Original Research Article

DOI: http://dx.doi.org/10.18203/2349-3291.ijcp20200211

Association of cord blood and maternal lipid profile

Noor Fathima S. Zohra^{1*}, Anitha S. Prabhu¹, Smitha B. Rao², Prakash R. M. Saldanha¹

¹Department of Paediatrics, ²Department of Obstetrics and Gynaecology, Yenepoya Medical College, Mangalore, Karnataka, India

Received: 30 December 2019 **Accepted:** 09 January 2020

*Correspondence:

Dr. Noor Fathima S. Zohra,

E-mail: jannatsamzam@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Cardiovascular diseases (CVDs) are the leading cause of mortality and morbidity with dyslipidemia as an important contributing risk factor. Objective of the study was to determine whether there is an association between maternal lipid profile and the cord blood lipid profile of their newborns.

Methods: This was a hospital-based Cross-sectional study on 60 mothers and their respective newborns (30 term and 30 preterm) conducted in Yenepoya medical college hospital from August to November 2019. Umbilical cord blood samples from the newborns were collected after birth and the mother's venous blood was collected in the fasting state (8hrs of fasting) before delivery. The levels of total cholesterol, triglycerides, HDL, LDL and VLDL were determined in mothers and their newborns by an enzymatic colorimetric method. Data obtained was analyzed by the SSPS software 23.0 version and Pearson's correlation was done.

Results: There was a significant correlation between the mean concentration of maternal Triglycerides and the Triglycerides and HDL levels of neonates (p-value <0.05).

Conclusions: There was a significant association of cord blood and maternal lipid profile, hence changes in maternal lipid levels might influence the lipid levels in the cord blood of newborns.

Keywords: Cord blood lipid profile, Total cholesterol, Total triglyceride, High density lipoprotein, Low density lipoprotein cholesterol, Very-low-density lipoprotein

INTRODUCTION

Cardiovascular diseases (CVD) due to atherosclerosis is the main cause of mortality and morbidity in both developed and developing countries. An estimated 17.9 million people died from CVD in 2016, representing 31% of all global deaths. Of these deaths, 85% are due to heart attack and stroke.¹

According to Barker's hypothesis, the atherosclerotic lesion may have its origin in the neonatal period generally during the adverse intrauterine period of fetal development, which may result in impaired intrauterine growth and diseases in later adult life.² This adverse intrauterine period of fetal development occurs as a result

of maternal malnutrition, sedentary lifestyle, obesity, smoking, alcohol abuse, metabolic diseases and placental insufficiency causing prematurity and growth-restricted neonates, hence these neonates have lost the chance to complete their energy deposits in later part of pregnancy. Thus, uses endogenous reserves, thereby activating lipid metabolism, which generates energy and promotes gluconeogenesis. Long term consequences of these metabolic adaptations will lead to an increased prevalence of cardiovascular diseases, hypertension, and type 2 diabetes mellitus.^{3,4}

Studies have also shown metabolic adaptations in pregnancy might occur during this period by intense maternal hormonal changes resulting in physiologic

changes in maternal lipid profile, which increases throughout the pregnancy supporting the development of the fetus. However, during this intrauterine development, pathophysiologic processes can occur in the metabolism of the lipids leading to an abnormal concentration in fetal circulation which may result in permanent changes in neonatal lipid profile and these are the ones who are at higher risk of developing cardiovascular diseases in the future.⁵ But the overall nature of the progress of atherosclerosis is age-dependent, which begins in childhood and progresses with advancing age. Although lipid profiles have been extensively studied in adults, limited studies are available in the pediatric population and very limited data is available on cord blood lipid levels of preterm and term newborns.⁶ The present study was done for early detection of abnormalities in the lipid profile at the earliest (at birth) in the newborns so that these high-risk babies can be under vigilant monitoring in the future. As early diagnosis followed by prudent dietary supplementation and drug therapy in these high-risk neonates may provide an opportunity for the amelioration of risk factors that contribute to the development of cardiovascular diseases in adult life. Hence this study was undertaken to compare the cord blood lipid profile in terms and preterms newborns.

Objective of the study was to determine whether there is an association between maternal lipid profile and the cord blood lipid profile of their newborns.

METHODS

This study was done after obtaining Institutional Ethical Committee clearance over a period of 3 months from August to November 2019, this is a Hospital-based Cross-sectional study conducted on 60 inborn neonates (30 term and 30 preterm neonates) and their mothers in Yenepoya Medical College Hospital.

Inclusion criteria

- All the mothers and their newborns who were delivered in Yenepoya Medical College hospital (including mothers who deliver twins or multiple children).
- All newborns with gestational age less than 37 weeks were included under preterm and between 37-42 weeks were included under term.

Exclusion criteria

- Neonates with congenital malformations, antenatally detected congenital heart diseases, not breathing or having respiratory distress after birth.
- Mother with a maternal illness like Diabetes including insulin-dependent diabetes mellitus (IDDM) and mothers with gestational diabetes with FBS >126mg/dl will be considered as diabetic as per ADA guidelines. (HbA1c will not be done for the purpose of study).

 Mothers with hypertension, thyroid diseases, and myocardial diseases. (For the sake of ruling out cardiac diseases in the mother such as a structural cardiac lesion, history and clinical examination will be done by the principal investigator).

Informed consent was taken from the mothers who were meeting the inclusion criteria in a preformed proforma during antenatal admission in the third trimester (when the mother was not in labor pains). Then the demographic profile and relevant information such as fasting blood glucose, thyroid profile and medication history were collected from the mother's case sheet and obstetrician involved in the mother's care.

Then 3 ml of mothers venous blood was collected in the fasting state (8hrs of fasting) under aseptic precautions in a plain dry test then allowed to clot at room temperature for 1 min then immediately sample was sent to hospital laboratory where they were centrifuged at 3000 rpm for 30 minutes to obtain serum, Serum was used for determination of lipid profile.

Then their respective newborns based on new Ballard's scoring newborns were classified as term and preterm depending on the gestational age. Clinical examination was done to rule out any congenital anomalies, respiratory distress, and the weight of the baby was measured by an electronic weighing machine. Birth weight (in gms) along with the gestational age will be plotted on the WHO recommended weight for gestational age chart, 3 ml of umbilical venous blood was collected at birth from newborns umbilical cord under aseptic precautions in a plain dry test tube immediately after cord clamping, allowed to clot at room temperature for 1min then immediately samples were sent to the laboratory where they will get Centrifuged at 3000 rpm for 30 minutes to obtain serum.

Serum was used for determination of total cholesterol (TC), Total triglyceride (TG), High-density lipoprotein (HDL-C), low-density lipoprotein (LDL-C) by Enzymatic colorimetric method. Then the estimated levels of maternal lipid profile will be compared with the cord blood lipid profile of their neonates.

Statistical analysis

Data analyzed using SPSS version 23.0 for windows and Pearson's correlation.

RESULTS

The study was conducted on 60 newborns (30 term and 30 preterm) and their respective mothers after obtaining consent, having met all the inclusion criteria. Their lipid profile was obtained, and the Data was analyzed using statistical software SPSS version 23.0 for windows and Suggested Pearson's correlation.

In this study 60 newborns and their mother were included, mean distribution and standard deviation of lipid profile were high in mothers than the newborns (Table 1).

In the present study, preterm had higher Total cholesterol, Triglycerides, HDL, LDL, and VLDL levels compared to Term neonates.

There is a statistically significant difference in mean lipid profile in term and preterm neonates and Mothers of the term neonates had higher Total cholesterol, Triglycerides, HDL and lower LDL and VLDL levels compared to mothers of preterm neonates, but there is no significant difference in mean lipid profile in mothers of term and preterm neonates (Table 2).

Table 1: Distribution of lipid profile in mothers and their neonates.

	Group	N	Mean	SD
TC	Baby	60	69.4833	26.28107
	Mother	60	200.5000	55.97351
TG	Baby	60	46.3000	34.48227
	Mother	60	178.2333	74.23539
HDL	Baby	60	27.0333	10.69130
	Mother	60	57.8833	18.40053
LDL	Baby	60	33.5667	17.02477
	Mother	60	107.6333	38.10110
VLDL	Baby	60	8.6667	6.71620
	Mother	60	42.6333	11.76315

*TC-Total cholesterol, TG-Total triglyceride, HDL-High-density lipoprotein, LDL- low density lipoprotein

Table 2: Comparison of lipid profile between term and preterm neonates and their mothers.

Group			N	Mean	SD
	TC	Preterm	30	80.4667	30.78483
		Term	30	58.5000	14.41922
	TG	Preterm	30	58.0667	44.14391
		Term	30	34.5333	13.56144
Doby	HDL	Preterm	30	29.8000	12.10699
Baby		Term	30	24.2667	8.37456
	LDL	Preterm	30	39.4333	21.12309
	LDL	Term	30	27.7000	8.50213
	VLDL	Preterm	30	10.3000	8.83625
		Term	30	7.0333	2.85854
Mother	TC	Preterm	30	195.9333	51.08879
		Term	30	205.0667	60.99911
	TG	Preterm	30	165.5333	80.10025
		Term	30	190.9333	66.79869
	HDL	Preterm	30	54.5667	16.51892
		Term	30	61.2000	19.82927
	LDL	Preterm	30	108.5667	36.84701
		Term	30	106.7000	39.92420
	VLDL	Preterm	30	44.0333	12.31339
		Term	30	41.2333	11.21785

Table 3: Comparison of lipid profile between mothers and their neonates.

	t-test for Equality of means								
Group							95% Confidence interval of the difference		
	t		df	p-value	Mean Difference	Std. Error Difference	Lower	Upper	
Baby	TC	3.539	58	0.001	21.96667	6.20650	9.54301	34.39033	
	TG	2.791	58	0.007	23.53333	8.43129	6.65628	40.41039	
	HDL	2.059	58	0.044	5.53333	2.68770	0.15331	10.91336	
	LDL	2.822	58	0.007	11.73333	4.15721	3.41178	20.05489	
	VLDL	1.927	58	0.059	3.26667	1.69559	-0.12742	6.66076	
Mother	TC	-0.629	58	0.532	-9.13333	14.52694	-38.21216	19.94549	
	TG	-1.334	58	0.187	-25.40000	19.04216	-63.51702	12.71702	
	HDL	-1.408	58	0.165	-6.63333	4.71195	-16.06533	2.79866	
	LDL	0.188	58	0.851	1.86667	9.91908	-17.98853	21.72186	
	VLDL	0.921	58	0.361	2.80000	3.04116	-3.28754	8.88754	

		B_TC	B_TG	B_HDL	B_LDL	B_VLDL
M_TC	Pearson Correlation	-0.017	-0.129	0.119	-0.002	-0.119
	p-value	0.898	0.327	0.364	0.990	0.364
	N	60	60	60	60	60
M_TG	Pearson Correlation	-0.036	-0.290*	0.257^{*}	-0.085	-0.253
	p-value	0.784	0.024	0.047	0.519	0.051
	N	60	60	60	60	60
M_HDL	Pearson Correlation	-0.211	-0.156	-0.143	-0.127	-0.157
	p-value	0.106	0.233	0.277	0.332	0.231
	N	60	60	60	60	60
M-LDL	Pearson Correlation	0.090	-0.162	0.120	0.117	-0.131
	p-value	0.495	0.216	0.360	0.372	0.317
	N	60	60	60	60	60
M_VLDL	Pearson Correlation	0.139	-0.060	0.063	-0.001	-0.115
	p-value	0.288	0.649	0.631	0.993	0.380
	N	60	60	60	60	60

Table 4: Correlation between mothers and baby's lipid profile.

In this study lipid levels were higher in neonates with a p-value of <0.05, which is statistically significant in comparison to mothers (Table 3).

There was a significant correlation between mothers Triglycerides with the Triglycerides and HDL of neonates (Table 4).

DISCUSSION

As the incidence of cardiovascular diseases is increasing with age, awareness in population to ameliorate the risk factors is becoming crucial. hence, the interest to determine cord blood lipids has increased, as its abnormal levels at birth, might result in atherogenic changes later in life. Lipid profile is an indicator of an underlying cardiovascular status, and there is a direct correlation amongst the abnormalities in lipid levels and incidence of cardiovascular morbidities and mortality, hence the present study was done to find the association of maternal lipid levels with the neonates.⁷

In the present study, the cord samples were taken from term and preterm babies who were born without any complications so that it did not interfere with the results. Maternal adiposity has been shown to have a role in fetal programming and in cord lipid profile levels.⁸

In our study, the cord lipid values were found to be statistically significant in preterm babies compared to terms of babies in terms of higher TC, TG, LDL, HDL and VLDL levels. In our study by Pearson's correlation, a statistically significant association was found between the mother's triglycerides and the triglyceride and HDL levels of babies. when lipid levels were compared between the mothers of term and preterm babies it was

observed that mothers of term babies had higher lipid levels than mothers of the preterm neonates, but no significant differences were present between them.

The relationship of a maternal lipid profile to the lipid profile of their newborn is not well understood. There are studies that say that lipid transport occurs through the placenta, but this may not influence the lipids in the newborn. Some studies say that the placenta presents membrane receptors to lipoprotein and triglycerides, which binds to these receptors and become available to the fetus. Might be due to the presence of such a transport system, the maternal concentration of TG levels has affected the lipid profile of newborns as in our study. Similar to our study, Sales et al conducted a study, in which it was concluded that there is no significant association between altered maternal lipids and cord lipids.4 In a study by Nita Mariam Abraham et al, no association was found between cord blood and maternal lipid profiles. Shahla Vaziri Esfarjani et al, studied the influence of maternal age on the cord lipid profile and found that there is a statistically significant negative correlation between cord blood HDL-C and maternal age (p <0.01).10 A study by Juárez IE et al, concluded that there is an association between lipid levels in mothers and their children.¹¹ However, Murthy et al, in his study noted a significantly high level of TC in the newborn of mothers with high TG levels. 12 Hence, as the sample size is small, this study may not be representative of the general population. Increasing the sample size may have yielded a more definite result.

CONCLUSION

There was a significant association of cord blood and maternal lipid profile, hence changes in maternal lipid

^{*}TC-Total cholesterol, TG-Total triglyceride, HDL-High-density lipoprotein, LDL- low density lipoprotein, M-Mother, B-Baby

levels might influence the lipid levels in the cord blood of newborns.

Recommendations

Preterms had relatively higher levels of lipid profile compared to term babies, indicating the necessity of constant vigil and follow up of these mothers during pregnancy and the lipid profiles of their children in the adolescent and adult age group for the risk of development of atherosclerosis.

Funding: No funding sources Conflict of interest: None declared

Ethical approval: The study was approved by the

Institutional Ethics Committee

REFERENCES

- World Health Organization. Cardiovascular diseases (CVDs). Available at: https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds). Accessed 17 May 2017.
- 2. Barker DJP. Fetal origins of coronary heart disease. BMJ. 1995 Jul 15;311(6998):171-4.
- 3. Freedman DS, Srinivasan SR, Cresanta JL, Webber LS, Berenson GS. Cardiovascular risk factors from birth to 7 years of age: the Bogalusa Heart Study. Serum lipids and lipoproteins. Pediatr. 1987 Nov;80(5 Pt 2):789-96.
- 4. Levy-Marchal C, Jaquet D. Long-term metabolic consequences of being born small for gestational age. Pediatr Diabetes. 2004;5:147-53.
- 5. Sales WB, Silleno Junior JD, Kroll C, Mastroeni SSBS, Silva JC, Mastroeni MF, et al. Influence of altered maternal lipid profile on the lipid profile of the newborn. Arch Endocrinol Metab. 2015 Apr;59(2):123-8.

- Geraghty AA, Alberdi G, O'Sullivan EJ, O'Brien EC, Crosbie B, Twomey PJ, et al. Maternal blood lipid profile during pregnancy and associations with child adiposity: Findings from the ROLO study. PLoS One. 2016;11:e0161206.
- 7. Pardo IM, Geloneze B, Tambascia MA, Barros-Filho AA. Atherogenic lipid profile of Brazilian near-term newborns. Braz J Med Biol Res Rev Bras Pesqui Medicas E Biol. 2005;38:755-60.
- 8. Solis-Paredes M, Espino Y Sosa S, Estrada-Gutierrez G, Nava-Salazar S, Ortega-Castillo V, Rodriguez-Bosch M, et al. Maternal and fetal lipid and adipokine profiles and their association with obesity. Int J Endocrinol. 2016;2016;7015626.
- 9. Abraham NM, Kuruvilla SK, Manikandan S, Krishnan L. Association of cord blood and maternal lipid profiles. Indian J Child Health. 2018;5(7):465-8.
- Vaziri Esfarjani S, Iravani E, Razzaghi Azar M. Determination of the Lipid Profile of Cord Blood in Neonates and its Correlation with Maternal Age in Iran. J Compr Ped. 2013; 4(1):72-6.
- Juárez IE, Rivera-Silva G, Mejía-Arangure JM, Mercado-Arellano JA, Díaz-Bensussen S. [Lipid profile in healthy newborn infants and its correlation with maternal lipid levels] Salud Publica Mex. 1999 Sep-Oct;41(5)405-9.
- 12. Murthy KA, Bhandiwad A, Murthy KV, Aggarwal S. Neonatal lipid levels Can they be a benchmark for lipid-lowering in adults? Asian J Pharm Clin Res. 2014;7:165-8.

Cite this article as: Zohra NFS, Prabhu AS, Rao SB, Saldanha PRM. Association of cord blood and maternal lipid profile. Int J Contemp Pediatr 2020;7:478-82.