Original Article

Comparison of Lipid Profile between Small for Gestational Age and Appropriate for Gestational Age Babies in a Tertiary Level Hospital in Bangladesh

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Abstract

Background: *Coronary heart disease is a common cause of morbidity and mortality. Dyslipidemia is one of the risk factors of coronary vascular disease. Many patients have been seen coronary artery disease with dyslipidemia with a history of intrauterine growth retardation and low birth weight (LBW). Lipid profile at the start of life broadens the understanding of dyslipidemia and their association with coronary heart disease in later life. This study will help to identify high-risk babies at birth and preventive management of the disease. So, the study was conducted to compare the serum lipid profile between small for gestational age (SGA) and appropriate for gestational age (AGA) babies.* ***Methodology:*** *A cross-sectional study was conducted at Mymensingh Medical College and Hospital. A total of 50 cases of SGA babies and another 50 of AGA were taken as a control according to selection criteria. Information was collected by detailed history, clinical examination, and follow up by using a pre-designed questionnaire. A lipid profile was done in both groups. Then the lipid profile between the two groups were compared.* ***Results:*** *Serum total cholesterol (TC), LDL, and triglyceride (TG) were significantly higher in terms SGA, preterm SGA as well as SGA babies than term AGA, preterm AGA as well as AGA babies. Only TC was seen significantly higher in LBW babies than NBW babies. Regarding HDL level, no significant difference was found between term SGA, preterm SGA as well as SGA babies and term AGA, preterm AGA as well as AGA babies. And no significant difference was found in the lipid profile values between male and female newborns.* ***Conclusion:*** *This study concludes that serum lipid levels are higher in SGA neonates. It may have a great impact on the future life of these newborns which needs long term to follow up.*

Key words: SGA, AGA, Lipid profile, Comparison.

Received: July 23, 2022; **Accepted:** August 29, 2022

Introduction

Small for gestational age (SGA) infants are defined as having a birth weight below the 10th percentile for the gestational age or >2 standard deviations below the mean for gestational age[1]. Baby with birth weight >10th and <90th percentile is defined as appropriate for gestational age (AGA). Low birth weight (LBW) is defined as birth weight less than 2,500 gm (up to and including 2,499 gm) irrespective of gestational age[2]. Intrauterine growth restriction (IUGR) has been defined as the rate of fetal growth that is below normal considering the growth potential of a specific infant as per the race and gender of the fetus[3].

The intrauterine growth and development period is a critical period during human life[4,5]. LBW babies contribute to a range of poor health outcomes. LBW can arise because of a baby being born too soon (less than 37 weeks of pregnancy-preterm) or if they are SGA. SGA baby may be genetically small but healthy or it may be an IUGR baby[6]. The majority of SGA babies in developing countries are having IUGR. More than 20 billion infants worldwide, representing 15.5 percent of all births are born with LBW[7]. LBW is a public health problem in Bangladesh in which an estimated 22% of births result in LBW babies, and among those 77% are growth retarded. The prevalence of LBW in our country is higher because of maternal undernutrition, teenage pregnancy, poor antenatal care, and lack of nutritional education[8].

Coronary heart disease (CHD) is the leading cause of morbidity and mortality in both developed as well as a developing country[9]. Dyslipidemia which is one

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of the main risk factors of atherosclerosis may have its onset during childhood. Generally, atherosclerosis occurs in adulthood, but several experimental and clinical studies have shown that these lesions may have their onset at a very early stage[10]. An author demonstrated that LBW is correlated with an increased prevalence of cardiovascular disease, hypertension, and type-2 diabetes mellitus. Fetal origin of adult disease gives evidence that chronic disease originates through adaptations that the fetus makes when it is undernourished (LBW) and that certain adult diseases are programmed at utero. Insults during intrauterine life could result in an alteration of physiology and metabolism during adult life[11-13].

There is an inverse relationship between birth weight and mortality from coronary heart disease and the incidence of CHD is also higher in the baby with histories of low birth weight at birth[14-16]. A study which was conducted in Tangungsari, West Java shows that growth disorders in the pre and postnatal period have more risk of having abnormal lipid profile when they reach age 12-15 years old[17]. High triglyceride levels at the age of 16 years were observed more among low-birth-weight adolescent group as compared to the normal birth weight group[18]. Types of research in a different population of a newborn in Chile, Europe, North America, and Canada shows that low birth weight associated with prematurity and alteration of the intrauterine development is associated with increased lipid level[19-21].

In developing countries like Bangladesh incidence of LBW is more. These babies are at risk of diabetes mellitus, hypertension, and coronary heart disease patients. Thus, the country is going to face more burden of chronic disease. This study is to see the lipid profile in neonates and their relationship with birth weight and gestational maturity and compare the result with other studies. Interference to this value a high-risk baby can be identified. These risk babies can be advised proper dietary regime to overcome hyperlipidemia and prevent the early onset of coronary heart disease in adulthood. To the best of our knowledge, in Bangladesh, very few studies have been conducted on this ground. As for the limited period follow up of susceptible newborns will not be possible but it will help future research whether these neonates are at increased risk of developing cardiovascular disease in adult life or not.

Materials & Methods

This hospital-based cross-sectional study was conducted in the neonatal unit and NICU of Mymensingh Medical College and Hospital for about 1 year; at different times from May 2013 to October 2013 and January 2021 to July 2021.

A total of 50 cases of SGA babies admitted in the unit were enrolled in the study. Another 50 AGA neonates of Gynae & obstetric department were taken as a control. The selection of the case and control group was done by applying selection criteria. The case group was included when neonates of both sexes were gestational age ranging from 32 to 42 weeks, birth weight <10th percentile of IUGR chart. Control groups were included when neonates of both sexes were gestational age ranging from 32 to 42 weeks, birth weight >10th and <90th percentile of the IUGR chart. Neonates with congenital anomalies, very sick neonate, neonates with large for gestational age were excluded from this study.

Necessary information was collected by detailed history taking, clinical examination, and close follow up of the hospital course, using a pre-designed questionnaire. After proper counseling, written consent was taken from the guardian of both groups. The physical examination was done meticulously after taking a detailed history from the mother or other caregivers. Weight was recorded by using an electronic weighing scale, the length was recorded with the help of an infantometer, head circumference, chest circumference, and other relevant anthropometric data were recorded. Gestational age was calculated from the first day of the last menstrual period and confirmed by clinical assessment using modified New Ballard's Scoring. After enrolling blood samples (2-3 ml venous blood) were collected 24 hours after birth. Blood was collected in a clean dry glass tube under full aseptic precaution. The collected blood was allowed to clot at room temperature and then immediately sent to the laboratory.

The blood samples were centrifuged at 4,000 RPM for 10 minutes, and then serum was separated and stored at -20°C until analysis. This was used for estimation of total cholesterol, TG, HDL, and LDL by an enzymatic method using an auto-analyzer (Ebra Mannheim Transasia biomedical LTD). LDL was computed by the Friedewald equation; LDL=TC- HDL+ (TG/2.2) mmol/L[22].

The main outcome variables were the serum lipid level of SGA and serum lipid levels of AGA babies. All data from serum lipid profiles were recorded in a case record form.

The serum concentrations of lipids were expressed as mean and standard deviation. These values were compared between preterm-AGA and term-AGA group and preterm-SGA and term-SGA groups. All data were entered, checked, rechecked, and scrutinized by the principal investigator for following standard procedure and were analyzed by the SPSS software program. Categorical variables were reported as a percentage. A significant

association of different variables were tested by using an unpaired t-test. After sorting and processing data checklist and data coding were made a prior analysis to get an appropriate outcome.

Results

Comparisons were done between genders at birth. Among the 50 cases; male 38 (76%) & female 12 (24%) and among the 50 controls; male 32 (64%) & female 18 (36%). There is no statistically significant difference in sex between the case and the control group (p >0.1) (Table-I).

Serum total cholesterol (TC) was significantly (<0.001) higher in term SGA (150±7.2) as compared to term AGA (138±6.9). LDL was higher (p<0.01) in term SGA (66.2±18.4) as compared to the term AGA (48.3±25.3). The triglyceride (TG) level of term SGA (139.8±15.2) was significantly higher (p<0.01) than the term AGA group (128.7±13.6). HDL levels in term newborns, both SGA (31.3±11.3) and AGA (28.2±10.4) were not found a statistically significant difference (p>0.05) (Table-II).

Serum total cholesterol (TC) was significantly (p<0.01) higher in preterm SGA (162±40.2) as compared to preterm AGA (132±35.6). LDL was higher (p<0.05) in preterm SGA (99.4±31) as compared to preterm AGA newborns (80.6±28). The TG level of preterm SGA (165.4±39.4) was significantly (p<0.001) higher than the preterm AGA group (130.6±26.8). HDL levels in preterm newborns, both SGA (36.7±11.9) and AGA (31.4±7.4) were not found a statistically significant difference (p>0.05) (Table-III).

Serum total cholesterol was significantly higher (p<0.001) in LBW babies (166.3±9.2) as compared to NBW (149.6±8.3). LDL, TG, and HDL levels were not significantly higher in LBW compared to NBW (p>0.05) (Table-IV).

TC was significantly higher (p<0.05) in preterm babies (159.8±8.3) as compared to the term (147.4± 6.9). LDL was higher (p<0.001) in preterm neonates (83.3±22.5) as compared to term newborns (61.7 ±31.4). The TG level of preterm neonates (155.2±12.3) was significantly higher (p<0.05) than the term AGA (140.4±14.7). HDL cholesterol levels in newborns, both preterm (45.2±12.3) and term (41.4±9.2) were not found a statistically significant difference (p>0.05) (Table-V).

Serum TC was significantly higher (p<0.05) in SGA babies (160.4±38.4) as compared to AGA (144.3±30.7). LDL was higher (p<0.001) in SGA neonates (88.3±21.2) as compared to AGA (71.2±19.3). The TG level of SGA neonates (140.1± 28.2) was significantly higher (p<0.05) than AGA (126.8±23.3). HDL cholesterol levels in SGA (28.1±18) and AGA (24.7±11) neonates were not found a statistically significant difference (p>0.05) (Table-VI).

Table-I: Gender distribution of case and control group.

Study population (N=100)	Male n (%)	Female n (%)
Case (n=50)	38 (76)	12 (24)
Control (n=50)	32 (64)	18 (36)

X^2=0.16; df-1, p>0.05 Not significant

Table-II: Comparison of lipid profile between term SGA and AGA neonates.

Parameter (mg/dl)	Term SGA n=25 (mean±SD)	Term AGA n=25 (mean±SD)	p-value
Total Cholesterol (TC)	150 ±7.2	138 ±6.9	<0.001
LDL	66.2±18.4	48.3±25.3	<0.01
Triglyceride (TG)	139.8 ±15.2	128.7 ±13.6	<0.01
HDL	31.3+11.3	28.2+10.4	>0.05

Table-III: Comparison of lipid profile between preterm SGA and AGA neonates.

Parameter (mg/dl)	Preterm SGA n=25 (mean±SD)	Preterm AGA n=25 (mean±SD)	p-value
Total Cholesterol (TC)	162 ±40.2	132 ±35.6	<0.01
LDL	99.4±31	80.6±28	<0.05
Triglyceride (TG)	165.4 ±39.4	130.6 ±26.8	<0.001
HDL	36.7±11.9	31.4±7.4	>0.05

Table-IV: Comparison of lipid profile between low birth weight (LBW) and normal birth weight (NBW) neonates (below and above 2.5 Kg).

Parameter (mg/dl)	LBW n=70 (mean±SD)	NBW n=30 (mean±SD)	p-value
Total Cholesterol (TC)	166.3 ±9.2	149.6 ±8.3	<0.001
LDL	78.3±33.6	69.8±27.4	>0.05
Triglyceride (TG)	143.3 ±48.2	138.9 ±31.5	>0.05
HDL	32.8±22.7	27.5±19.3	>0.05

Table-V: Lipid profile between preterm and term neonates

Parameter (mg/dl)	Preterm n=50 (mean±SD)	Term n=50 (mean±SD)	p-value
Total cholesterol (TC)	159.8 ±8.3	147.4 ±6.9	<0.05
LDL	83.3±22.5	61.7±31.4	<0.001
Triglyceride (TG)	155.2 ±12.3	140.4 ±14.7	<0.05
HDL	45.2±12.3	41.4±9.2	>0.05

Table-VI: Comparison of lipid profile between SGA and AGA neonates

Parameter (mg/dl)	SGA n=50 (mean±SD)	AGA n=50 (mean±SD)	p-value
Total cholesterol (TC)	160.4 ±38.4	144.3 ±30.7	<0.05
LDL	88.3±21.2	71.2±19.3	<0.001
Triglyceride (TG)	140.1 ±28.2	126.8 ±23.3	<0.05
HDL	28.1±18	24.7±11	>0.05

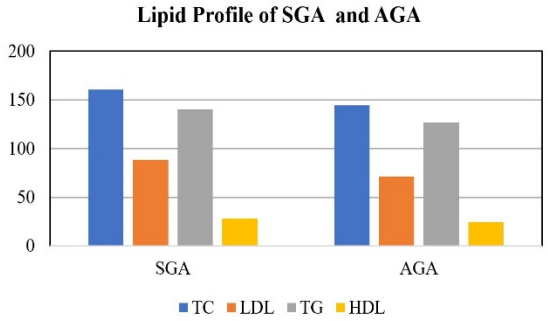

Figure-1: Bar diagram showing lipid profile of SGA and AGA

Discussion

Intrauterine growth and birth weight are probably the most important factors that affect survival and future quality of life. IUGR causes program changes in body systems especially lipid metabolism that creates various problems of which coronary heart disease is important. Atherosclerosis originates during childhood and the serum lipid levels are a key factor in the process. Higher lipid profile in SGA babies relates to the increasing incidence of coronary heart disease[23]. The observations on newborns offer an opportunity to study the risk factor variables in the earliest stage. The observations in infancy provide a background for the studies in older children and adults.

Here, the study has been conducted on neonates coming to Mymensingh medical college hospital. A total of 100 newborns were included. There was a total of 100 newborns out of which 50 were SGA and 50 AGA, 50 were preterm and 50 were terms newborn and 70 were low birth weight (LBW) and 30 were normal birth weight (NBW) babies. In this study 25 preterm SGA and 25 preterm AGA babies; 25 terms SGA and 25 terms AGA babies were included which may raise the question of biasness.

There was no difference of lipid values between male and female newborns in this study. These findings were consistent with findings of the study on Tanzania in 1980[24]. But the result of our study was contrary to another study. In their study lipid parameters were higher in the female neonates compared to their male counterparts[25,26].

In the current study total cholesterol was significantly higher in preterm SGA babies (162±40) than preterm AGA (132±35) babies. Similarly, total cholesterol was significantly higher in terms of SGA babies (1507±7.2) than term AGA (138±6.9) babies. This result was like a study done in Spain in 1989[27]. In our study LDL was also significantly higher in preterm SGA (99.4±31) than preterm AGA (80.6±28). A similar result was found in the study done by many authors in December 2004 at Brazil[27,28].

Serum TG level of preterm SGA babies (165.43±9.4) was found also significantly higher than preterm AGA (130.6±26.8) babies. Similarly, TG level of term SGA (139.8±15.20) also found significantly higher than term AGA (128.7±13.6) babies. This was like the result of the study done in Chile at 2000[29]. Higher TG levels were also seen in growth-retarded newborn babies in the study at Turkey at 2006[30]. A cross-sectional study was conducted in Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh from July 2004 to June 2005[31]. It was observed that serum TG level in IUGR babies was significantly higher than that of term normal babies which were also like our study.

Though the HDL level of preterm SGA (36.7±11.9) was higher than preterm AGA babies (31.4±7.4), but it was not statistically significant (p>0.05). Similarly, there was no significant difference in HDL level (p>0.05) between term SGA (31.3±11.3) and term AGA babies (28.2±10.4). The fall in HDL level may be associated with an increase in the activity of the lecithin cholesterol acyltransferase enzyme[32].

In another study of 150 cases at GSVM Medical College Kanpur, India in 2011 showed that total cholesterol, LDL and TG level were higher in babies of SGA as compared to AGA[33]. So, the results of this study are consistent with our study.

When lipid parameter values were compared based on the birth weight (below and above 2.5 Kg), we found though lipid values were higher in LBW babies than NBW babies, it was not statistically significant ($p>0.05$). Only total cholesterol (TC) was statistically significant where TC was more in LBW babies. A similar study was found where there was no association between the birth weight and lipid levels[34]. But another study showed that Total cholesterol was significantly higher in LBW than NBW babies[35].

In our study, the more premature the baby is, the significant higher are the lipid parameters. No significant difference was observed in cases of HDL values between term and preterm babies. In 2006 a study was conducted in Brazil found similar results except for TG values which were lower in preterm newborns[36].

Lipid parameter values are significantly higher in babies of SGA compared to AGA babies except for HDL in this study. Birth weight is a measure of fetal growth. It is visible that there is an inverse correlation between a bad lipid profile and birth weight. Studies have shown that babies who have a reduced birth weight with gestation tend as adults to develop syndrome 'X' - a combination of hypertension, non-insulin-dependent diabetes mellitus, disordered lipids, hyperinsulinemia, obesity, and abdominal fatness[1,23]. Some other studies also proved the same, like preterm and low birth weight, are factors for cardiovascular risk at adult life[15-16,32]. Another study showed that SGA babies have to adapt to a limited supply of nutrients and in doing so they permanently changed the risk of future coronary heart disease[17]. An author reported an inverse correlation of birth weight and neonatal abdominal circumference with adult serum cholesterol, LDL, and Apo-B levels suggesting that the association between aberrant lipid metabolism and low birth weight is present by the time intrauterine growth restriction is clinically evident[23]. The points of interest in the present study are that there is a significantly high lipid profile among the SGA neonates when compared to AGA neonates. In this study the future effect of SGA babies and their higher lipid levels was not observed because of the short duration of the study period. The results of the present study indicate the necessity for further research to determine if an adverse lipid profile can affect body metabolism, increasing the risk for future complications. This requires a follow-up study for a lifelong period and can be an area of interest for further research.

The limitation of this study was the sample size and conducted in a single center. As this study was done on a relatively small scale, large sample size and multicenter study are recommended for further information.

Conclusion

Serum lipid levels are higher in small for gestational age neonates. It may have a great impact on the future life of these newborns which needs long term to follow up.

Conflict of interest

The authors declared that they have no conflict of interest.

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Citation of this article
Islam T, Ghosh UK, Sufian A, Sharmin M, Akhter N, Ali MA, Hossain MA, Ahmed ATMF, Bhuiyan MR. Comparison of Lipid Profile between Small for Gestational Age and Appropriate for Gestational Age Babies in a Tertiary Level Hospital in Bangladesh. Eastern Med Coll J. 2023; 8 (1): 6-11.