	5	0.2 [0.0-0.4]	0.2 [0.0-0.5]	0.2 [0.0-0.5]
things	2	0.1 [0.0-0.1]	-	0.2 [0.0-0.5]
Knee	2	0.1 [0.0-0.2]	0.1 [0.0-0.2]	-
Shin	3	0.1 [0.0-0.3]	0.2 [0.0-0.4]	-
Chest	1	0.01 [0.0-0.1]	-	-

^aRepeated numbers

Table 3. Mongolian blue spots size, location

Location of Blue spot	n	Mongolian Blue Spot, X± CX		
		Length(cm)	Depth (cm)	Square (cm ²)
Sacral area	2127	3.0±2.6	2.0±1.9	6.0
Gluteal area	864	3.0±3.1	2.0±2.1	6.0
Right shoulder	121	3.3±2.9	3.0±2.1	9.5
Left shoulder	58	5.0±3.4	4.0±2.2	19.6
Right hand	53	3.0±3.4	2.6±2.3	7.9
Left hand	39	4.0±2.4	3.0±1.9	12.0
Ankle	38	5.0±4.0	4.1±2.5	22.0
Lumbar area	29	4.0±2.2	3.0±1.7	12.0
Thigh	19	2.0±3.2	3.0±2.0	6.0
Foot	6	3.0±2.3	2.7±1.5	6.7
Shoulder	5	2.0±2.7	2.0±1.4	4.0
Cheeks	5	6.0±3.7	4.5±3.5	27.0
Knee	2	6.0±1.4	4.0±0.1	24.0
Shin	2	6.0±0.1	4.0±0.1	24.0
Chest	3	7.5±0.1	4.2±0.1	31.5
Total	3372	3.7±2.7	2.7±1.9	14.2±23.3

^aRepeated numbers

Table 4. Mongolian Blue Spots shape, by color and location

	Location n	Sacral area		Gluteal area		Shoulders		Total	
		%	n	%	n	%	n	%	n
Shape	Elliptical	1538	75.8	614	75.2	156	87.6	1807	75.0
	Oval	484	23.8	200	24.0	22	12.4	596	24.7
	Unclear	6	0.4	6	0.8	-	-	7	0.3
Color	Deep blue	1222	60.3	493	59.8	110	64.3	1374	59.7
	Gray blue	775	38.2	308	37.8	63	35.6	878	38.2
	Mixed	31	1.5	19	2.3	1	0.1	48	2.1
Total		2028	100.0	820	100.0	174	100.0	2410	100.0

with spots, the babies had a single spot, while 71.7% had more than one. There were 40 different grouping of locations for blue spots in newborns with more than one and 16 locations for a blue spot when the newborn had a single spot.

The Mongolian spot on the lumbosacral area was usually single, while spots on the upper and middle back typically had 2-3 separate parts. The majority of Mongolian spots on shoulders had up to 3 parts. Mongolian spots on the ankle and legs had 3 or more parts. Elliptical spots were found on 75.0% (95% CI:73.1-76.7) of the infants while 24.7% [95% CI: 22.9-26.7] were circular. Most of the spots on the lumbosacral were oval-shaped and deep blue in color (Table 4).

4. Results of the relevance analysis of infant Mongolian spot

Number of indicators, such as infant gender, birth weight, birth height, provinces and ethnicity were used for the statistical analysis. The Mongolian spots were not related with the birth weight or birth height (p=0.27, p=0.884).

In Kazakh infants, 66.4 percent (95% CI: 57.9-74.4) were born with Mongolian spots while 92.5% of Mongolian infants [95%CI: 91.5-93.5] had them. This difference was highly statistically-significant (p=0.0001). The prevalence of infants with Mongolian spot in Western province of Mongolia is 86.3%, which was significant lower (p=0.0001) than the other provinces (Table 5). The size of the infant Mongolian spot was not statistically associated with the length of the infant, the gestational age, and the age of the mother (Table 6). The size of the Mongolian spots were positively correlated with the infant’s weight (p=0.013). The size of the Mongolian spot square was strongly and directly correlated with the body surface area of the infant (p=0.0001) (Figure 2).

Discussion

There are two ethnic groups present in Mongolia that have Mongolian spots, the Mongols and Kazakhs. This study found that 66.4% [95% CI:57.9-74.4] of infants from Tureg (Kazakh and Khoton) parentage has Mongolian spots and 92.5% [95% CI: 57.9-74.4] of infants from Mongolian descent has Mongolian spots. The low prevalence [65.0%; 95% CI:63.7-70.3] of Mongolian spot in Bayan-Ulgii province comes from the larger proportion of Kazakh people living in that province. Several studies on prevalence of Mongolian spot have been conducted worldwide. The reported prevalence of the Mongolian spot varies as follows: East Africa (95.0%), Native Americans (90.0%), Korean (97.1%), China (86.3), Japan (81.5%), Nigeria (74.8%), Iran (71.3%), India (60.2-62.2%), Spain (60.0%), Taiwan (61.6%), Brazil (60.0%), Hungary (22.6%), Australia (25.5%), Italy (2-5%), Arab (8-10%), Azerbaijan (10%), and Turkey (10-12%) [2, 5-20].

We found that the prevalence of Mongolian spot in Mongolia is 91.6%. Accordingly, this result shows close correlation with East African people (95.0%) and the Native Americans (90.0%) (Figure 3). In 1912, Eric Bellingham Smith first proposed the hypothesis that the unique characteristic of infant birth with a Mongolian spots was not unique to the Mongolians [3]. Indeed, the findings of the Mongolian spot studies in many countries proves his hypothesis. One very old Mongolian dictionary interpreted the Mongolian spot as an indicator of heritage and the term’s importance in the modern Mongolian language is reflected in the saying “Heredity is your blood, bone, brain, flesh and the Mongolian spot on the lower back on your body that came with your birth represents your Mongolian heredity”[22].

According to these Mongolian heritage original resources

Table 5. Distribution of Mongolian spot, by some indicators, Mongolia

Variable/ Category	Newborn				Total n	p-value	
	With spot		None spot				
	n	%	n	%			
Gender	Male	1292	90.6	134	9.4	1426	p=0.07 ^a
	Female	1119	92.1	96	7.9		
Birth weight (g)	<2500	67	91.8	6	8.2	73	p=0.44 ^a
	>2500	2344	91.3	224	8.7	2568	
Gestational age	<37 week	2243	91.2	217	8.8	2460	p=0.45 ^a
	≥37 week	168	92.8	13	7.2	181	
Region	Western	327	86.3	52	13.7	379	p=0.0001 ^b
	Khangai	483	93.8	32	6.2	515	
	Central	331	94.0	21	6.0	352	
	Eastern	172	98.3	3	1.7	175	
Nationality (mothers)	Mongolian	2343	92.6	187	7.4	2530	p=0.00001 ^b
	Turkic	68	61.3	43	38.7	111	
Nationality (fathers)	Mongolian	2325	92.5	189	7.5	2514	p=0.0001 ^b
	Turkic	81	66.4	41	33.6	122	
Total Newborn		2411	91.3	230	8.7	2641	

^aMann-Whitney U test, ^bKruskal Wallis test

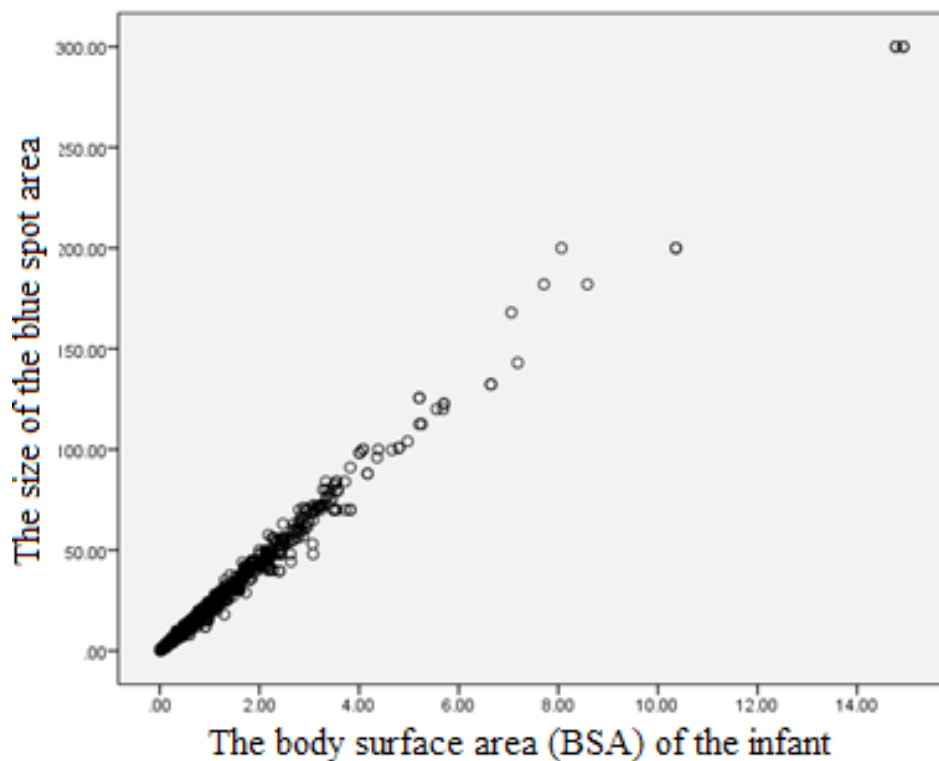


Figure 2. Correlation of the Mongolian blue spot size (square) with the surface area of the infant body

Table 6. Correlation of newborns weight and square of Mongolian spot's

Variable	Birth weight	Newborn's height	Gestational age	Body surface area (BSA)	Mother's age	Square of spot
Birth weight	1.000	0.620**	0.300**	-0.019	0.060**	0.051*
		0.0001	0.0001	0.342	0.002	0.013
Newborn's height		1.000	0.241**	-0.038	0.041*	0.016
			0.000	0.061	0.033	0.435
Gestational age			1.000	-0.042*	-0.008	-0.018
				0.679	0.367	
Body surface area (BSA)				1.000	-0.020	0.996**
					0.0001	
Mother's age					1.000	-0.017
						.413

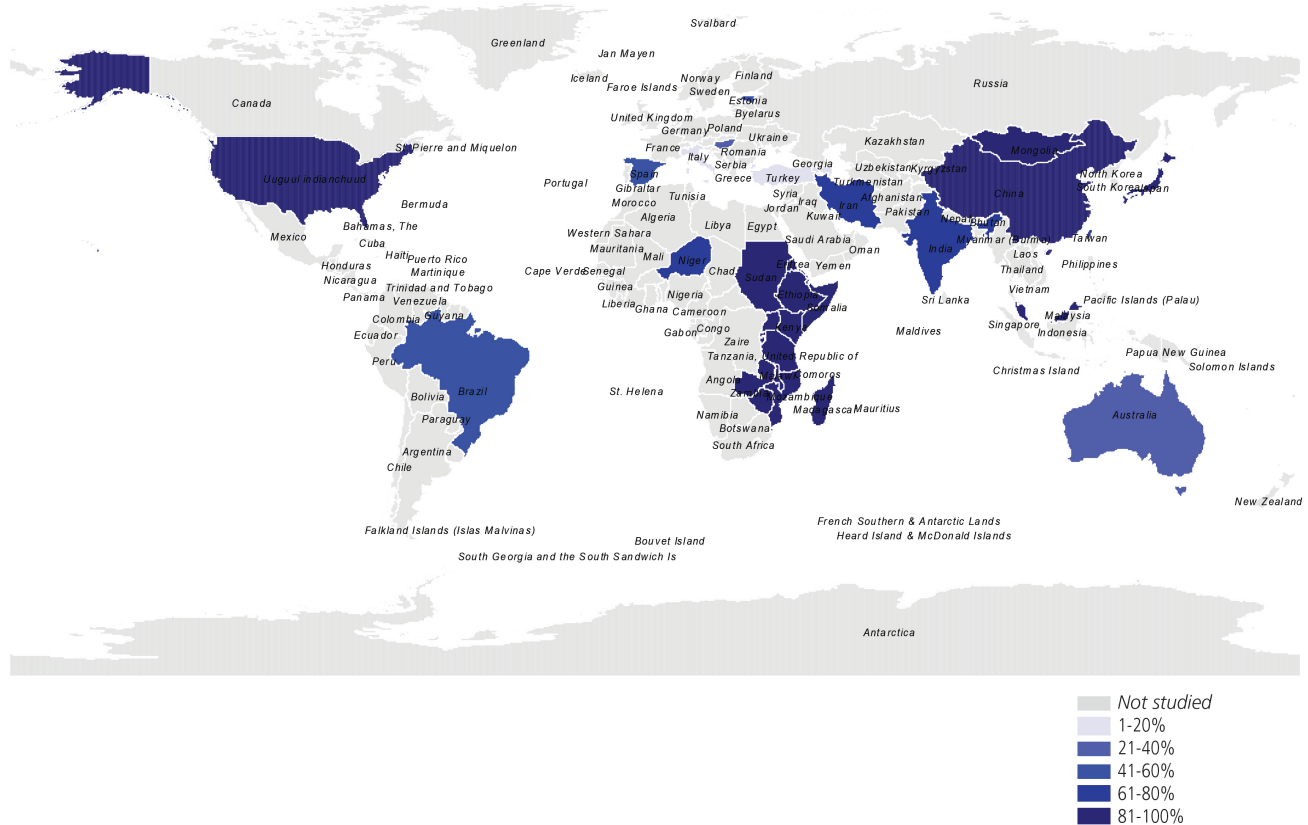


Figure 3. Countries with the prevalence of the blue spot, 2012

dated 40,000 years ago, Mongolian ancestors had knowledge of the Mongolian spot then proving that Mongolians were born with Mongolian spots during that time [22]. Throughout the centuries, Mongolian spot has been subject of controversy in many biological and anthropological studies. Earliest known

accounts of Mongolian spots dated back to Hippocrates. In Turkey, it was known as "leke" or "spot". Also, the Mongolian spot is referred to in Japanese as "oss Shirigaai", meaning to have a blue bottom. In China, it is known simply as "mark" (taiji), where when a child is born. Also, in Mexican and Kyrgyzstan's

ancient historical sources noted that blue spot's presence among their infants [21]. These historical records describing Mongolian spots indicate it has existed among infants of many countries all over the world since ancient time. During the late 19th and earlier of the 20th century, Mongolian spots were a central topic of many anthropological debates. Some Mongolists claim that the "Mongolian spots" in other nations are inherited as a result of the conquest of the Mongolian army. Larsen and Godfrey proposed a Mendelian inheritance as a hypothesis that Mongolian spot is inherited generation to generation by the Law of Segregation [23]. There are 3 types of general inheritance from parents to child like dominant, homozygous, and heterozygous [24]. Researchers have yet to define the general inheritance Mongolian spots or heterogeneity of the types of spots.

In general, Mongolian spot is located lower side of back and has deep blue and grey blue color [17]. According to the study of Silengo et al the classical location of Mongolian spot is the back [9]. Our survey also found similarity of location of Mongolian spot. However, some infants had the Mongolian spot on their leg, hand, shoulder, face, and sole. However, these locations for the Mongolian spot were rare as was reported by Lever et al (2015) and Pariser, et al [23, 24]. According to the study of Gordova, Mongolian spots located are not found on the face and chest but only in rare cases they have reported on the shoulders and soles [25]. Our study results were similar.

In addition, we did not find relationship between Mongolian spot with gestational age, gender, weight, and height of infant, maternal age, and birth delivery type. These results were similar with results of other studies [3, 10, 20, 25].

We trust that this study will provide baseline information for historians, ethnographers, anthropologists and sociologists who are interested in expanding research regarding the Mongolian spot. Further research is needed to understand the genetics and health implications of the blue spot. One of the limitations of our study was the number of respondent's and the occasional lack of information on the birth place, age and ethnicity of the infants' father. Moreover, it was not possible to compare our results to other studies, as we could find no previous studies on the distribution of the Mongolian spot among Mongolian descents.

In conclusion, the prevalence of Mongolian spots among

Mongolian infants was 91.3% (95% CI: 87.2-95.3) and its prevalence was higher among Mongolian compared to Kazakh infants (92.5% versus 66.4 percent, $p=0.0001$). Its prevalence was lower in Western province of Mongolia ($p=0.0001$) where there is a larger proportion of Kazakh people. The spot's size was positively correlated with the body surface area ($p=0.0001$) and infant's weight ($p=0.013$).

Conflict of Interest

The authors state no conflict of interest.

Acknowledgements

We sincerely thank the neonatologists of 21 hospitals in the provinces and maternity homes of Ulaanbaatar of Mongolia, who collaborated to conduct the study. We also appreciate the financial and organizational support of the Science and Technology Foundation and the Mongolian Academy of Medical Sciences.

References

1. Leung AKC. Mongolian Spots in Chinese Children. *Int J Dermatol* 1988; 27: 106-8.
2. Web MD. Dermatology. Congenital Dermal Melanocytosis (Mongolian Spot) [accessed on 20 Sep 2016]. Available at: <http://emedicine.medscape.com/article/1068732-overview>.
3. Bista R, Pandey P. Mongolian Spot. *Radiography*. 2014; 1: 12-8.
4. Kikuchi I, Inoue S. "Biology and Diseases of Dermal Pigmentation": Circumscribed dermal melanosis (Mongolian spot), University of Tokyo Press; 1981: p83.
5. Ben Saif GA, AlShehab SA, Almutawa A. Case report: Unusual combination of pigmentary lesions. *Int J Dermatol*. 2010; 49: 1059-62.
6. Nam SW, Ko SY, Lee YK, Shin SM, Kim EH. The Incidence of Birthmarks in Korean Newborn Infants. *Neonatal Medicine* 2014; 21: 151-7.
7. Tsai FJ, Tsai CH. Birthmarks and congenital skin lesions in Chinese newborns. *J Formos Med Assoc* 1993; 92: 838-41.
8. Hidano A, Purwoko R, Jitsukawa K. Statistical survey of skin changes in Japanese neonates. *Pediatr Dermatol* 1986; 3:

- 140-4.
9. Onayemi O, Adejuyigbe EA, Torimiro SE, Oyelami O, Jegede OA. Prevalence of Mongolian spots in Nigerian children in Ile-Ife, Nigeria. *Niger J Med* 2001; 10: 121-3.
 10. Moosavi Z, Hosseini T. One-year survey of cutaneous lesions in 1000 consecutive Iranian newborns. *Pediatr Dermatol* 2006; 23: 61-3.
 11. Ashrafi MR, Shabani R, Mohammadi M, Kavusi S. Extensive Mongolian spots: a clinical sign merits special attention. *Pediatr Neurol J* 2006; 34: 143-5.
 12. Nanda A, Kaur S, Bhakoo N, Dhall K. Survey of cutaneous lesions in Indian newborns. *Pediatr Dermatol* 1989; 6: 39-42.
 13. Sachdeva M, Kaur S, Naqpal M, Dewan SP. Cutaneous lesions in new born. *Indian J Dermatol Venereol Leprol* 2002; 68: 334-7.
 14. Shih IH, Lin JY, Chen CH, Hong HS. A birthmark survey in 500 newborns: clinical observation in two northern Taiwan medical center nurseries. *Chang Gung Med J* 2007; 30: 220-5.
 15. Hellstein JW, Cummings CW, Flint PW, Haughey BH. Odontogenesis, odontogenic cysts, and odontogenic tumors. *Otolaryngology: Head & Neck Surgery*. 5th ed. Philadelphia, Pa: Mosby Elsevier; 2010: p 93.
 16. Rivers JK, Frederiksen PC, Dibdin CA. Prevalence survey of dermatoses in the Australian neonate. *J Am Acad Dermatol* 1990; 23: 77-81.
 17. Boccardi D, Menni S, Ferraroni M, Stival G, Bernardo L, La Vecchia, et al. Birthmarks and transient skin lesions in newborns and their relationship to maternal factors: a preliminary report from northern Italy. *Dermatology J* 2007; 215: 53-8.
 18. Leung AKC, Lane RWM. Superimposed Mongolian Spots. *J Pediatr Dermatol* 2008; 25: 233-5.
 19. Kahana M, Feldman M, Abudi Z, Yurman S. The incidence of birthmarks in Israeli neonates. *Int J Dermatol* 1995; 34: 704-6.
 20. Egemen A, Ikizoqlu T, Ergor S, Mete AG, Yilmaz O. Frequency and characteristics of Mongolian spots among Turkish children in Aegean region. *Turk J Pediatr* 2006; 48: 232-6.
 21. Cordova A. The Mongolian spot: A study of ethnic differences and a literature review. *Clin Pediatr* 1981; 20: 714-9.
 22. Nurzed J. Sorkuktani Bekuni setsen. *Khukh Monogoliig nii-khemeer badraakh hutagai durvun neuritikh zasag-iin altan deed unenii ayalguu*. Ulaanbaatar: Uralakh erdem company; 2008. p 81.
 23. Lever WF, Niedelman ML. *Histopathology of the skin*. Philadelphia: JB Lippincott Co. United States, Philadelphia: Wolters Kluwer Health; 2015: p 55-56.
 24. Pariser H, Beerman H. Extensive blue patch like pigmentation; A Morphologic variant of Blue Nevus? Persistent Extra sacral Mongolian Blue Spot? Diffuse Mesodermal Pigmentation? *Arch Derm Syphilol* 1949; 59: 396-404.
 25. Reza AM, Farahnaz GZ, Hamideh S, Alinaghi SA, Saeed Z, Mostafa H. Incidence of Mongolian spots and its common sites at two university hospitals in Tehran, Iran. *Pediatr Dermatol* 2010; 27: 397-8.