

Evaluation of serum cholesterol and triglycerides level in normal and low birth weight neonates

Hassna O. Al-Janabi.

Department of Physiology-College of Medicine/Tikrit University

Abstract

Normal birth weight neonates are those who delivered with a birth weight of 2500 g up to 2600 g, while the low birth weight neonates are those who delivered with a birth weight of less than 2500 g.

The Aim of this study is to evaluate the serum levels of cholesterol and triglycerides in apparently healthy normal birth weight neonates and low birth weight neonates. In a cases control study conducted in Iraq, the serum levels of cholesterol and triglycerides were tested during the period from the first of March 2006 to the last of July 2009. The study had been done on 200 neonates; they were divided into 2 groups, and these includes 100 apparently healthy normal birth weight mature neonates (NBW) and 100 apparently healthy low birth weight premature neonates (LBW). Each group was assessed for both physical characteristics and send for serum cholestrol and triglyceride level. The results revealed that: The mean serum cholesterol level in LBW (1.78 mmol/L) was significantly lower than that in NBW neonates (2.2 mmol/L). The mean serum triglyceride level in LBW (0.52 g/L) was significantly lower than that in NBW neonates (0.62 g/L).

Conclusion: Serum cholesterol and triglycerides are significantly decreased in LBW neonates compared to the apparently healthy NBW neonates.

Introduction

Normal birth weight (NBW) neonates are those who delivered with a birth weight of 2500 g up to 4600 g, while the low birth weight (LBW) neonates are those who delivered with a birth weight of less than 2500 g.

In serum, only about 30% of the total circulating cholesterol occurs free as such; while approximately 70% of the cholesterol occurs in lipoproteins in the form of cholesterol esters. (1, 2)

It is found that during the first few months of life, serum cholesterol levels

increase largely because of changes in LDL. Serum cholesterol levels are comparable in males and females early in life. (3)

It is found that the serum triglyceride levels are comparable in males and females at birth, which varies from 0.1 to 0.98 mmol/L in the cord blood. The level rises transiently in both males and females in the 1st year of life. (4)

AIM OF THE STUDY is to assess the level of serum cholstrol and triglycerides in normal birth weight (NBW) and low birth weight (LBW) neonates.

Materials and methods

The study was conducted in Tikrit Teaching Hospital during the period from the 1st of March 2006 till the 1st of July 2009.

Around 1000 newborns of both sexes, with different presentations in Tikrit Teaching Hospital were checked for their age, gestational age, and their birth weights. Only 200 of them were included in this study. Neonates included in this study were of comparable ages. Neonates included in this study were collected from:

1. Neonatal intensive care unit.
2. Delivery room.
3. Operating theater.
4. Out-patient clinic.

The studied neonates were classified into 2 groups, the first one composed of 100 apparently healthy NBW neonates and the second group was also composed of 100 apparently healthy LBW neonates.

Eligibility for inclusion in this study was restricted to newborns with none of the following conditions:

1. Premature infant with normal birth weight.
2. Full term that is small for his gestational age.
3. Overweight infant born at term.
4. Infant of diabetic mother.
5. Infant of thyrotoxic or hypothyroid mother.
6. Infant of hypertensive mother.
7. Syndromes.
8. Those who received oral feeding.

The birth weight of each newborn was measured twice at the same time by using 2 digital baby scales (with subtracting 2 g from the weight of each neonate: the weight of the umbilical clamp) present at the neonatal care unit soon after delivery of the newborn. The birth weight was taken by using 2 scales for each newborn included in this study in order to reduce the instrumental error; the two instruments were checked for their accuracy of their measurements against known standard iron pieces.

As a part of each newborn medical history, assessment of gestational age by using Dubowitz scoring system, (5) sex of the newborn, age of the newborn, whether the mother is hypertensive and/or diabetic was also considered and full physical examination of each newborn to find whether the newborn was healthy or diseased.

Blood Sampling:

One milliliter of umbilical venous blood sample were obtained by using an umbilical catheter from the umbilical vein of each neonate included in this study soon after the physical examination and before any feeding started for the estimation of serum cholesterol and triglycerides.

Serum cholesterol level was measured by cholesterol kit (BioMerieux, France), using an enzymatic method (Richmond method). (6)

Serum triglyceride was measured by triglyceride kit (BioMerieux, France),

using an enzymatic method (Fassatip method). (7)

Statistical Analysis:

Student t-test was used to determine if the mean values for biochemical tests were significantly different between. Any P value of less than 0.05 was considered significant.

Results

The general physical characteristics of the apparently healthy neonates included in this study are shown in the table (1). The data obtained shows that there is a significant statistical difference between the NBW and the LBW neonates regarding the birth weight and the gestational age at a P value of less than 0.001, while there is no significant difference concerning the age of the newborns.

Serum Cholesterol:

Table (2) clarifies the mean \pm SD, range, standard error of the mean, confidence interval of the mean, t-test, and the probability of the serum levels of cholesterol (mmol/L) in the studied groups. The mean serum values in LBW (1.78 ± 0.52 mmol/L) neonates are significantly lower ($P < 0.001$) than that in NBW neonates (2.2 ± 0.63 mmol/L).

Figure (1) shows a negative correlation ($r = -0.21$, significant at 0.05 level) between serum cholesterol levels and the age of NBW neonates.

Serum Triglyceride:

Table (3) illustrates the mean \pm SD, range, standard error of mean, confidence interval of the mean, t-test, and the probability of the serum levels of triglyceride (mmol/L) in the studied groups. It is evident that the mean serum level of triglyceride in LBW (0.52 ± 0.23 mmol/L) is significantly ($P < 0.05$) lower than the mean value in NBW (0.62 ± 0.33 mmol/L).

Figure (2) shows a positive correlation ($r = +0.21$, significant at the 0.05 level) between serum triglyceride levels and the age in LBW neonates. Discussion

The neonatal period is a highly vulnerable time for an infant, who is completing many of the physiologic and biochemical adjustments required for extrauterine existence. (8)

Table (1) clarifies that all the NBW neonates are full-term, and all the LBW neonates are preterm. It is also evident from this table that the mean age of each group is less than 1 hr.

The initial examination of a newborn infant should be performed as soon as possible after delivery to detect abnormalities and to establish a baseline for subsequent examination. (9)

In studies on newborns, it is necessary to know the birth weight to decide whether the neonate is a normal or a low birth weight because most of the biochemical parameters differ according to maturity and the birth weight. Therefore, each newborn included in this study was assessed carefully for the body weight at

Evaluation of serum cholesterol and triglycerides level in normal and low birth weight neonates

birth. The assessments of the birth weight were performed by using 2 digital baby scales in order to avoid the instrumental errors. (10)

The data obtained shows that there is a significant statistical difference between the NBW and the LBW neonates regarding the birth weight and the gestational age at a P value of less than 0.001, while there is no significant difference concerning the age of the newborns. This is due to the fact that preterm are those newborns that delivered before 37 week completed weeks while full term is the newborn that born between 38-42 weeks gestation and this explains the difference in the birth weight between the two groups due to the fact that fat deposition is mainly occur at the 3rd trimester so if the baby born prematurely this leads to decrease the birth weight compared with that who born at full gestation. (11)

The mean serum cholesterol levels in LBW are significantly lower than the level in NBW neonates. In fetal life, plasma total cholesterol is low, as there is no dietary source and maternal lipoproteins do not cross the placenta to reach the fetal circulation. In addition that the total body fat is lower in premature and low birth weight neonates, this could be the reason behind the lower mean serum value in LBW. This finding is not in agreement with the findings of Lutjohann, et al (2001) (12) who studied 12 preterm and 12 full-term neonates and they found that

serum cholesterol was significantly higher in preterm than in term neonates ($P < 0.001$), Lutjohann, et al attributed their finding to a normal cholesterol metabolism in the developing neonatal brain.

At birth the mean value of total serum cholesterol is 1.8mmol/L. It is found that around half of cholesterol is carried on HDL. During the first weeks of life, total and LDL cholesterol concentrations increase rapidly. (13) In this study the mean serum cholesterol level at birth is significantly higher ($P < 0.01$) than those reported in the above literature; this may be due to cord-blood drawings in this study rather than peripheral venous blood drawings. This explanation is in agreement with Gouedard, et al (1982). (14)

Serum cholesterol levels were negatively correlated to age in NBW neonates, this finding could be explained as follows: Since cholesterol is an important substance for brain growth (15) and the blood samples were taken before feeding, therefore the decrease in serum cholesterol with the advancing age is attributed to the consumption of cholesterol by the growing brain.

The mean serum levels of triglyceride in LBW are lower than the mean serum level in NBW neonates. This finding may be attributed to the body mass, in which a higher birth weight is associated with a higher serum level of triglyceride and a more synthetic ability of the liver. (4)

Triglyceride synthesis in the liver is used primarily for production of blood

Evaluation of serum cholesterol and triglycerides level in normal and low birth weight neonates

lipoproteins, although the products can be serving as energy sources. Most lipids in serum other than non-esterified fatty acids are transported in water-soluble form as lipoproteins. These macromolecules are in a state of flux with transfer of components between cells, tissues, and other lipoproteins. (16)

There were positive correlations between serum triglyceride levels and the age in LBW. This finding could be attributed to that, serum triglyceride start to increase gradually with the age until it reaches the adult level.

CONCLUSION

Serum cholesterol and triglycerides are significantly lower in apparently healthy LBW neonates compared to the apparently healthy NBW group.

References

1. Brown MS and Goldstein JL: A receptor – mediated pathway for cholesterol homeostasis. *Science* 1986; 232:68.
2. Gordon DJ and Rifkind BM: High-density lipoprotein: the clinical implications of recent studies. *N. Engl. J. Med.* 1989; 321:1311.
3. Frerichs RR, Srinivasan SR, Webber LS, et al: Serum cholesterol and triglyceride levels in 3446 children from a biracial community. the Bogalusa heart study. *Circulation* 1976; 54:302.
4. Hickman TB, Briefel RR, Carroil MD, et al: Distributions and trends of serum lipid levels among United States children and adolescents: Data from the Third National Health and Nutrition Survey. *Prev. Med.* 1998; 27:879-90.
5. Hittner HM, Hirsch NJ, and Rudolph AJ: Assessment of gestational age. *J. Pediatr.* 1977; 91:455.
6. Abell LL, Levey BB, Brodie BB, et al: A simplified method for the estimation of total cholesterol in serum and demonstration of its specificity. *J. Biol. Chem.* 1952; 195: 357-366.
7. Fossatia KR: Determination of triglyceride in blood serum. *Clin. Chem.* 1982; 28:2077.
8. Alexander GR, Kogan MD, and Himes JH: Racial differences in birth weight for gestational age and infant mortality in extremely low- risk US populations. *Pediatr. Perinat. Epidemiol.* 1999; 13:205.
9. Hoyer DI, Freedman MA, and Strobino DM: Annual summary of vital statistics:2000, *Pediatrics* 2001;108:1241.
10. Ventura SJ, Mathews TJ, and Hamilton BE: Births to teenagers in the United States, 1940-2000. *Natl. Vital. Stat. Rep.* 2001; 49:1.
11. Carroli G, Villar J, and Piaggio G: WHO systematic review of randomized controlled trials of routine antenatal care. *Lancet.* 2001; 357: 1565.
12. Lutjohann D, Bjorkhem J, Locatelli S, et al: Cholesterol dynamics in the fetal and neonatal brain as reflected by circulatory levels of 24S-Hydroxycholesterol. *Acta. Pediatr.* 2001 Jun; 90(6):652-7.

Evaluation of serum cholesterol and triglycerides level in normal and low birth weight neonates

13. U.S. Department of Health and Human Services, National Institutes of Health: Lipid Research Clinics Population Studies Data Book, Vol. I, The Prevalence Study, Washington DC: Government Printing Office 1980:23-6.
14. Gouedard H, Leglise D, L'Hostis D, and Conan G: Evaluation of serum cholesterol and cholesterol lipoprotein fraction levels in the neonatal period. Arch. Fr. Pediatr. 1982 Aug. Sep; 39(7):437-40.
15. Woollett LA: Fetal lipid metabolism. Front. Biosci. 2001 Mar 1; 6:D536-45.
16. Nilsson-Ehle P, Garfinkel AS, and Schotz MC: Lipolytic enzymes and plasma lipoprotein metabolism. Annu. Rev. Biochem. 1980; 49:667.

Table (1): Physical Characteristics of Newborns.

Groups	No.	Birth weight (g) mean \pm SD	Gestational age (wks) mean \pm SD	Age (min) mean \pm SD
NBW				
Male	56	3176.53 \pm 386.60	39.26 \pm 0.94	29.82 \pm 11.57
Female	44	3135.6 \pm 411.85	39.15 \pm 0.98	28.40 \pm 10.09
Total	100	3158.65 \pm 396.38	39.22 \pm 0.95	29.2 \pm 11.12
LBW				
Male	49	2116.85 \pm 206.53	34.08 \pm 1.81	20.10 \pm 12.11
Female	51	2117.82 \pm 221.49	34.23 \pm 2.12	27.94 \pm 14.71
Total	100	2117.35 \pm 213.21	34.16 \pm 1.96	29.0 \pm 12.33

Table (2): Biostatistical Calculation and Student t-test for cholesterol Levels in Sera of NBW, LBW.

Serum levels of cholesterol (mmol/L)	NBW	LBW
Sample size	100	100
Mean \pm SD	2.2 \pm 0.63	1.78 \pm 0.52
Range	0.8 – 3.5	0.8 – 3.4
Standard error of mean	0.063	0.052
Confidence interval of mean: Lower Upper	2.08 2.33	1.68 1.89
t-test		5.06
Probability		0.000*** (S)

*** P < 0.001

Evaluation of serum cholesterol and triglycerides level in normal and low birth weight neonates

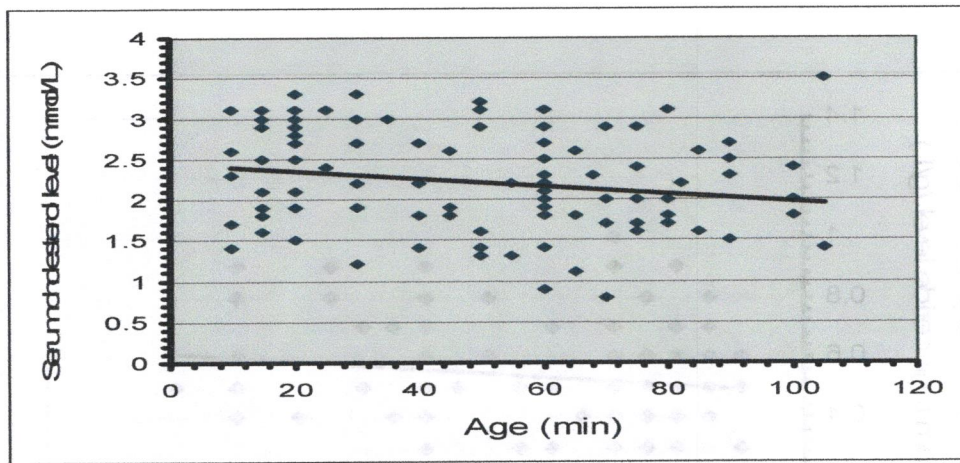


Figure (1): The correlation of serum cholesterol levels to age in NBW neonates.

Table (3): Biostatistical Calculation and Student t-test for triglyceride Levels in Sera of NBW and LBW.

Serum levels of triglyceride (g/L)	NBW	LBW
Sample size	100	100
Mean \pm SD	0.62 \pm 0.33	0.52 \pm 0.23
Range	0.1 – 2.5	0.1 – 1.5
Standard error of mean	0.033	0.023
Confidence interval of mean:		
Lower	0.57	0.48
Upper	0.70	0.57
t-test		2.61
Probability		0.01* (S)

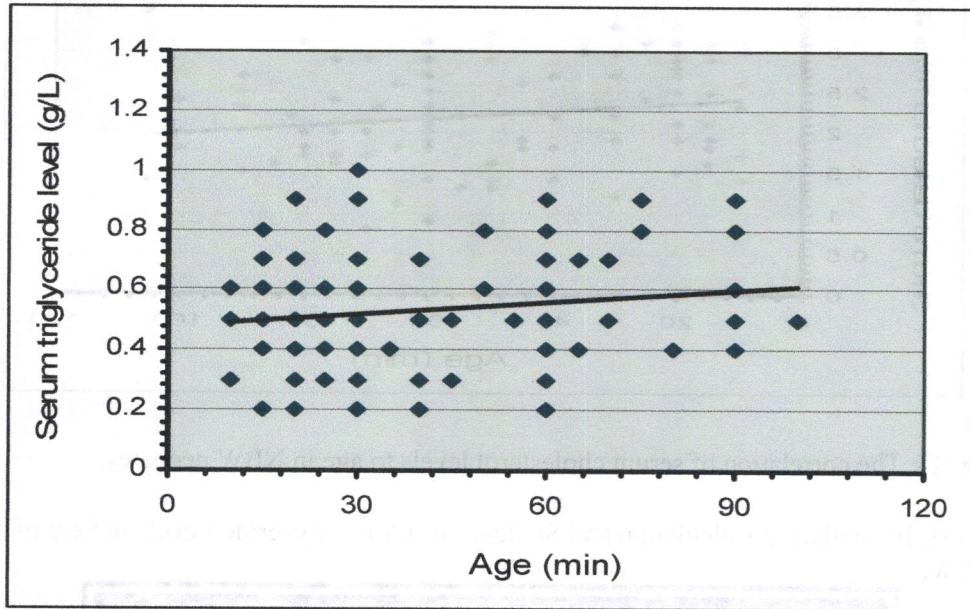


Figure (2): The correlation of serum triglyceride levels to age in LBW neonates.

تقييم لمستوى الكوليسترول و الدهون الثلاثية في مصلى الدم لدى الأطفال الحديثي الولادة ذوي الأوزان الطبيعية والأوزان القليلة:
د. حسنة عبيد الجنابي .

مقدمة: الطفل الخديج يعرف بكونه الطفل الذي يولد قبل عمر 37 اسبوع كامل . ان الاطفال الحديثي الولادة ذوي الأوزان الطبيعية هم الذين تتراوح أوزانهم بين 2500 غم الى 4600 غم، في حين ان حديثي الولادة ذوي الأوزان القليلة هم الذين تكون أوزانهم أقل من 2500 غم .
اهداف الدراسة: في أول دراسة في العراق وفي مستشفى تكريت التعليمي للفترة من الأول من اذار 2006 والى نهاية تموز 2009. تم قياس مستوى الدهون لدى الأطفال الحديثي الولادة وقبل البدء بالرضاعة لغرض تقييم مستواه في مصلى الدم.

طريقة العمل: لقد تم دراسة 200 طفل حديثي الولادة وقد تم تقسيمهم الى مجموعتين وتضم ، 100 حديثي الولادة يبدون أصحاء ذوي أوزان طبيعية و 100 خديج يبدون أصحاء ذوي أوزان قليلة. لقد تم قياس نسبة الكوليسترول و الدهون الثلاثية في مصلى الدم وقد تم مقارنة النتائج المستخلصة بينهم .

النتائج: لقد أظهرت النتائج أن معدل مستويات الكوليسترول في مصلى الدم لدى حديثي الولادة ذوي الأوزان القليلة (1.78 mmol/L) كان أقل بصورة دالة عما هو عليه لدى حديثي الولادة ذوي الأوزان الطبيعية (2.2 mmol/L) كما وجد أن معدل الدهون الثلاثية عند الاطفال ذوي الأوزان القليلة كان (0.52 g/L) وكان أقل من المعدل عند الاطفال ذوي الأوزان الطبيعية (0.62 g/L).

الاستنتاج: ان معدل مستويات الدهون قد وجدت أقل بصورة دالة لدى الاطفال الحديثي الولادة ذوي الأوزان القليلة بالمقارنة مع ذوي الأوزان الطبيعية الاصحاء ظاهرياً".