

ORIGINAL RESEARCH

Weight loss as a predictor of increased serum bilirubin levels in term and late preterm neonates during the early neonatal period

¹Dr. Roshan Sabu, ²Dr. Sundar Singh, ³Dr. Dhanya Roy, ⁴Dr. Bobby Christy

¹Post-Graduate Resident, Department of Paediatrics, Dr. SMCSI Medical College, Karakonam, Thiruvanthapuram, Kerala, India

^{2,3}Associate Professor, Department of Paediatrics, Dr. SMCSI Medical College, Karakonam, Thiruvanthapuram, Kerala, India

⁴Assistant Professor, Department of Paediatrics, Dr. SMCSI Medical College, Karakonam, Thiruvanthapuram, Kerala, India

Corresponding Author

Dr. Roshan Sabu

Post-Graduate Resident, Department of Paediatrics, Dr. SMCSI Medical College, Karakonam, Thiruvanthapuram, Kerala, India

Received: 12 March, 2023

Accepted: 18 April, 2023

ABSTRACT

Background: Excessive weight loss in newborns occurs mainly due to substantial decline in the total body water occurring after birth. The aim of this study is to determine the association of weight loss with hyperbilirubinemia in term and late preterm neonates during the early neonatal period. **Methods:** A hospital based prospective cross sectional study was conducted at our institution on 500 term and late preterm inborn neonates. The weight of the newborns were measured on a standard electronic infant weighing scale within one hour of birth and at 24 hours, 48 hours, 72 hours or till discharge. Serum bilirubin levels were analyzed for all babies at 48 and 72 hours of life by VITROS 5600 BuBc slide method. The data was analyzed and any association between significant weight loss and hyperbilirubinemia was looked for. The correlation between postnatal weight loss and serum bilirubin levels was determined. **Results:** Significant weight loss is neither associated with increased serum bilirubin levels at 48 hours ($p=1$) nor there is a correlation between post-natal weight loss and serum bilirubin ($r=0.05$). Significant weight loss is not associated with increased serum bilirubin levels at 72 hours ($p=0.29$) and there is a no correlation between post natal weight loss and serum bilirubin levels ($r=0.1$). **Conclusion:** Significant weight loss is not associated with increased serum bilirubin levels. However early identification and correction of dehydration should be targeted upon to prevent the potential complications.

Key words: Predictor, serum bilirubin, preterm neonates, neonatal period

This is an open access journal, and articles are distributed under the terms of the Creative Commons Attribution-Non Commercial-Share Alike 4.0 License, which allows others to remix, tweak, and build upon the work non-commercially, as long as appropriate credit is given and the new creations are licensed under the identical terms.

INTRODUCTION

The first 28 days after birth is referred to as the neonatal period. Neonates must quickly acclimatize to the extra uterine environment after birth. From foetal to neonatal life, the body's water content gradually changes. With time, there is a proportional decline in extracellular fluid compartments as well as total body water. It is known that newborns lose weight over the first few days. This along with dehydration, excessive hemolysis and the decreased amount of breast milk during the initial days usually cause them to lose more weight before gaining it. Preterm neonates may lose up to 10-15% of their birth weight during the first few

days of life compared to full-term neonates, who typically lose less than 10% of their birth weight.¹

A common clinical problem during the neonatal period, particularly in the first week of life, is neonatal hyperbilirubinemia manifesting usually as an increase in unconjugated serum bilirubin. Weight loss in the infant of greater than 7% from birth weight indicate possible breastfeeding problems. This is particularly important in the early days when lactation is being established.² Excessive weight loss is supposed to be one of the risk factors for hyperbilirubinemia.³ Healthy term infants who are exclusively breastfed and whose breastfeeding is not

well established by the time of discharge are more likely to consume few calories, become dehydrated due to decreased volume and frequency, and experience secondary delayed gastrointestinal motility, which causes an increase in the enterohepatic circulation of bilirubin.³ A search of literature reveals that though many studies were conducted on the association of postnatal weight loss with hyperbilirubinemia, there were only few prospective studies. The aim of this study is to determine the association of significant weight loss with increased serum bilirubin levels in term and late preterm neonates during the early neonatal period.

METHODS

STUDY DESIGN: Cross sectional study.

STUDY SETTING: The study was conducted in the department of Pediatrics of Dr. SMCSI Medical College, Karakonam, Trivandrum, Kerala.

SELECTION OF PARTICIPANTS: All term and late preterm inborn neonates born during the study period, fulfilling the criteria's were enrolled for the study after taking parental consent. All inborn term and late preterm neonates were considered for the study. Neonates born with major congenital anomalies or those who received phototherapy within 48 hours of life, neonates with birth weight < 2000 grams or those who received intravenous fluids or any other feeds, or discharged/DAMA before 48 hours of life were excluded from the study. Neonates were divided into two groups, those with significant weight loss (more than or equal to 10%) and those without significant weight loss (less than 10%).

DATA COLLECTION AND PROCESSING: The sampling technique was non probability sampling. The sample size calculated was 500.⁴ All the study participants were weighed by the primary investigator. The weight of the neonates in nude was recorded accurately on a calibrated standard electronic infant weighing scale by Nice Neotech (Model AD 1). The weighing scale was first corrected for any zero error. The baby was kept in the centre and the weight was noted accurately. The weight of the baby was measured within one hour of birth and at 24 hours, 48 hours, and 72 hours. Serial measurements were done on the same weighing scale. Serum bilirubin levels for all the babies were done at 48 hours of life as per department protocol. It was repeated later at 72 hours of life if indicated (if clinically significant icterus

persist or previous value is high). Serum bilirubin was analyzed by VITROS 5600 BuBc slide method.

Out of the 500 neonates enrolled in the study, serum bilirubin was measured for 496 neonates at 48 hours of life; four neonates were left out due to technical reasons. It was repeated for 326 neonates at 72 hours as per the study protocol.

DATA ANALYSIS: Post natal weight loss (%) was calculated by subtracting the daily weight from the birth weight and then dividing it by the birth weight. Post natal weight loss more than or equal to 10% was considered as significant weight loss.¹ A cut off serum bilirubin more than or equal to 15 mg/dl was considered for the study.⁵ The data was entered and analyzed using SPS Software version 21. Appropriate test of significance was used to calculate the association between the quantitative variables and Pearson correlation test was used to determine correlation. P value less than 0.05 was taken as significant.

RESULTS

Our study included 500 newborn that were born at our study centre, during the period from March 2021 to January 2022. We considered all inborn neonates who are 37 weeks or more as Term babies, and those between 34 to 36 +6 weeks as Late preterm babies. The study was done in a sample of 500 neonates who fulfilled the criteria. Out of the new borns we studied, there were 47 (9.4%) late preterm and 453 (90.6%) term babies. The study groups were comparable with each other with respect to birth weight and gestation age both at 48 and 72 hours. Analysis of the base line characters revealed that significant weight loss at 48 hours is more seen in neonates born at 37 weeks (n=13) or having a birth weight between 3-3.5 kg (n=16). At 72 hours, significant weight loss is more seen in neonates born at 38 weeks (n=43) or having birth weight of 2.5- 3 kg (n=54). The strength of association between the two groups was found at 48 hours and 72 hours using fissure exact test and chi square test respectively. There is no association between significant weight loss and increased serum bilirubin levels at 48 hours (P=1.00) or at 72 hours (p=0.29). Pearson's correlation test was used find out the correlation between postnatal weight loss (in percentage) and serum bilirubin levels. There is no correlation between post natal weight loss and serum bilirubin levels at 48 hours (r=0.05) or at 72 hours (r =0.1).

Table 1: Frequency distribution of the Neonates according to Gestational age

Gestational Age (weeks)	Weight loss at 48 hours (%)		Weight loss at 72 hours (%)	
	No significant Weight loss	Significant Weight loss	No significant Weight loss	Significant Weight loss
34	4	0	3	1
35	13	0	10	3
36	39	1	30	8
37	101	13	70	29

38	171	12	130	43
39	132	7	100	25
40	7	0	5	1
Total	467	33	348	110
P Value	0.42		0.79	

Table 2: Frequency distribution of the Neonates according to Gestational age

Birth weight (Kilograms)	Weight loss at 48 hours (%)		Weight loss at 72 hours (%)	
	No significant Weight loss	Significant Weight loss	No significant Weight loss	Significant Weight loss
< 2.5	61	0	45	10
2.5 - 3	190	13	134	54
3 - 3.5	170	16	129	37
> 3.5	46	4	40	9
Total	467	33	348	110
P Value	0.06		0.21	

Table 3: Comparison of weight loss with serum bilirubin

Weight loss at 48 hours (%)	Serum bilirubin (mg/dl)			P Value	Weight loss at 72 hours (%)	Serum bilirubin (mg/dl)			P Value
	< 15	≥15	Total			< 15	≥15	Total	
<10	459	4	463	1.0	<10	222	22	244	0.29
≥10	33	0	33		≥10	71	11	82	
Total	492	4	496		Total	293	33	326	

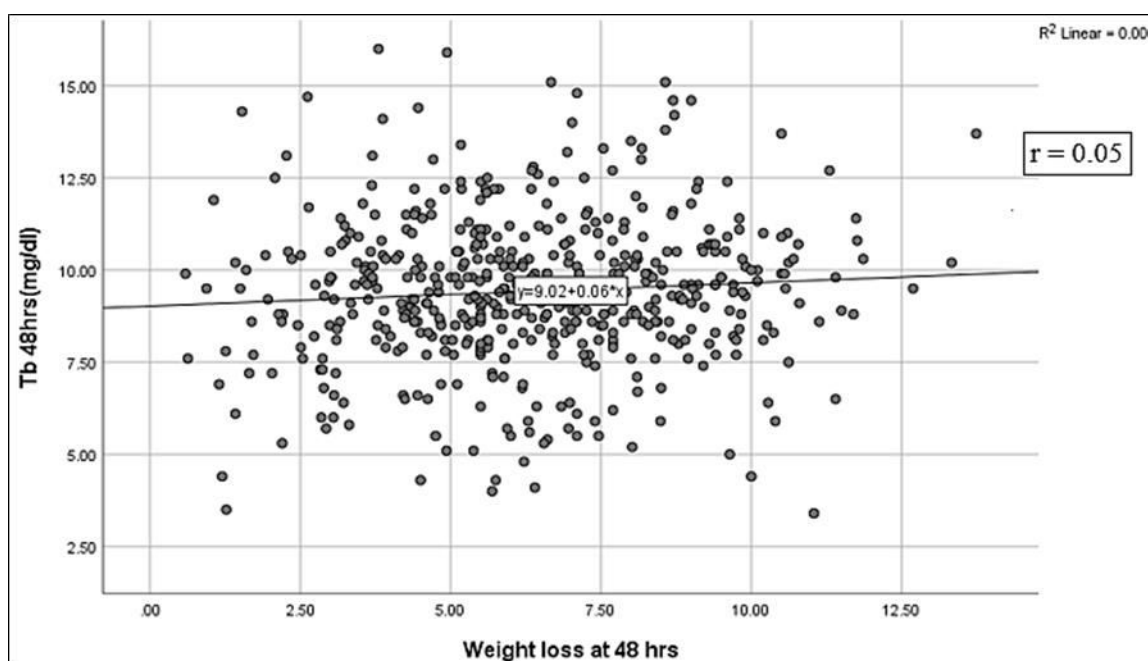


Fig 1: Correlation of postnatal weight loss with serum bilirubin at 48 hours

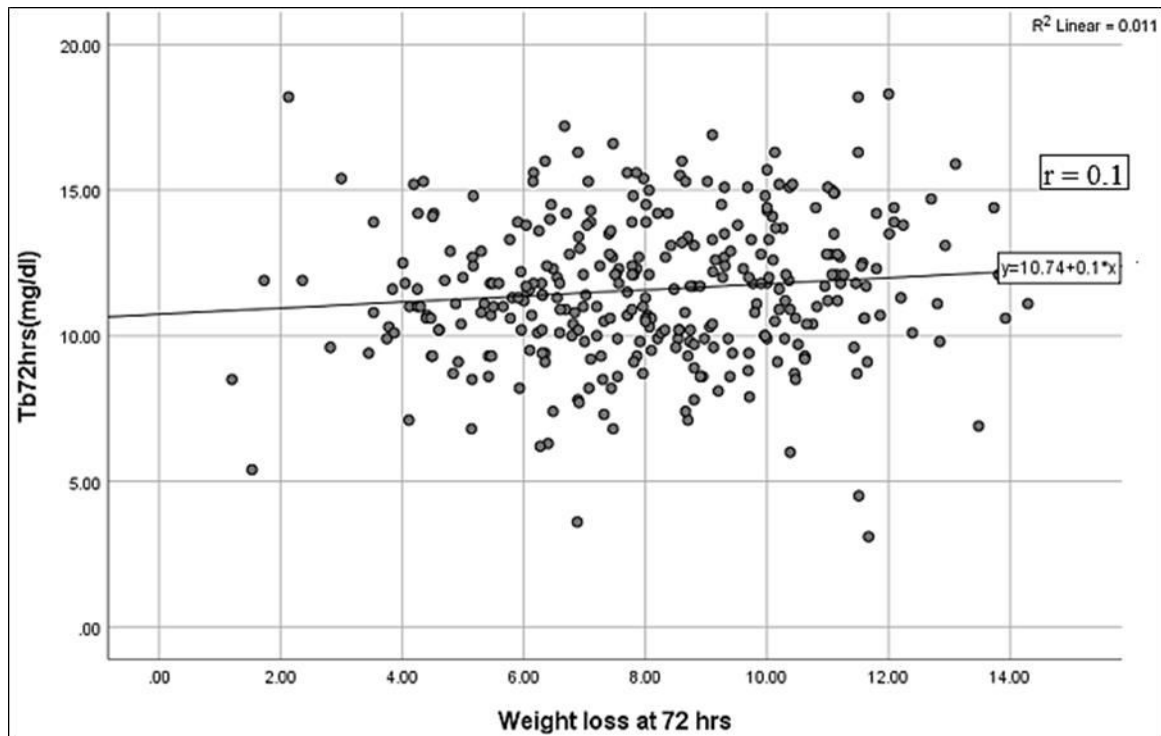


Fig 2: Correlation of postnatal weight loss with serum bilirubin at 72 hours

DISCUSSION

All the study participants born at our institution were routinely monitored for serum bilirubin levels at 48 hours irrespective of the risk factors for hyperbilirubinemia. There were many other studies in the literature in which serum bilirubin estimation was used to look for hyperbilirubinemia. The study by Khan *et al.* had also used serum bilirubin as a tool for monitoring neonatal jaundice⁶. There are also other methods for the initial screening of neonatal jaundice. A study conducted by Carolyn *et al.* had used Kramer's index as a visual assessment tool to look for hyperbilirubinemia⁷. In the study conducted by Yang *et al.* both transcutaneous and serum bilirubin estimation was done⁵.

In our study birth weight and gestational age were taken as the baseline characters. There is no difference in birth weight or gestational age between the two groups. A similar observation was seen in the study conducted by Yang *et al.*⁵.

We found that significant weight loss is not associated with increased serum bilirubin levels at 48 hours ($p=1.0$). The study by Huang *et al.* reported that a birth weight loss of more than 7% after 38 hours was an independent risk factor for early neonatal jaundice, and that infants with a birth weight loss of more than 7% had a 1.4-fold increased risk of jaundice⁸. The study by Yang *et al.* also reported that a weight loss of more than 10% is associated with significant hyperbilirubinemia at 48 hours⁵. In the present study, no correlation was found between post natal weight loss at 48 hours and serum bilirubin levels ($r = 0.05$). Contrary to this, the study done by Yang *et al.* had

showed a correlation between the two parameters at 36 hours ($r=0.3$)⁵.

In the present study, the association between weight loss and serum bilirubin levels at 72 hours was found to be non-significant. In contrary to this, the study done by Yang *et al.*, reported that among the neonates who presented with significant hyperbilirubinemia at 72 hours of birth, the percentages of weight loss on the first three days were all higher than those in the non-significant hyperbilirubinemia group (all $p < 0.05$)⁵. Huang *et al.*, also studied term neonates from birth to 72 hours and found association between significant weight loss and hyperbilirubinemia ($p < 0.01$)⁸. A significant association between the two parameters at 72 hours of life was also shown by the study done by Indriyani *et al.* ($p=0.01$)⁴.

In our study postnatal weight loss and serum bilirubin did not have any correlation at 72 hours ($r = 0.1$). A positive correlation was observed in the studies done by Indriyani *et al.* ($r=0.3$)⁴, Yang *et al.* ($r=0.4$)⁵.

The limitations of our study are that many confounding factors affecting the serum bilirubin levels during the early neonatal period were not considered, so the results obtained may be skewed. As long term follow up of these neonates could not be done, we do not have information about the long term complications associated with significant weight loss. Through this study, we conclude that significant weight loss is not associated with increased serum bilirubin levels as there is no statistical association or correlation between weight loss and serum bilirubin levels at 48 hours or at 72 hours of life. Methods to improve breast feeding, such as early initiation of feeds, early detection and correction of nipple

problems, galactogogues when necessary, improving maternal health etc. may be targeted upon to prevent dehydration, thus decreasing the incidence of neonatal hyperbilirubinemia and its long term complications.

References

1. Chawla D, Agarwal R, Deorari AK, Paul VK. Fluid and electrolyte management in term and preterm neonates. *The Indian Journal of Pediatrics*. 2008;75(3):255–9. doi:10.1007/s12098-008-0055-0
2. Pulmamidi, Rajeshkhanna, and RamyaMadhuriYendamuri. “Prospective Study to Determine Weight Loss as Predictor for Neonatal Hyperbilirubinemia in Term Neonates.” *Panacea Journal of Medical Sciences*, 15 Apr. 2021, www.ipinnovative.com/journals/pjms/article-details/13748/volume/358/issue/1047.
3. Management of hyperbilirubinemia in the newborn infant 35 or more weeks of gestation. *Pediatrics*. 2004;114(1):297–316. doi:10.1542/peds.114.1.297
4. Indriyani SA, Retayasa IW, Surjono A, Suryantoro P. Percentage birth weight loss and hyperbilirubinemia during the first week of life in term newborns. *Paediatrica Indonesiana*. 2009;49(3):149. doi:10.14238/pi49.3.2009.149-154
5. Yang W-C, Zhao L-L, Li Y-C, Chen C-H, Chang Y-J, Fu Y-C, Wu H-P. Bodyweight loss in predicting neonatal hyperbilirubinemia 72 hours after birth in term newborn infants. *BMC Pediatrics*. 2013;13
6. Khan HA, Akter T, Rahman S, Noman F, Begum P, Hassan MK, Ahmed S. Comparative Study of Serum Bilirubin Level between Term and Preterm Babies in Mymensingh Medical College Hospital. *Faridpur Medical College Journal*. 2017;12:5-8.
7. Nassuna C, Yaser A, Karamagi C, Mugalu J. Significant hyperbilirubinemia among well neonates due for discharge at Kawempe-Mulago Hospital, prevalence, factors associated, and accuracy of transcutaneous bilirubinometry for screening. *African Health Sciences*. 2022;22:526-534.
8. Huang A, Tai BC, Wong LY, Lee J, Yong EL. Differential Risk for Early Breastfeeding Jaundice in a Multi-ethnic Asian Cohort. *Annals of the Academy of Medicine, Singapore*. 2009;38:217-224.