Investigating the Relationship between Serum Bilirubin Levels in the First Week of Life with Season of Birth

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Abstract

Introduction: Hyperbilirubinemia is a physiological phenomenon; however, it can be influenced by many factors, such as the season of birth.

Methodology: This analytical cross-sectional study was conducted in Jahrom University of Medical Sciences during 2016-2017. Using simple random sampling, 100 infants were selected in each season. The inclusion criteria included: surviving within the first 24 hours of birth, lack of any kind of congenital abnormalities, avoiding the use of specific drugs (mothers) that may raise neonates' bilirubin levels, no history of hepatic disorders (mothers), gestational age between 38-42 weeks, absence of Rh and blood type incompatibility, absence of G6PD deficiency, normal birth weight (2500-3400 g), maternal age between 18-35 years, normal Apgar scores at 1 and 5 minutes and completion of all patients' records. Using capillary technique, the serum bilirubin levels in the first week were taken and the bilirubin levels were calculated. Data were analyzed in SPSS 16.

Results: 49.5% of the infants were female. The mean gestational age was 38.28 (1.416) weeks. The mean bilirubin level at the time of birth was 10.61 (3.24). The highest bilirubin level was observed in winter 10.86 (3.23). Based on the Spearman's test, there was no statistical significant relationship between season of birth and bilirubin levels in the first week of life (Sig. = 0.951; r = -0.003). However, the stepwise multivariate linear regression test showed that only type of delivery and gestational age (3.7% and 5.2%, respectively) predicted the changes in the serum bilirubin levels in the first week of life (Beta= - 0.213; Beta= -0.123).

Conclusion: There was no significant relationship between season of birth and serum bilirubin levels in the first week of life; however, the contradictions observed in various studies highlights the need to conduct further research in this area.

Key words: neonatal, jaundice, hyperbilirubinemia, season.

Introduction

Neonatal jaundice is one of the most common neonatal diseases; as, up to 60% of full term infants and 80% of preterm infants develop jaundice during the first week of life (1, 2). In the first few weeks of life, most newborns experience hyperbilirubinemia and develop jaundice symptoms. This physiological phenomenon is the result of the relative impairment of the bilirubin excretion mechanisms (3). Non-conjugated bilirubin is crucially dangerous for the nervous system. The severity of jaundice varies among different infants and may be associated with factors such as race, nutrition, climate and season of birth (4-6). The possible impact of season of birth on physical and psychological characteristics of infants as well as their susceptibility to diseases has been studied by researchers for many years (7, 8).

Bottini conducted a study on 343 newborns to investigate the relationship between serum bilirubin levels in the first week of life and season of birth and found that bilirubin levels were significantly lower in autumn than other seasons. There was no significant difference between other seasons. Meanwhile, this increase (in spring and winter) was significantly higher among female infants (9). Bottini in another study in 2010 observed that phototherapy has been mostly applied in May and August. He also observed significant relationships between season of birth and phototherapy usage with the probability of developing jaundice (10 and 11). Gonazales conducted a study on 61 neonates with hyperbilirubinemia and observed significantly higher increases in bilirubin levels in summer, compared to other seasons (10). Cerna in a study compared increases in bilirubin levels in winter and summer in preterm and full term neonates and found significantly higher increases in bilirubin levels in winter and higher phototherapy usage in summer (12). Studies conducted on the relationship between bilirubin levels and season of birth have provided different results (9-7). Due to the lack of evidence on the impact of season of birth on bilirubin levels, the researcher conducted this study to investigate the relationship between bilirubin levels in the first week of life and season of birth. This study provides useful information to the medical team responsible for protecting infants, to identify risk factors and the possibility of neonatal jaundice in different seasons.

Methodology

This analytical cross-sectional study was conducted in Jahrom University of Medical Sciences during 2016-2017 The sample size was determined based on Bottini's study and using simple random sampling, 100 infants were selected in each season. The inclusion criteria included: surviving within the first 24 hours of birth, lack of any kind of congenital abnormalities, avoiding the use of specific drugs (mothers) that may raise neonates' bilirubin levels, no history of hepatic disorders (mothers), gestational age between 38- 42 weeks, absence of Rh and blood type incompatibility, absence of G6PD deficiency, normal birth weight (2500-3400 g), maternal age between 18-35 years, normal Apgar scores at 1 and 5 minutes and completion of all patients' records. Informed written consent was obtained from all infant's parents. The principle of anonymity was observed. Routine treatments were carried out immediately for infants with high bilirubin levels. Data were analyzed in SPSS 16.

Findings

Most of the births occurred during summer (1319), autumn (1304), winter (1222) and spring (1095), respectively. 40% of the deliveries were cesarean and 60% of them were normal deliveries. In addition, 49.5% of the infants were female. The mean gestational age was 38.28 (1.416) weeks. The mean bilirubin level at the birth time was 10.61 (3.24). The highest bilirubin level was observed in winter 10.86 (3.23) (Table 1). The mean weight of the infants was 3127.00 (452.142). The mean of the first and second minutes Apgar scores was 8.98 (0.412) and 9.96 (0.281), respectively. The ANOVA test showed no statistically significant difference between season of birth and bilirubin levels after birth (Sig. = 0.290; F = -1.254). However, the stepwise multivariate linear regression test showed that only type of delivery and gestational age (3.7% and 5.2%, respectively) predicted the changes in the serum bilirubin levels in the first week of life (Beta= - 0.213; Beta= - 0.123).

According to the independent t-test, there was no significant relationship between: type of delivery and the mean bilirubin levels (Sig. = 0.065; F = 3.425); neonate's gender and the mean bilirubin levels (Sig. = 0.813; F = 0.056) and multiple birth and bilirubin levels (Sig. = 0.403; F = 0.764).

Table 1: The mean and standard deviation of the characteristics of the neonates in terms of season

	Pregnancy age M(SD)	Bilirubin M(SD)	Weight M(SD)	Apgar-1 M(SD)	Apgar-5 M(SD)	NVD %	Boy %	Twin %
spring	38.09(1.33)	10.69(2.92)	3.09 (.43)	9.09(.43)	9.99(.10)	76	44	1
summer	38.31(1.72)	10.82(3.62)	3.13(.46)	8.96(.43)	9.98(.14)	54	50	.5
autumn	38.26(1.292)	10.06(3.17)	3.08 (.47)	8.92(.44)	9.93(.43)	58	51	1
winter	38.48(1.26)	10.86(3.23)	3.20 (.43)	8.93(.33)	9.96(.32)	52	51	1
Total	38.28(1.42)	10.61(3.24)	3.12 (.45)	8.98(.41)	9.96(.28)	60	49	

Table 2: The results of the multivariate regression test using stepwise method

Model Summary

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.192[a]	.037	.034	3.186
2	.227[b]	.052	.047	3.165

ANOVA[c]

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	150.126	1	150.126	14.793	.000[a]
	Residual	3917.254	386	10.148		
	Total	4067.380	387			
2	Regression	209.825	2	104.912	10.471	.000[b]
	Residual	3857.555	385	10.020		
	Total	4067.380	387			

Coefficients[a]

Model		Unstandardized Coefficients		Standardized Coefficients	t	Sig.
		B	Std. Error	Beta		
1	(Constant)	12.629	.550		22.962	.000
	kind of delivery	-1.267	.330	-.192	-3.846	.000
2	(Constant)	24.136	4.746		5.086	.000
	kind of delivery	-1.403	.332	-.213	-4.225	.000
	age of pregnancy	-.295	.121	-.123	-2.441	.015

Excluded Variables[c]

Model		Beta In	t	Sig.	Partial Correlation	Collinearity Statistics
						Tolerance
1	season	-.041[a]	-.810	.419	-.041	.974
	age of pregnancy	-.123[a]	-2.441	.015	-.123	.972
	sex	.080[a]	1.606	.109	.082	1.000
	Weight	-.041[a]	-.826	.409	-.042	.998
	Apgar-1	.026[a]	.524	.601	.027	.999
	Apgar-5	-.053[a]	-1.063	.288	-.054	1.000
2	season	-.033[b]	-.664	.507	-.034	.970
	sex	.089[b]	1.802	.072	.092	.994
	Weight	-.003[b]	-.059	.953	-.003	.898
	Apgar-1	.029[b]	.586	.558	.030	.998
	Apgar-5	-.041[b]	-.811	.418	-.041	.988

a. Predictors: (Constant), kind of delivery

b. Predictors: (Constant), kind of delivery, age of pregnancy

Discussion

This study showed that season of birth does not affect bilirubin levels in the first week of life. The bilirubin levels were slightly higher in winter, compared to other seasons. However, there was no statistically significant difference between other seasons. Similar to the present study, Bottini's study also showed that there was no statistically significant difference between various seasons in terms of bilirubin levels (9). In another study in 2000, Bottini investigated the relationship between season and bilirubin levels in the neonatal period using phototherapy analysis on 5,540 newborns. Bottini observed that phototherapy was mostly applied in May and August. He also observed significant relationships between season of birth and phototherapy usage with the probability of developing jaundice. The author disproved the impact of sunlight on serum bilirubin levels in infants (10 and 11). Therefore, the findings of this study are also consistent with our study. Cerna in a study compared increases in bilirubin levels in winter and summer in preterm and full term neonates and found significantly higher increases in bilirubin levels in winter and higher phototherapy usage in summer and the author disproved the impact of sunlight on serum bilirubin levels in infants (12). In the present study, higher bilirubin levels were observed in winter and summer; however, the differences were not statistically significant. Gonazales conducted a study on 61 neonates with hyperbilirubinemia and observed significantly higher increases in bilirubin levels in summer. High temperature during summer and subsequently higher dehydration rate may be the main cause of this increase in bilirubin levels (10). However, higher bilirubin levels were observed during winter in the present study. In the winter, parents often increase the baby's room temperature to prevent hypothermia. This causes dehydration and increases serum bilirubin levels. Therefore, it can be concluded that since there is less sunlight in the winter, the decomposition of bilirubin decreases in this season and this in turn will increase serum bilirubin levels.

In the first few weeks of life, most newborns experience hyperbilirubinemia and develop jaundice symptoms. This physiological phenomenon is the result of the relative impairment of the bilirubin excretion mechanisms (2-4). Non-conjugated bilirubin is crucially dangerous for the nervous system; however, the protective role of bilirubin against oxidative stresses should not be ignored. Factors such as race, religion, eating habits and seasonal differences can affect the severity of jaundice in various populations (3, 11). Another possible reason that needs further research is the differences in eating habits of mothers in different seasons of the year. For instance, mothers are more susceptible to viral diseases during winter and have to take more drugs. Due to the lack of similar studies in this area in Iran and ignoring climatic and environmental factors in performed studies, more extensive research is needed to find the environmental factors involved in increasing bilirubin levels in different seasons. The limited number of samples, ignoring climatic factors as well as mothers' diets during pregnancy and especially at the last trimester of pregnancy were some of the limitations of this study.

Conclusion

Unlike some previous studies, in the present study, no significant relationship was observed between season of birth and serum bilirubin levels in the first week of life. However, the aforementioned studies have also confirmed the effects of variables such as reduced light or increased ambient temperature. Therefore, it is suggested to examine other effective environmental variables in each season separately and independent of the seasons.

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