Comparison of Birth Outcomes Based on Maternal Ethnicity in Korea: Korean, Vietnamese, and Chinese, 2010–2015

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ABSTRACT

Purpose: The purpose of this study is to compare birth outcomes based on maternal ethnicity in Korea.

Methods: Using the birth data of Statistics Korea from 2010 to 2015, this study selected data from infants with a Vietnamese mother and Korean father (Vietnamese/Korean group), and a Chinese mother and Korean father (Chinese/Korean group), to compare them with that of a Korean mother and Korean father (Korean/Korean group). The newborn infants' birth outcomes and parental characteristics were investigated, and trends in annual changes were compared. In addition, this study investigated whether the mother's ethnicity affected the mean birth weight.

Results: Gestational age and birth weight were highest in the Chinese/Korean group, and were slightly lower in the Korean/Korean and Vietnamese/Korean group, in that order. The highest rate of preterm birth before 37 weeks and low birth weight rate were observed in the Vietnamese/Korean group; 4.62% and 4.26%, respectively. From 2010 to 2015, the mean gestational age decreased in all the three groups, and the preterm birth rate increased at gestational ages less than 37 weeks. However, the birth weight decreased only in the Korean/Korean group, but increased in the Chinese/Korean and Vietnamese/Korean groups. In addition, we found that factors such as parents' educational levels, percentage of hospital births, and appropriate maternal age improved in the Vietnamese/Korean group.

Conclusion: This study confirms that the mean birth weight and low birth weight rate are affected by maternal ethnicity in Korea. Therefore, careful research and active national support policies are needed.

Key Words: Ethnicity, Race, Cultural diversity, Immigrants, Birth weight, Preterm, Infants, Newborn, Gestational age

INTRODUCTION

According to the data from Statistics Korea, it was reported that the mean birth weight

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of Korean infants was 3.20 kg in 2015, which has gradually decreased from 3.25 kg in 2005 by a total of 0.05 kg¹⁾. The mean birth weight of newborn infants in a country is known to be affected by factors such as preterm birth rate, plurality, percentage of small for gestational age, mean gestational age, racial disparity, maternal socioeconomic states, maternal obstetric and medical diseases²⁾.

An increase since the 1990's, multiracial families in Korea are reported to account for 4.5% of all births in 2015³⁾. Therefore, parental ethnicity should also be considered as a factor influencing the mean birth weight. Various national support projects for multiracial families are under way, and research is actively pursued^{4,5)}. However, comparative studies on the characteristics of multiracial newborn infants and their parents, and their annual trends, are still rare and limited to regional data⁶⁾.

Low birth weight infants have been extensively studied to reduce the birth rate of low birth weight infants due to their higher prevalence and mortality rates compared to full term infants^{2,7)}. In addition, there are studies that have found the mean birth weight to be different in certain race or ethnicity groups within one country, and also that the optimal birth weight showing minimal mortality can vary according to race⁸⁻¹⁴⁾.

As the number of multiracial families increase in Korea, it is expected to affect the mean birth weight. Korea is a typical low birth rate country; the birth rate of premature infants, multiple births, and low birth weight infants continues to rise due to maternal aging and increased use of assisted reproductive technologies, which could have an effect on the mean birth weight^{15,16)}. In addition, as the present appropriate prenatal care and socio-economic situation has improved compared to the

past, the number of infants born at an appropriate gestational age has increased whilst and the number of infants who are large for their gestational age has decreased, which could affect the mean birth weight¹⁶⁾.

Due to the increasing number of multiracial families in Korea, parental ethnicity has been registered in the birth data of Statistics Korea since 2010¹⁷⁾.

This study was conducted using the birth data of Statistics Korea. Parental race or ethnicity in the multiracial families are very diverse; therefore, this study selected only newborn infants with either a Vietnamese mother and a Korean father or a Chinese mother and a Korean father, who together account for more than 50% of multiracial families in Korea. We compared the data with that of newborn infants born from a Korean mother and father. From 2010 to 2015, this study examined the differences in the characteristics among the infants and parents in the three groups, compared them to the annual changing trends, and determined whether maternal ethnicity affected the mean birth weight.

MATERIALS AND METHODS

1. Study population and variables

Since 2010, the annual birth data in Statistics Korea has classified parental nationalities as Korean, naturalized Korean, or foreigner at birth, and then their nationality by country. This study used the annual birth data in Statistics Korea from 2010 to 2015. The excluding criteria were a gestational age younger than 22 weeks or older than 44 weeks, a birth weight less than

Figure 1. Selection of the study population. Abbreviations: GA, gestational age; BW, birth weight.

*Data from Statistics Korea. 2017 [17].

300 g, multiple births, and unknown multiple births. The study included 2,495,175 newborn infants with Korean parents, 41,523 with a Vietnamese mother and Korean father, and 26,285 with a Chinese mother and Korean father.

The group classification in this study was as follows; newborn infants whose parents' ethnicity were both Korean at birth belong to the Korean/Korean group, newborn infants with a Vietnamese mother and Korean father at birth belong to the Vietnamese/Korean group, and newborn infants with a Chinese mother and Korean father at birth belong to the Chinese/Korean group (Figure 1).

This study assessed the mean gestational age, mean birth weight, preterm birth rate less than 32 weeks, total preterm birth rate, very low birth weight rate, low birth weight rate, and sex ratio of each newborn infant, and compared each newborn infant parents' age, education level, marital status, period of cohabitation, place of birth, and the number of deliveries by the mother. In relation to the parental education level, this study investigated the proportion of parents who received more than 12 years of education, meaning more than high school graduation. In relation to the place of birth, this study investigated the percentage of births in hospitals.

This study compared the preterm birth rate, low birth weight rate, mean gestational age, and mean birth weight of the three groups from 2010 to 2015 graphically, and examined the annual changes in the characteristics of the newborn infants and parents in the three groups. Simple and multiple regression analysis was performed on factors affecting the mean birth weight and low birth weight rate, including the factor of maternal ethnicity.

2. Statistics

Statistical analyses were performed using STATA 14 (Stata Corp., College Station, TX, USA). Categorical variables were analyzed by the chi-square test. Differences in continuous variables were assessed by ANOVA. The post hoc test was conducted by bonferroni to examine the differences between two groups. Multiple regression analysis was used to estimate the association between maternal ethnicity and birth weight adjusting for gestational age, parental age, parental education, and place of birth. *P* values <0.05 were considered significant.

RESULTS

1. Characteristics of the infants and parents from the three groups, 2010-2015

The Chinese/Korean group had the highest mean gestational age and birth weight; 38.8 weeks and 3,306.7 g. They were slightly lower in Korean/Korean and Vietnamese/Korean groups, in that order. The Korean/Korean group had the highest preterm birth rate of gestational ages less than 32 weeks and very low birth weight rate; 0.52% and 0.40%, respectively. On the other hand, the Vietnamese/Korean group showed the highest preterm birth rate of gestational age less than 37 weeks and low birth weight rate; 4.62% and 4.26%, respectively. The proportion of infants that were male was over 51% in all three groups.

The mean maternal age in the Korean/Korean group was 31.4 years, 24.6 years in the Vietnamese/Korean group, and 30.3 years in the Chinese/Korean group. This demonstrates that the Korean/Korean group had the oldest mothers and in the Vietnamese/Korean group they were especially young. The father's mean age was 33.6 years in the Korean/Korean group, 41.7 years in the Vietnamese/Korean group, and 37.9 years in the Chinese/Korean group, which indicates that the Vietnamese/Korean group had the oldest fathers. The proportion of mothers with an education extending further than high school was highest in Korean mothers (73.6%), followed by Chinese mothers (37.9%), and Vietnamese mothers (8.0%). The proportion of fathers with an education extending further than high school was highest in Korea (73.7%), followed by China (43.9%), and Vietnam (21.8%). In terms of the education levels beyond high school graduation, the Korean/Korean group had the highest levels of education, followed by the Chinese/Korean group, and the Vietnamese/Korean group. The mean number of deliveries was 1.6 in the Korean/Korean group, 1.4 in the Vietnamese/Korean group, and 1.5 in the Chinese/Korean group. The period of cohabitation in the Vietnamese/Korean group was 2.0 years, which was slightly shorter than in the other groups. More than 98% of the infants were born in hospitals in all three groups (Table 1).

2. Changes in gestational age and birth weight of newborn infants in 2010 and 2015

This study compared the characteristics of newborn infants and parents from the three groups in 2010 with those from the same groups in 2015. From 2010 to 2015, the number of new-

Table 1. Characteristics of Infant and Parents in Three Groups, 2010-2015

	Korean/Korean [†]	Vietnamese/Korean [‡]	Chinese/Korean [§]	Total
Infants				
Number	2,495,175	41,523	26,285	2,562,983
Mean gestational age (wks, mean±SD)	38.7±1.5	38.7±1.4	38.8±1.5	38.7±1.5
Mean birth weight (g, mean±SD)	3,240±432	3,163±409	3,307±436	3,240±431
<32 weeks of gestation [¶] (%)	0.52	0.39	0.43	0.51
<37 weeks of gestation [¶] (%)	4.61	4.62	4.07	4.60
VLBWIs [¶] (%)	0.40	0.23	0.30	0.40
LBWIs [¶] (%)	3.62	4.26	2.80	3.62
Sex ratio (M:F)	51.4:48.6	51.0:49.0	51.5:48.5	51.4:48.6
Parents				
Age				
Mother (y, mean±SD)	31.4±4.0	24.6±4.2	30.3±4.7	31.2±4.1
Father (y, mean±SD)	33.6±4.3	41.7±5.1	37.9±5.7	33.8±4.5
Education[¶]				
Mother, more than 12 years (%)	73.6	8.0	37.9	72.1
Mother, more than 9 years (%)	98.8	58.6	84.9	98.0
Father, more than 12 years (%)	73.7	21.8	43.9	72.6
Father, more than 9 years (%)	98.5	84.2	92.1	98.2
Parity (n, mean±SD)	1.6±0.7	1.4±0.6	1.5±0.6	1.6±0.7
Married status [¶] (%)	98.8	99.6	98.6	98.8
Period of cohabitation (y, mean±SD)	2.9±3.0	2.0±2.0	2.7±2.7	2.9±3.0
Birth in hospital [¶] (%)	98.6	98.8	98.3	98.6

*Data from Statistics Korea. 2017 [17].

[†]Korean mother/Korean father group.

[‡]Vietnamese mother/Korean father group.

[§]Chinese mother/Korean father group.

^{||} P<0.05 vs. Korean group.

[¶] P<0.05 for the differences between three groups.

Abbreviations: SD, standard deviation; VLBWIs, very low birth weight infants; LBWIs, low birth weight infants.

born infants decreased in all the groups; the Chinese/Korean group decreased by 29.3%, which was significantly lower than the decrease in the Vietnamese/Korean group (12.0%) and the Korean/Korean group (7.5%) (Table 2). From 2010 to 2015, the gestational age reduced in all three groups (Figure 2A). The birth weight decreased from 3,250 g to 3,240 g in the Korean/Korean group; however, it increased from 3,308 g to 3,315 g in the Chinese/Korean group, and from 3,152 g to 3,189 g in the Vietnamese/Korean group (Figure 2B). The preterm birth rate of infants with a gestational age less than 37 weeks increased in all the three groups (Figure 2C). The low birth weight rate increased from 3.47% to 3.67% in the Korean/Korean group; however, it decreased from 2.92% to 2.61% in the Chinese/Korean group, and from 4.13% to 3.97% in the Vietnamese/Korean group (Figure 2D).

3. Comparison of parents' characteristics in 2010 and 2015

The mean age of the parents' in 2015 had increased in all three groups compared to 2010. Paternal age in 2015 was the highest in the Vietnamese/Korean group (42.8 years), and maternal age was the highest in the Korean/Korean group (31.8 years). Cases with parental education levels higher than high school graduation increased in all the three groups; it increased the most in the Vietnamese/Korean group (131% in mothers and 65% in fathers). The mean number of deliveries increased in all the three groups; it was higher in the Vietnamese/Korean and Chinese/Korean groups than in the Korean/Korean group. The period of cohabitation did not change much in the Korean/Korean group, but the Vietnamese/Korean and Chinese/Korean groups showed increased periods of cohabitation. Cases

Figure 2. Birth outcomes of the three groups by year, 2010-2015. (A) Mean gestational age of the three groups by year. (B) Mean birth weight of the three groups by year. (C) Preterm birth rate of the three groups by year. (D) Low birth weight rate of the three groups by year. *Data from Statistics Korea. 2017 [17].

of infants born in hospitals accounted for 99% of those in the Korean/Korean and Vietnamese/Korean groups, and 98% in the Chinese/Korean group (Table 2).

4. Association of birth weight with maternal ethnicity

To examine the relationship between the mean birth weight and maternal ethnicity, linear regression analysis was performed, which was adjusted gestational age, parental age, parental education level, and birth place. After adjustment, we confirmed that the mean birth weight and maternal ethnicity were statistically significantly associated. In addition, gestational age, mother's age, education level, and place of birth were also related with the mean birth weight (Table 3).

Furthermore, by adjusting for the above factors, an independent effect of maternal ethnicity on infant low birth weight rate was examined using logistic regression. The relation between infant low birth weight and maternal ethnicity was still significant after the adjustment. Moreover, the infant low birth weight rate was associated with the gestational age, maternal age, and duration of parental education (Table 4).

5. Summary

From 2010 to 2015, the mean gestational age decreased in all the three groups, and the preterm birth rate of a gestational age less than 37 weeks increased. However, the birth weight only decreased in the Korean/Korean group, and increased in the Chinese/Korean and Vietnamese/Korean groups. We found that various maternal factors improved in the Vietnamese/Korean group, such as parents' level of education, percentage of hospital births, and the appropriate age of the mother. In addition, we confirmed that the mean birth weight and low birth weight rate are affected by the maternal ethnicity in Korea. As the number of multiracial families increases, the maternal ethnicity and other maternal factors may affect the characteristics of newborns, such as the birth weight. Therefore, continuous research and active national support policies are needed.

DISCUSSION

As observed in previous studies, this study found that the mean birth weight and low birth weight rate of newborn infants

Table 2. Comparison on Characteristics of Infant and Parents, by year, 2010 and 2015

	Korean/Korean [†]	Vietnamese/Korean [‡]	Chinese/Korean [§]
2010			
Infants			
Number	431,432	6,755	4,933
Gestational age (wks, mean±SD)	38.8±1.5	38.9±1.4	39.0±1.5
Birth weight (g, mean±SD)	3,250±432	3,152±400	3,308±439
< 37 weeks of gestation (%)	4.45	4.34	3.89
LBWIs [¶] (%)	3.47	4.13	2.92
Sex ratio (M:F)	51.7:48.3	50.8:49.2	51.8:48.2
Parents			
Maternal age (y, mean±SD)	30.9±3.9	23.6±3.9	29.5±4.9
Paternal age (y, mean±SD)	33.3±4.3	40.8±5.1	37.9±5.5
Maternal education [¶] >12 years (%)	69.0	5.3	29.8
Paternal education [¶] >12 years (%)	70.9	16.6	36.4
Parity (n, mean±SD)	1.7±2.8	1.5±3.2	1.5±3.7
Married status [¶] (%)	98.7	99.9	98.7
Period of cohabitation (y, mean±SD)	3.0±3.1	1.6±1.6	2.2±2.4
Birth in hospital [¶] (%)	98.3	98.5	98.2
2015			
Infants			
Number	398,947	5,945	3,490
Gestational age (wks, mean±SD)	38.7±1.5	38.7±1.4	38.7±1.4
Birth weight (g, mean±SD)	3,240±432	3,189±411	3,315±436
< 37 weeks of gestation (%)	4.84	4.89	4.27
LBWIs [¶] (%)	3.67	3.97	2.61
Sex ratio (M:F)	51.3:48.7	51.9:48.1	50.6:49.4
Parents			
Maternal age (y, mean±SD)	31.8±4.0	25.7±4.4	31.1±4.4
Paternal age (y, mean±SD)	34.0±4.4	42.8±5.1	37.9±5.7
Maternal education [¶] >12 years (%)	77.8	12.3	46.6
Paternal education [¶] >12 years (%)	76.3	27.4	51.2
Parity (n, mean±SD)	1.7±3.9	1.9±5.8	1.9±6.0
Married status [¶] (%)	98.9	98.9	98.5
Period of cohabitation (y, mean±SD)	2.9±2.9	2.6±2.4	3.0±2.9
Birth in hospital [¶] (%)	99.2	99.0	98.0

*Data from Statistics Korea. 2017 [17].

[†]Korean mother/Korean father group.

[‡]Vietnamese mother/Korean father group.

[§]Chinese mother/Korean father group.

^{||} $P < 0.05$ vs. Korean group.

[¶] $P < 0.05$ for the differences between three groups.

Abbreviations: SD, standard deviation; LBWIs, low birth weight infants.

varied according to the ethnicity of the mother. Therefore, careful observation is needed because multiracial families are expected to have more influence on the mean birth weight of newborn infants in Korea as the number of multiracial families increase.

Along with the increase in the preterm birth rate and decrease in the mean gestational age at birth, the low birth weight rate increased and the mean birth weight decreased by 10 g in the Korean/Korean group in 2015 when compared to 2010. How-

Table 3. Multiple Linear Regression on Birth Weight of Infants to the Korean, Vietnamese and Chinese Mother, 2010-2015

	Unadjusted Coefficient	95% CI	Adjusted Coefficient [†]	95% CI
Gestational age (wks)				
≤31	-1,898.6	-1,905.2--1,891.9	-1,899.3	-1,905.9--1,892.7
32-36	-670.5	672.9--668.1	-670.4	-672.8--668.0
37-39				
≥40	165.4	155.2-175.5	166.9	156.7-177.1
Maternal ethnicity				
Korean				
Vietnamese	-77.0	-81.2--72.8	-79.4	-83.3--75.4
Chinese	66.4	61.1-71.6	58.6	53.9-63.4
Maternal age (y)				
≤19	-114.5	-122.3--106.7	-62.1	-70.1--54.1
20-34				
≥35	-6.6	-7.9--5.3	-0.5	-1.9-0.9
Paternal age (y)				
≤19	-128.3	-141.6--115.0	-45.2	-58.8--31.7
20-34				
≥35	1.9	0.8-2.9	12.6	11.5-13.8
Maternal education (y)				
≤12				
>12	18.5	17.3-19.7	2.9	1.7-4.1
Paternal education (y)				
≤12				
>12	15.7	14.5-16.9	1.2	0.0-2.4
Birth place				
At home				
In hospital	36.7	31.3-42.1	32.9	28.0-37.8
Others site	59.1	49.2-68.9	42.9	34.0-51.8
Constant (Intercept)	3,277.0	3,276.5-3,277.4	3,237.0	3,232.1-3,242.0

*Data from Statistics Korea. 2017 [17].

[†]Coefficient adjusted for all other variables listed.

Abbreviation: CI, confidence interval.

ever, the low birth weight rate decreased and the mean birth weight increased by 37 g and 7 g in the Vietnamese/Korean and Chinese/Korean groups, respectively, even though the preterm birth rate increased and the mean gestational age decreased.

As shown above, the mean birth weight of newborn infants decreased in the Korean/Korean group and increased in the Vietnamese/Korean group, resulting in a reduced birth weight difference between the two groups. It is presumed that improved antenatal care due to better medical accessibility, an improvement of the parents' level of education, an increase in the mother's age and socioeconomic condition, etc. would have resulted in the increase in birth weight in the Vietnamese/Korean group¹⁸⁾.

The preterm birth and low birth weight infants in the Korean/Korean group continued to increase, and the multiple birth rate, which was excluded from the study subjects, also increased in all three groups. It increased from 2.8% to 3.7% in the Korean/Korean group, from 1.6% to 2.7% in the Vietnamese/Korean group, and from 2.7% to 3.9% in the Chinese/Korean group. In addition, the multiple birth rate in all the three groups had been 3.2% for six years.

Hospitals were the most popular birth place for both years; however, 23,827 persons gave birth at their home, and 10,462 at other sites. Although the national healthcare support policy has increased the number of available obstetric clinics for vulnerable areas¹⁹⁾, there are many cases of non-hospital births. In such

Table 4. Risk of Low Birth Weight of Infants to the Korean, Vietnamese and Chinese Mother, 2010-2015

	Unadjusted Odds Ratio	95% CI	Adjusted Odds Ratio [†]	95% CI
Gestational age (wks)				
≤31	27.01	25.06–29.12	26.89	24.94–28.98
32–36				
37–39	0.03	0.03–0.03	0.03	0.03–0.03
≥40	0.01	0.00–0.01	0.01	0.00–0.01
Maternal ethnicity				
Korean				
Vietnamese	1.19	1.13–1.24	1.18	1.12–1.26
Chinese	0.77	0.71–0.83	0.74	0.68–0.80
Maternal age (y)				
≤19	1.85	1.72–2.00	1.33	1.19–1.48
20–34				
≥35	1.35	1.33–1.37	1.14	1.12–1.17
Paternal age (y)				
≤19	2.19	1.94–2.47	1.23	1.03–1.46
20–34				
≥35	1.18	1.17–1.20	1.00	0.98–1.02
Maternal education (y)				
≤12				
>12	0.77	0.76–0.78	0.92	0.90–0.94
Paternal education (y)				
≤12				
>12	0.78	0.77–0.79	0.92	0.90–0.94
Birth place				
At home				
In hospital	0.93	0.87–0.99	1.05	0.97–1.14
Others site	0.72	0.63–0.82	0.97	0.83–1.13

*Data from Statistics Korea. 2017 [17].

[†]Odds Ratio adjusted for all other variables listed.

Abbreviation: CI, confidence interval.

cases, more active support policies are needed as mothers and newborn infants are more likely to be exposed to risk.

The newborn infants of gestational age less than 32 weeks and very low birth weight infants in the Vietnamese/Korean and Chinese/Korean groups were about 20 cases per year, which was too small for this study to perform an annual comparison.

This study has the following limitations. First, although we collected data concerning the factors that affect birth weight in order to examine the relationship between parental ethnicity and birth weight, due to the small proportion of data for gestational age, rate of prenatal care, maternal smoking status, maternal consumption of alcohol, maternal obstetric and medical disease, and maternal body mass index, we couldn't include it.

Second, this study did not investigate every multiracial families

mean birth weight and gestational age in Korea; the maternal ethnicities were limited to only Vietnamese and Chinese mothers.

Though Table 2 compares the birth outcomes of 2010 and 2015 with the parental characteristics, the analysis is limited to a comparison between the two years; each individual year was not considered. It is necessary that further studies with longer time periods are required for additional results.

This study provides meaningful data through utilization of a large Statistics Korea dataset, which allows assessment of the yearly trends in birth outcomes and parental characteristics in Korean and multiracial families. Therefore, this study will hopefully be useful for future related research and the national support policy.

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