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A Clinical Study of Dehydration, Dyselectrolytemia, Hyperthermia and Azotemia among Neonates Admitted to Tertiary Care Centre

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Abstract

Background: Fever and hypernatremia are often found in neonates with excessive weight loss. In low-risk full-term infants, fever with no other symptoms during the first days of life is primarily related to dehydration and breast-feeding, Hypernatremia occurs primarily because of water deprivation and secondarily because of an accumulation of sodium in an attempt to maintain a proper circulating volume. Azotemia occurs in these patients as a consequence of impaired renal blood flow or decreased perfusion resulting from decreased blood volume. As the literature regarding the association between dehydration, dyselectrolytemia, hyperthermia and azotemia is less, a study on this subject would help in early detection, prevention and better management.

Objectives: To study the clinical, biochemical profile and outcome of neonates who presented with dehydration and hyperthermia to a tertiary care centre.

Methodology: All neonates admitted with dehydration and hyperthermia during the study period of 18 months, were enrolled for the study. Results: In this study of 241 neonates, most common symptom found were decreased voiding of urine (27.71%), followed by fever (26.29%), refusal to feed (24.29%), jaundice (19.43%) and convulsions (2.29%) and the most common biochemical derangement observed were Azotemia (69.52%), followed by hypernatremia (56.19) and hyperbilirubinemia (30.95%). 38.2% of the study subjects had sodium in the range of 151-160 mEq/L, followed by 26.1% (<150 mEq/L). The mean birth weight in the present study was 3+0.31 kg and the mean weight at presentation was 2.64+0.37 kg. The percentage of weight loss was 11.9%.

Conclusion: The results of our study provide support for the hypothesis that one of the main cause of fever during the first days of life is from dehydration resulting from difficulties at the initiation of breast feeding. Hypernatremic dehydration can be prevented by education of mothers regarding breastfeeding techniques, beginning in the antenatal period. Those with identifiable problems should be referred promptly for lactation management and supportive counselling. Also, close follow-up of infants should be done within the first week after hospital discharge for checking weight gain and adequate hydration.

Keywords: Hypernatremic dehydration; Azotemia; Convulsion; Jaundice

Introduction

Fever is a common symptom and sign of neonatal illness. Between 1 to 2.5% of all newborn admitted in the nursery have fever judged from rectal or axillary temperature. There is no universally accepted definition of neonatal fever. Craig1 defined neonatal pyrexia as a rectal (core body) temperature higher than 37.4°C. For the purpose of present study fever is defined as skin temperature of 37.5°C or more [1,2].

The elevations in temperature (38-39°C) are occasionally noted on the 2nd - 3rd day of life in infants whose clinical course has been otherwise satisfactory [3,4]. This disturbance occurs in breast fed infants whose fluid intake is lowered or exposed to high environmental temperatures. In neonatal care we should provide a thermal range, which does not stress the infant to produce or lose large amounts of heat, in addition to early initiation of effective breastfeeding [5].

Fever during the neonatal period is considered an alarming sign of systemic infection. Only a few studies have tried to identify infants with fever yet with a low risk of serious bacterial infection [2,3,6]. In these studies, normal physical examination and laboratory tests were correlated with low risk for serious bacterial infection. In some of the studies, low risk babies were treated on ambulatory basis, and no antibiotic treatment was given [7]. The dehydration fever in the newborn has been accepted as a clinical entity to identify low risk babies with fever during the first days of life. Von resus [8] referred this condition as transitory fever which he described as a short duration of fever that may be remittent over a period of a few days. According to Stone [9] dehydration fever is intermittent or remittent type, coming rather suddenly in the first week. Sanford and Greene JW3 suggested increased concern with infection in the newborn thus lessening interest in recent years in dehydration fever. Appleton and Foo [10] described the phenomenon of dehydration fever in large breast fed babies on day 3-4 of life. Singh et al. [11] discussed the possible pathogenesis of this phenomenon, suggesting that fever may be caused by environmental temperature rather than dehydration [12]. While

MC Kay and Smith [13] referred it to rise in temperature to 100-104°F on the second or third day. Whereas a clinical Study by Yadav [14] found that dehydration fever was second commonest cause of neonatal fever after sepsis.

Breastfeeding is universally considered to be the best and the safest way to feed neonates. Most of the babies lose atleast 10% of body weight in the early days after birth. A steady state increase in weight gain is observed provided the neonate is fed with adequate breast milk. A very small number of breast-fed neonates do not establish an adequate milk intake, continue to lose weight and may develop hypernatremic dehydration [15,16]. Azotemia occurs in these patients as a consequence of impaired renal blood flow or decreased perfusion resulting from decreased blood volume. The association of hypernatremia with significant hyperbilirubinemia, might enhance the risk of bilirubin encephalopathy [17].

As the literature regarding the association between dehydration, dyselectrolytemia, hyperthermia and azotemia is less, a study on this subject would help in early detection, prevention and better management.

Objectives

To study the clinical, biochemical profile and outcome of neonates who presented with dehydration and hyperthermia to a tertiary care centre.

Materials and Methods

After obtaining institute ethical committee clearance, with level IV evidence, a descriptive study was performed from 2016 to 2018 in the department of Paediatrics, NICU of BCH and RI, CGH and WCH attached to JJM Medical College, Davangere, Karnataka, India. The cases for this study were recruited by convenient sampling technique. All 241 neonates admitted with dehydration and hyperthermia during the study period of 18 months will be enrolled for the study. A pre structured proforma were used to record the relevant information from individual case selected for the study. All cases were taken into consideration for statistical analysis (IBM SPSS Statistics for Windows, Version 20.0, IBM Corp, Chicago, IL).

The neonates with signs and symptoms of dehydration such as decrease urine output, irritability, poor feeding, lethargy and hyperthermia, neonates born to gestational age of >34 weeks and neonates with birth weight of >1.8 kg were included in the study. The neonates with infection, shock, on IV fluids, CNS infections and congenital anomalies, gestational age of <34 weeks, birth weight of <1.8 kg, neonates of retarded intrauterine growth, twin neonates and neonates born to infants of diabetic mother were excluded from the study (Figure 1 and 2).

Figure 1: 14 days old neonate brought with complaints of refusal of feeds and decreased voiding of urine.

Figure 2: The neonate four days after treatment.

Results

A total of 241 cases were enrolled in the study and the treatments were instituted as per our study protocol. The descriptive statistics were reported as mean (SD) for continuous variables, frequencies (percentage) for categorical variables. Data were statistically evaluated with IBM SPSS Statistics for Windows, Version 20.0, IBM Corp, Chicago, IL. The association between categorical data were analysed by using chi square test and p value <0.05 were considered statistically significant.

In our study, males (n=126, 52.3%) outnumbered females (n=115, 47.4%). A total of 169 cases (70.1%) of the study subjects were outborn patients and 72 cases (29.9%) were inborn. Among the study subjects (n=241), the majority cases belong to greater than 5 days (47.3%) followed by 4 (19.1%), 3 (15.4%), 5 (17%) and 2 days (1.2%) (Figure 3).

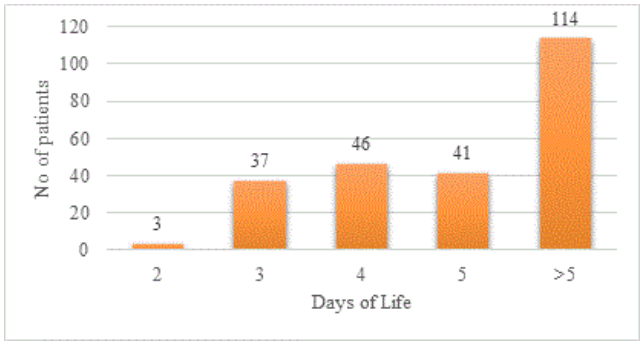

Figure 3: Distribution of patients according to days of presentation.

In our study, the percentage of primigravida was more (n=160, 66.4%) compared to multigravida (n=81, 33.6%) in the present study. A total of 161 (66.8%) patients were born out of lower segment caesarean section and 80 (33.2%) patients were born out of normal vaginal delivery. Out of 241 cases, 61.8% of the study subjects (n=149) had temperature <37.5°C and around 27.8% of the subjects (n=67) had 38.5-39.5°C (Figure 4).

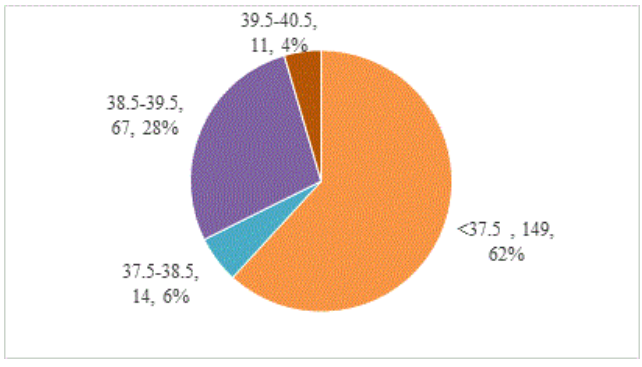

Figure 4: Distribution of patients based on temperature.

Among the study subjects, 17.8% had mean temperature of 35.63+2.97 in the month of April, followed by 13.7% (35.1+3.04). The highest temperature noted in our study was in the month of November (36.12+3.10) by 7.1%, followed by December (35.21+2.95) by 4.6% of the study subjects.

Around 38.2% (n=92) of the study subjects had sodium in the range of 151-160 mEq/L, followed by 26.1% (n=63) in ≤150 mEq/L (Figure 5).

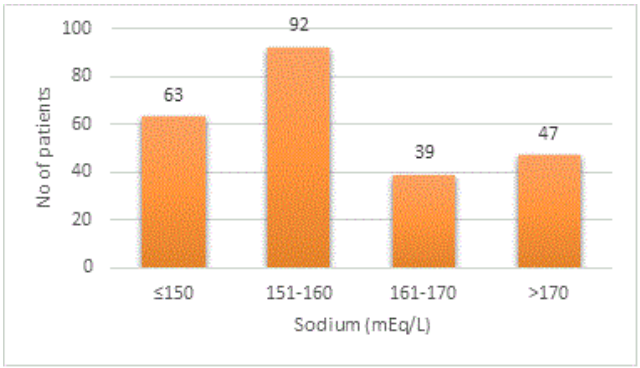

Figure 5: Distribution of patients according to serum sodium level.

The mean birth weight in the present study was 3+0.31 kg and the mean weight at presentation was 2.64+0.37 kg. The percentage of weight loss was 11.9. The most common symptom found were decreased voiding of urine (n=97, 27.71%), followed by fever (n=92, 26.29%), refusal to feed (n=85, 24.29%), jaundice (n=68, 19.43%) and convulsions (n=8, 2.29%). The most common biochemical derangement observed were azotaemia in 146 patients (69.52%), followed by hypernatremia in 118 patients (56.19%) and hyperbilirubinemia in 65 patients (30.95%) (Figure 6).

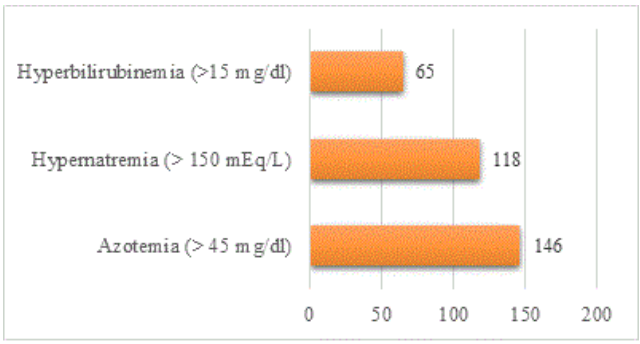

Figure 6: Biochemical derangements in dehydration fever.

In our study, there was a significant statistical difference between the association of fever during the first few days of life and dehydration, dyselectrolytemia, hyperthermia, azotemia and weight loss (p<0.05).

Discussion

Breastfeeding has more advantages on health to both infant and mother. Adequate breast milk intake depends on several inter-dependent processes namely mammogenesis, lactogenesis and galactopoiesis and effective milk delivery to the infant which depends on effective maternal breastfeeding techniques, combined with an

intact milk-ejection reflex. The volume of human milk consumed daily by a neonate depends on the frequency and duration of feeds and the pattern of breast use [9,18,19].

Due to the low availability of sodium in the human breast milk, the possible development of hypernatremia in breastfed neonates is inevitable [20]. Various studies showed a mean sodium concentration of 64.8 ± 4.4 mmol/L after delivery, dropping to 21.4 ± 2.3 mmol/L by the third postpartum day (colostrum), and levelling off at a value of 7.0 ± 2.0 mmol/L by week two in mature milk [21]. Compared with cow's milk, mature human milk contains considerably less sodium, potassium, and chloride [22].

The lactation failure and reduction in feeding frequency are associated with the higher concentrations of sodium in breast milk [23]. It has been shown that insufficient breast milk production is the most important factor in the induction of neonatal hypernatremic dehydatrion which is a potentially lethal condition through induction of cerebral edema, intracranial haemorrhage, seizures, disseminated intravascular coagulation and finally death [24-27].

In the present study, total of 241 neonates were admitted to the study site in which majority of them were males (n=126, 52.3%) and females were (n=115, 47.4%). The majority of the cases belong to greater than 5 days (47.3%) of age, followed by 4 (19.1%), 3 (15.4%), 5 (17%) and 2 days (1.2%). So, the age of presentation in dehydration fever was 2nd day onwards. The maximum numbers of neonate admitted were on 5th day or greater than 5th day of postnatal life. Criag et al. reported that dehydration fever developed at any time in the first fortnight whereas Livingstone et al. [9] and Laing [28] et al. found that the age of presentation from 3 to 14 day and around 10 days respectively. Our study findings also were in correlation with the reported studies. This difference in presentation may be attributed to the different study settings.

In the present study, a total of 169 cases (70.1%) of the study subjects were outborn patients and 72 cases (29.9%) were inborn. Majority of the neonates were delivered through LSCS (66.8%) and 33.2% were normal vaginal delivery. Maayan-Metzgera et al. [29] and Yaseen et al. [27] have reported that dehydration fever was associated with Caesarean section. Caesarean section appears to be an important risk factor for dehydration as it is related to failure of effective lactation and was also found to delay initiation of breast feeding. Significant delay of first breast feeding after caesarean section deliveries was also reported in studies of Newman and Manganaro [30] which may be attributed to postoperative painful conditions and post-anaesthesia state. It has also been found that volume of breast milk transferred to the infant was less than that transferred to the infant born by normal vaginal delivery over the first 6 days of life according to Donald et al. [26] and Evans et al. [31]. Studies by Oddies [32] and Dewey [33] showed that by day 6, only 20% of infants in the caesarean group regained their birth weight compared with 40% in the normal vaginal group.

The percentage of primigravida was more (n=160, 66.4%) compared to multigravida (n=81, 33.6%) in the present study. Therefore, it is suggested that primigravida mothers should receive more reassurance and practical advice in the technique of breast feeding and should be trained about how to correctly position the baby appropriately attach it to the breast and observe that suckling is successful.

In the present study, 61.8% of the neonates had temperature of <37.5°C and around 27.8% of neonates had 38.5-39.5°C. Almost similar findings were reported in the study conducted by Appleton et al. [10] in which the temperature range in dehydration fever was 37.8°C to 40.0°C. Zacharissen et al. [34] reported the admission temperature was 37.6°C to 39.7°C in 64% of cases.

It has been reported that environmental factors could also be a factor in the formation of dehydration because of increased insensible water loss. In the present study, majority of the cases (43) were admitted in the month of April and recorded mean temperature of 35.63+2.97. This is because of tropical country like India, during summer months the environment will be very hot and there are more chances of dehydration in the neonates.

In our study, the mean birth weight was 3 ± 0.31 kg and the mean weight at presentation was 2.64 ± 0.37 kg. The percentage of weight loss was 11.9%. Approximately similar weight loss was found in studies conducted by Boskabadi et al. [35] i.e. 16.2 ± 5.95% and Jain et al. [36] i.e 15.74 ± 5%. In Appleton et al. [10] and Zachariassen et al. [34] studies, the percentage weight loss was approximately 10% and 8% of their birth weight respectively. Similarly, Yaseen et al. [27] and Tiker et al. [37] found that percentage weight loss was 12% and 8% of their birth weight respectively.

In the present study, the most common symptom found was decreased voiding of urine (27.71%), followed by fever (26.29%), refusal to feed (24.29%), jaundice (19.43%) and convulsions (2.29%). Similar kind of findings was also observed in the studies conducted by Craig et al. [1], Meharban Singh [38] and Bhat et al. [39], Boskabadi et al. [35] reported that convulsions was found in 22.6% of cases. The convulsion in dehydration fever may be due to hypernatremia leading to cerebral edema, intracranial haemorrhage and disseminated intravascular coagulation.

In our study, 38.2% of the study subjects had sodium in the range of 151–160 mEq/L, followed by 26.1% (<150 mg/dl). The most common biochemical derangement observed was Azotaemia (69.52%), followed by hypernatremia (56.19) and hyperbilirubinemia (30.95%). In the study conducted by Bhat et al. [39], hypernatremia and hyperbilirubinemia was found in 31.8% and 28% of cases respectively. Caqlar et al. [40] also observed hypernatremia in 33.3% of cases. Neonatal hypernatremia dehydration results from inadequate transfer of breast milk from mother to infant. Furthermore, poor milk discharge from the breast results in persistence of high milk sodium concentrations. The occurrence of hyperbilirubinemia in dehydration fever is due to dehydration itself which increases enterohepatic circulation of bilirubin. In our study, azotaemia was a predominant bio-chemical derangement observed in 65.4% of cases. Azotaemia was possibly pre renal in origin, as in all cases it recovered to normal after rehydration.

Conclusion

The dehydration fever is an important cause of neonatal fever in tropical countries like India especially during summer months. Our study provides support for the hypothesis that one of the main cause of fever during the first days of life is from dehydration resulting from difficulties at the initiation of breast feeding. We believe there is a need for early intervention to educate and instruct primi mothers about breast feeding, particularly those who have given birth by caesarean section. Hypernatremic dehydration can be prevented by education of mothers regarding breastfeeding techniques, beginning in the antenatal period. Those with identifiable problems should be referred promptly for lactation management and supportive counselling. Also, close follow-up of infants should be done within the first week after

hospital discharge for checking weight gain and adequate hydration. This will help in prevention of Hypernatremic dehydration.

References

1. Craig WS (1963) The early detection of pyrexia in the newborn. Arch Dis Child 38: 29-39.
2. Voora S, Srinivasan G, Lililen LB, Yeh TF, Pildes RS (1982) Fever in full term newborn in the first four days of life. Pediatrics 69: 40-44.
3. Greene JW, Hara C, O'Connor S, Altemeier WA (1981) Management of febrile outpatient neonates. Clin Pediatr (Phila) 20: 375-380.
4. Voora S, Kovar MG, Serdula MK, Mark JS (1984) Review of epidemiologic evidence for an association between infant feeding and infant health. Pediatrics 74: S615-S638.
5. Cooper WO, Atherton HD, Kahana M, Kotagal UR (1995). Increased incidence of severe breastfeeding malnutrition and hypernatremia in metropolitan area. Pedaitrics 96: 957-960.
6. Dagan R, Powell KR, Hall CB, Menegus MA (1985) Identification of infants unlikely to have serious bacterial infection although hospitalised for suspected sepsis. J Pediatr 107: 855-860.
7. Dagan R, Sofer S, Philip M, Shachak E (1988) Ambulatory care of febrile infants younger than 2 months of age classified as being at low risk for having serious bacterial infection. J Pediatr 112: 355-360.
8. Bakwin MD, Von r, Taeusch WH, Ballard RA, Gleason AC, et al. (1954) Avery's disease of the newborn, Elsevier Health Sciences 369-370.
9. Livingstone VH, Willis CE, Abdul-Wareth LO, Thiassen P, Lockwith G (2000) Neonatal hypernatremic dehydration associated with breast-feeding malnutrition. CMAJ 162: 647-655.
10. Appleton RE, Foo CK (1989) Dehydration fever in the neonate--a common phenomenon. Arch Dis Child 64: 765-766.
11. Singh M, Chaudhary VP, Vasuki K (1975) Pathogenesis of so-called "dehydration fever" in newborn. Indain Pediatr 12: 465-467.
12. Bakwin H, Catherine MD, Goes AB (1922) Dehydration fever in newborns II. AMJ Dis Child 24: 508-519.
13. Jaskiewicz JA, McCarthy CA, Richardson AC, White KC, Fisher DJ, et al. (1994) Febrile infant at low risk for serious bacterial infection:an appraisal or the Rochester criteria and implications for management. Febrile infant collaborative study group. Pediatrics 94: 390-396.
14. Yadav M (2012) Clinical study of fever in neonates with special emphasis on dehydration fever. RUHS Rajasthan.
15. Hanoudi BM (2012) Factors contributing to dehydration fever in a neonate, A teaching hospital study. Iraqi J Comm Med 25: 248-252.
16. Boskabadi H, Maamouri G, Ebrahimi M, Ghayour-Mobarhan M, Esmaeily H, et al. (2010) Neonatal hypernatremia and dehydration in infants receiving inadequate breastfeeding. Asia Pac J Clin Nutr 19: 301-307.
17. Ng PC, Chan HB, Fok TF, Lee CH, Chan KM, et al. (1999) Early onset of hypernatremic dehydration and fever in exclusively breast fed infant. Department of Paediatrics, Prince of Whale's hospital, Chinese university of Hong Kong, J Pediatric Child Health 35: 585-587.
18. Olguner M, Hakguder G, Ates O, Caglar M, Ozer E, et al. (2006) Urinary trypsin inhibitor present in fetal urine prevents intraamniotic meconium-induced intestinal damage in gas- troschisis. J Pediatr Surg 41: 1407-1412.
19. Bhat SR, Lewis P, David A, Liza SM (2006) Dehydration and hypernatremia in breast-fed term healthy neonates. Indian J Pediatar 73: 39-41.
20. Peters JM (1989) Hypernatremia in breast-fed infants due to elevated breast milk sodium. J Am Osteopath Assoc 89: 1165-1170.
21. Heldrich FJ, Shaw SS (1990) Case report and review of literature: hypernatremia in breast-fed infants. Md Med J 39: 475-478.
22. Flynn A (1992) Minerals and trace elements in milk. Adv Food Nutr Res 36: 209-252.
23. Humenick SS, Hill PD, Thompson J, Hart AM (1998) Breast milk sodium as a predictor of breast-feeding patterns. Can J Nurs Res 30: 67-81.
24. Laing IA, Wong CM (2002) Hypernatraemia in the first few days: is the incidence rising? Arch Dis Child Fetal Neonatal Ed 87: F158-F162.
25. Iyer NP, Srinivasan R, Evans K, Ward L, Cheung WY, et al. (2008) Impact of an early weighing policy on neonatal hypernatremic dehydration and breast feeding. Arch Dis Child 93: 297-299.
26. Mac Donald P, Ross S, Grant L, Young D (2003) Neonatal weight loss in breast and formula fed infants. Arch Dis Child Fetal Neonatal 88: F472-F476.
27. Yaseen H, Salem M, Darwich M (2004) Clinical presentation of hypernatremic dehydration in exclusively breast fed neonates. Indian J Pediatr 71; 1059-1062.
28. Laing IA, Escobar GJ, Gonzales VM, Armstrong MA, Folck BF, et al. (2002) Rehospitalisation for neonatal dehydration: a nested case-control study. Arch Pediatr Adolesc Med 156: 155-161.
29. Metzger AM, Magkerth R, Keint J (2003) Fever in healthy asymptomatic newborns during the first days of life. Arch Dis Child Fetal Neonatal Ed 88: F312-F314.
30. Mangaroo R, Mami C, Marrone T, Marseglia L, Gemelli M (2001) Incidence of dehydration and hypernatremia in exclusively breast-fed infants. J Pediatr 139: 673-635.
31. Evans KC, Evans RG, Royal R, Esterman AJ, James SL (2003) Effects of caesarean section on breast milk transfer to the normal term over the first week of life. Arch Dis Child Fetal Neonatal 88: F380-F382.
32. Oddie S, Richmond S, Coulthard M (2001) Hypernatremic dehydration and breast-feeding: a population study. Arch Dis Child 85: 318-320.
33. Dewey KG, Nommsen-Rives LA, Heining MJ, Cohen RJ (2003) Risk factors for suboptimal infant breast behaviour, delayed onset of lactation and excess weight loss. Pediatrics 112: 607-619.
34. Zachariassen G, Juvonen P (2002) Neonatal dehydration (dehydration fever) in newborn infants. Ugeskr Laeger 164: 4930-4934.
35. Boskabadi H, Maamouri G, Ebrahimi M (2010) eonatal dehydration and hyperthermia in infants receiving inadequate breastfeeding. Asia Pac J Clin Nutr 3: 301-307.
36. Jain S, Basu S (2010) Hypernatremic dehydration in term and near term neonates. Indian J Pediatr. 77: 461.
37. Tiker F, Gurakan B, Kilicdag H, Taracan A (2004) Dehydration the main cause of fever during first week of life. Arch Dis Child Fetal Neonatal 89: F373-F374.
38. Singh M (2004) Care of the newborn (6thedn), Sagar Publication, India.
39. Bhat SR, Lewis P, David A, Liza SM (2006) Dehydration and hypernatremia in breast-fed term healthy neonates. Indian J Pediatar. 73: 39-41.
40. Caqlar MK, Ozer I, Altugan FS (2006) Risk factors for excess weight loss and hypernatremia in exclusively breast fed infants. Braz J Med Biol Research 39: 539-544.