Effect of Infant Massage Oil on Jundiced Neonate Undergoing Phototherapy

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Abstract

Infant massage is a natural way for caregivers to improve health, sleep patterns, and reduce colic. Massage therapy is one of the oldest touch therapies, and it has been used for many conditions. We have systematically reviewed article on infant massage oil aimed to evaluate its effects on neonates with jaundice who are receiving phototherapy. Study design was randomized controlled trial which was conducted on 80 full term neonates with physiological jaundice in the hospital, sample were randomized into two groups (control and study group). Massage was given twice a day, the study group showed significantly higher defecation frequency ($p = 0.03$) and significantly lower bilirubin levels ($p = 0.008$) compared with the control group. No significant differences related to feeding amount or body weight were observed between the two groups. Neonatal massage could help to reduce bilirubin levels and increase defecation frequency in neonates receiving phototherapy for jaundice. Massage with oil is an inexpensive, simple, and effective intervention which improved neonatal health status in selected samples. Further studies are needed to evaluate the serious adverse effects, if any, to notify health care staff.

Key words: Neonatal massage, Jaundice, Phototherapy, Sweet almond oil

Introduction

Infant massage, in which babies are massaged soon after birth, is a tradition that is common in some countries. Massage therapy is one of the oldest touch therapies, and it has been used for many conditions. We have systematically reviewed articles on infant massage to evaluate its effects on neonates undergoing phototherapy, and also on mother-infant relationship**(Church et al; 2016 & Michael et al; 2015)**. Infant massage has been known to benefit mothers and infants, regarding several health variables such as depression, parenting stress, weight gain for the infant, hormones and anxiety as well as functionality of the immunity system. Several studies have reported that infant massage can improve weight gain, sleep patterns, growth and development, and autonomic nervous system functions, and that it can also reduce the rates of colic and infant mortality. In addition, massage therapy can help reduce infant stress and can promote positive emotional bonding between parents and babies **(Chien et al;2015)**.

Infant massage could help to reduce bilirubin levels and increase defecation frequency in neonates receiving phototherapy for jaundice. massage therapy can help reduce infant stress and can promote positive emotional bonding between parents and babies. Jaundice refers to the yellow staining of the skin and sclera caused by an increase in serum bilirubin levels. Excessive hyperbilirubinemia can lead to permanent brain damage. Jaundice affects as many as 60 % of healthy neonates and is responsible for 75 % of hospitalizations within the first week after

birth **(Gandhi, N. 2017).** In general, healthy full-term infants were discharged at 3 days of age. If neonatal jaundice was found and phototherapy was available in the nursery, they received phototherapy there. However, if phototherapy was not available in the nursery, infants with jaundice were discharged and transferred to another hospital for further care. Massage techniques were performed in accordance with International Association of Infant Massage (IAIM) guidelines. The researcher thoroughly washed his or her hands, applied massage oil (sweet almond oil, AEOMA, England), and then performed a skin test before starting the first massage therapy procedure **(Lynn, M. 2017).**

Jaundice comes from the French word jaune, which means yellow. Neonates are at higher risk because of an immature blood-brain barrier, and the susceptibility of the brain cells to damage by bilirubin. Various treatment modalities have been used to treat neonatal hyper-bilirubinemia but phototherapy and exchange transfusion remain the mainstay of treatment of neonatal jaundice **(Arora etal; 2015).**

Infant massage could potentially benefit both physiological and psychological health. The sense of touch is one of the first senses to develop, and parent-infant touch provides numerous benefits including regulation of heartbeat and temperature for babies as well as protection against infections. It also promotes parent-infant bonding and early social development **(Vnankani, 2016 &Vincent, 2011).**

Mechanisms of the massage therapy affecting weight gain are not yet known. Various possibilities have been proposed to explain the positive effects of massage on weight gain in preterm and full term infants including hormone growth, vagal tone and gastric motility, in addition to improved circulation of blood and lymph fluids; however, it has been suggested that further research is needed to confirm these mechanisms. Moreover, oils have long been used for massage therapy. *i.e*., topical oil application is recommended for improving skin barrier function **(Church et al; 2016 & Kaplan et al; 2011).** overall condition of the skin, providing moisture, antimicrobial activity, and reducing skin injury.

Accordingly, it is important to select a proper kind of oil in massage. **(Roy, C. 2017)** showed that infants massaged with sesame oil achieved better somatic growth and improvement of blood flow than infants messaged with other oils. For this reason, they introduced sesame oil as the best oil for infant massage. While other researchers have observed benefits for the use of sunflower oil in massage, such as fewer nosocomial infections and erythema plus improved skin hydration. Sunflower oil contains high levels of essential fatty acids, particularly linoleic acid which then provides positive effect on life-quality parameters. Traditionally, infant massage using various oils has proved effective in the first months of infancy**(Mandana, 2015).**

The significance of this systematic article lies in the important role of massage therapy in human health, as it highlights a crucial yet often underestimated effect in psychological and biosomatical variable. This study aims to determine the effect of massage with oils on the growth of full-term infants, which is given by their caregivers.

Aim of the study :-

Evaluate the effect of infant massage oil on jaundiced neonates undergoing phototherapy.

Research hypothesis :-

Neonatal infant with jaundice who are receiving phototherapy exposed to massage oil will increase defecation frequency and decrease bilirubin levels.

Subjects and Methods

The study was conducted according to the following designs :-

1- Technical design

2- Operational design

3- Administrative design

4- Statistical design

1- Technical design

The technical design includes the research design, setting, sample and tools of data collection.

Research design

Experimental study design was used.

Setting

This study was carried out at the neonatal intensive care units (NICU) of the governmental and health insurance hospital and university hospital in Ismailia city.

Sample:

A sample of convenience was used in this study. 80 Full-term neonates with physiological jaundice, admitted for phototherapy at hospital, were randomly allocated to either a 40 control group or a 40 study group.

Data collection:

Data collection took a period of 4 months from January to April 2016. All participants in this study were normal neonates (from birth to 5 days of age) who were receiving phototherapy for jaundice (high bilirubin level). The medical information for each neonate, including total feeding amount, body weight, defecation frequency, and bilirubin level, was collected and compared between two groups. The inclusion criteria for study participation were as follows: (1) healthy full-term (gestational age, 37–41weeks), normal neonates (from birth to 5 days of age), (2) birth weight of 2500–3600 g, (3) APGAR score at birth of 8–10, and (4) receiving phototherapy for hyperbilirubinemia. The institutional review board of our hospital approved the study, and informed consent was obtained from the parents of the neonates.

Tool of data collection:

The tool were developed by the researcher to identify effect of massage with oil on neonates, it included two parts.

Part 1:-

Structured interviewing questionnaire sheet were included all the information about children (age, gender, gestational age, and clinical data…..). Bilirubin was measured using a microassay, This test required only minimal blood samples to be taken from the neonate's foot.

Part 2 :-

Massage procedure:-

All participating neonates in the study group received massage therapy from trained therapists. Neonates in the control group did not receive massage therapy.

Each massage therapy session started on the first day of live, lasted for 15–20 min per session, and was conducted twice daily (between meals) for 3 days. Phototherapy was stopped during neonates received massage therapy.

Massage techniques were performed in accordance with International Association of Infant Massage (IAIM) guidelines, washed hands, applied massage oil (sweet almond oil), and then performed a skin test before starting the first massage therapy procedure. For the skin test, we applied sweet almond oil to the inside of baby's wrist, and after 30 min, we checked the skin for redness, a rash, or other signs of allergic reaction. None of the neonates in the massage group had an allergic reaction or experienced side effects from the sweet almond oil. After the test, we started the massage on the leg and foot (with one hand used to fix the foot), before progressing to the abdomen, hands, and finally, the back, provided massage therapy to all study group, and the room temperature was maintained at between 26 °C and 28 °C.

2-**Operational design**

The operational design includes preparatory phase, content validity and reliability and ethical consideration.

Preparatory phase :

The researcher was review local and international related literature to be aware of various aspects of the research problem. Tools of data collection was developed.

Content of validity and reliability:

The revision of tools was done by three expertise's in pediatric nursing to measure the validity of the tools and the necessary modification was done. The reliability of the developed tools was estimated using the Chronbach's Alpha test.

Ethical consideration :

Aim, nature and expected outcomes of the study was explained for the study sample' parents before their inclusion in order to obtain their acceptance. The study sample' parents was informed that all gathered data was used for research purpose only. Confidentiality was secured, their participation was voluntary and they were allowed to withdraw at any time of the study.

3- Administrative design

An official permission was obtained from hospitals' administrators.

4- Statistical design

Data were analyzed using IBM SPSS for Windows, Version 19.0 (IBM Corp., Armonk, NY, USA), *t*-tests were used to investigate differences between the study and control group neonates with regard to feeding amount, body weight, defecation frequency, and microbilirubin levels. A chi-square test was used to compare the demographic characteristics of neonates in the study and control groups. Results were considered significant at a p value of <0.05 and are presented as mean ± standard deviation.

Results :

Table 1 Distribution of the studied sample according to their sociodemographic characteristics (No=80)

Item	Study group ($n = 40$)		Control group ($n = 40$)		P value
	No	%	No	%	
Sex :-					
-Male	17	40.7	22	55.2	0.29
Female -	23	59.3	18	44.8	
Feeding :-					
-Breast	7	18.5	6	17.2	0.78
-Formula	4	11.I	6	13.8	
-Mixed	29	70.4	28	69.0	
Mode of delivery for mothers:-					
Vaginal-					0.52
Cesarean-section-	37	92.6	39	96.6	
	3	7.4	1	3.4	
	means ± S.D				
Gestational age(week)	38.7±0.7		38.1±0.8		0.35
Age (hours)	118 ± 57		109 ± 42		0.42

Table 1 shows the socio-demographic characteristics of participating neonates. We observed no significant differences between the two groups in terms of type of feeding, type of delivery, gestational age at birth.

Table 2 illustrates the current physical assessment and blood investigation of the studied neonates. It is clear from the table that no significant differences in body weight at birth, body weight on the date of admission, but found that significant differences between two groups in microbilirubin level in three day of hospitalization and hospital stay.

Table 2: Distribution of the studied sample according to their current blood investigation and physical assessment (N=80)

Item	Study group ($n=40$)		Control group ($n=40$)		P value
	No	%	No	%	
Hematoma -Yes -No	6 34	14.8 85	3 37	6.9 27	0.36
	means ± S.D				
Body height (cm)	50.9 ± 1.7		50.9 ± 1.9		0.92
Body weight at birth (gm)	3069.3 ± 233.3		3174.5 ± 340.6		0.18
Body weight at admission (gm)	2118.9 ± 271.8		3228.2 ± 308.0		0.14
D1 microbilirubin level	16.6 ± 1.4		17.1 ± 1.5		0.22
D2 microbilirubin level	14.1±1.2		14.5 ± 1.7		0.37
D3 microbilirubin level	11.0 ± 1.1		11.8 ± 2.0		0.08
Hospital stay (hours)	78.5 ± 14.0		87.8 ± 24.0		0.07

D1: first day of hospitalization, D2: second day of hospitalization, D3: third day of hospitalization.

Table 3 Comparison between study and control group of neonate and their mothers as regarding clinical status pre massage application (N=80)

Item	Study group ($n=40$)	Control group ($n=40$)	P value
	means ± S.D		
Apgar score	9.0 ±0.1	9.0 ±0.1	0.77
Mothers -total number of deliveries -blood loss at delivery	 1.5 ±0.7 307.6 ±147.8	 1.6 ±0.8 390.8 ±213.5	 0.77 0.08

Table 3 represent Clinical status of neonates and their mother's condition. It is shown from the table that no significant differences between the two groups in terms of apgar score and total number of deliveries and blood loss at delivery.

Table 4 Comparison between study and control group of neonate as regarding feeding intake during massage application (N=80)

Item	Study group ($n=40$)	Control group ($n=40$)	t value	P value
	means ± S.D			
D1 feeding amount (ml)	330.7 ± 111.0	330.4 ± 104.3	0.11	0.98
D2 feeding amount (ml)	504.1 ± 79.8	499.0 ± 99.1	0.22	0.84
D3 feeding amount (ml)	558.1 ± 74.3	555.9 ± 85.7	0.2	0.93

D1: first day of hospitalization, D2: second day of hospitalization, D3: third day of hospitalization

Table 5 Comparison between study and control group of neonate and as regarding body weight during massage application (N=80)

Item	Study group ($n = 40$)	Control group ($n = 40$)	t value	P value
	means ± S.D			
D1 body weight (gm)	2,888.8 ± 271.8	3,009.2 ± 309.0	-1.53	0.12
D2 body weight (gm)	2,968.1 ± 262.8	3,099.3 ± 324.0	-1.65	0.11
D3 body weight (gm)	3,031.8 ± 263.6	3,164.8 ± 343.1	-1.61	0.12

D1: first day of hospitalization, D2: second day of hospitalization, D3: third day of hospitalization

For all participating neonates, food intake increased through hospitalization. In both groups, food intake was significantly higher on the second and third days of hospitalization than on the first day ($p < 0.001$). However, no significant difference was observed between the groups during hospitalization(Table 4).

The body weights of all neonates increased through hospitalization, with the body weight being significantly higher on the third than on the first day of hospitalization ($p = 0.03$). However, there was no significant difference between the groups (Table 5).

Table 6 Comparison between study and control group of neonate as regarding defecation frequency during massage application (N=80)

Item	Study group ($n = 40$)	Control group ($n = 40$)	t value	P value
	means ± S.D			
D1 defecation frequency (times)	3.2 ± 1.6	3.0 ± 2.0	0.1	0.99
D2 defecation frequency (times)	5.0 ± 1.5	4.3 ± 1.5	1.71	0.92
D3 defecation frequency (times)	4.7 ± 1.4	3.8 ± 1.2	2.06	0.03*

-D1: first day of hospitalization, D2: second day of hospitalization, D3: third day of hospitalization - * Significantly differnceses, $P < 0.05$

Table 6 revealed the defecation frequencies for the study and control groups. The defecation frequency significantly increased for all neonates during hospitalization ($p < 0.001$). Although the defecation frequency was not significantly different between the control and study groups on the first and second days of hospitalization, it was significantly higher in the study group on the third day ($p = 0.04$).

The microbilirubin level was significantly decreased for all participating neonates during hospitalization ($p < 0.001$). Because intravenous infusions can increase the excretion of bilirubin and thereby decrease serum bilirubin levels, we excluded neonates who received intravenous infusions when comparing microbilirubin levels between the study and control groups. We found no significant differences in the microbilirubin levels between the control and study groups during the first and second days of hospitalization. However, on the third day of hospitalization, the microbilirubin level was significantly lower in the study group than in the control group ($p = 0.02$; Table 7).

Table 7 Comparison between study and control group of neonate as regarding Microbilirubine level during massage application (N=80)

Item	Study group ($n = 40$)	Control group ($n = 40$)	t value	P value
	means ± S.D			
D1 microbilirubine level (mg/dL)	15.7 ± 0.9	15.9 ± 1.0	-1.34	0.17
D2 microbilirubine level (mg/dL)	14.9 ± 1.3	14.5 ± 0.9	-1.35	0.18
D3 microbilirubine level (mg/dL)	10.8 ± 0.9	12.2 ± 1.9	-2.5	0.02*

-D1: first day of hospitalization, D2: second day of hospitalization, D3: third day of hospitalization - * Significantly differnceses, $P < 0.05$

Table 8 Comparison between study and control group of neonate as regarding serum bilirubin level in 3 days during massage application (N=80

Item	Study group ($n = 40$)	Control group ($n = 40$)	t value	P value
	means ± S.D			
Total bilirubin (mg/dl)	13.9±1.7	12.7±2.9	2.84	0.008
Unbound bilirubin (ug/dl)	0.4±0.2	0.5±0.2	0.30	0.78

Table 8 describe the total and unbound bilirubin level between the two groups. It is reveled from this table that highly significant differences in the microbilirubin levels between the control and study groups.(p=0.008).

Discussion

Although a number of massage therapy studies on neonates infant have been conducted, there are limited studies assessing the effects of massage therapy on term infants in Egypt. The rationale of this study was that the massage therapy might be one of the effective methods on promoting an infant's growth. Massage therapy has led to weight gain in infants, increase in bone density and decrease level of bilirubin **(Church et al; 2016 & Field et al; 2011)**. Nonetheless, the massage is an easy and cost-effective practice which can be included as a part of the overall package of early infant intervention in infants 'care thereby enhancing the growth. Moreover,

All things considered, if caregivers and health professionals conducting deliveries use inexpensive and readily available oil massage, it can be beneficial to the neueonates and this practice could have substantial public-health benefits.

Infant massage is a way of comforting skin inputs and nourishment for the healthy development of mind, body and spirit. It was shown that the role of massage therapy with oil was effective **(Seyyedrasooli et al; 2014).** Topical oil massage is routinely practiced in many countries, Application of a barrier such as oil prevents insensible water loss from the skin. Plus, the use of synthetic oil increases vagal activity, which may indirectly contributed to weight gain **(Lynn, 2017).**

However, **Serrano et al; (2010)** reported that oil massaged infants weighed significantly more than control infants after 2 months and 14 weeks of massage therapy. This study indicates that body weight was not significantly different between the study and control groups. This result is consistent with **(Abd Elataief, 2016). Smith et al; (2013)** also failed to identify significant differences in weight gain between neonates who received massage therapy and control group neonates after 4 weeks of treatment. In our study, the lack of a significant increase in body weight gain after massage may have been because of the young age of our neonates participants. In addition, it is possible that the duration of massage therapy was too short . In contrast, **Arora *et al; (2015)*** reported a non-significant effect of oil massage on height of preterm babies in an oil massage group.

Although, its supposed to the infant's skin absorbed the oil through oil massage and significant absorption of fat; since it is thinner and more vascular . This may also result in greater caloric intake and consequently a better weight gain. Also, **Gandhi, (2017)** compared the effects of massaging with oil with no massaging on term infants, and found no statistically significant difference between the groups. In this study, no relationship was found between infant weight (height) gain and gender likewise. Although the present study indicated that massage application with oil had a potential to promote infants' growth, the observed benefit was probably because of the tactile kinesthetic stimulation rather than the oil used.

The defecation frequency in the study group of this study was significantly higher than that in the control group on the third day of massage therapy. This results compatible with **Seyyedrasooli et al; (2014)** who found that the defecation frequency of infants who received massage therapy was significantly higher than that in the control group by the fourth day of therapy. Previous researches has indicated that most neonates first pass feces within 24 h of birth, although study therapy can stimulate the passage of meconium. This may explain the significantly higher defecation frequency that we observed in the study group by the third day of treatment. Massage therapy can increase bowel movements and the excretion of meconium.

In my study, the bilirubin level of the study group neonates was significantly lower than that of the control group on the third day of massage therapy. This result is consistent with the study by **Chen et al; (2015) and Moghadam et al; (2012)** who reported that in full-term neonates with jaundice, bilirubin levels were significantly decreased in the study group compared with the control group on the fourth day of therapy. In addition, indicated that the mean bilirubin level of infants with jaundice in the study group significantly decreased on the fourth day compared with the control group.

Infant massage had significantly lower depression scores than infant without

massage , and reported significantly more adaptive temperament. Nevertheless, neonates who received massage showed significantly fewer stress behaviors, and they exhibited more mature motor behaviors. infant massage is regarded as safe intervention for infant exposed to various medical conditions as tactile stimulation is vital to development of the central nervous system **(Yoshiro et al; 2012 & Puneet et al; 2011).**

Increased defecation might therefore explain the significant reduction in bilirubin levels observed in the study group. The most likely mechanism underlying the reduction in neonatal jaundice in the group receiving massage therapy is the stimulation of intestinal movement. This, in turn, will increase defecation frequency and allow the neonate to pass greater amounts of meconium, which contains bilirubin **(Chien et al; 2015)**. This is consistent with the findings of **Gandhi, (2017)** who noted that stool production and serum bilirubin levels were negatively correlated in healthy term infants during the first week of life.

Baby massage could reduce neonatal jaundice and control bilirubinemia to within the normal range. The significant reduction of neonatal jaundice in the study group can be explained by the study infant' higher frequency of stooling on the first and second day compared to control infants **(Jun et al; 2011).** This research result consisted with this study. Furthermore, increased stool frequency on day 1 and 2 may be the cause for the low values of serum total bilirubin.

Moreover, massage therapy also stimulates the vagus nerve, which will increase the frequency of bowel movements and diminish the enterohepatic circulation of bilirubin, thereby increasing bilirubin excretion. Furthermore, in subcutaneous tissue, physiological massage therapy can increase the flow of blood, lymph, and tissue fluids, which increases the collection and excretion of waste products such as bilirubin **(Mandana et al; 2015).** Infant massage facilitates caregivers-infant bonding and the development of warm, positive relationships, reduces

stress responses to painful procedures, reduces pain associated with constipation, reduces colic, helps induce sleep, and effects positive feelings on caregivers while they are massaging their infants **(Michael et al; 2015).**

Conclusion

Massage therapy is one of the oldest touch therapies. This study shows that by the third day of intervention, the defecation frequency of neonates receiving phototherapy for jaundice was significantly higher in those also receiving massage therapy, compared with the control group not receiving massage therapy. Furthermore, microbilirubin levels were significantly lower in the study group on the third day. However, the benefits of massage therapy remain uncertain for neonatal jaundice, and although this study adds to the evidence in its favor, further research is needed to clarify the true effects of such auxiliary treatments on the outcomes of neonatal jaundice.

Recommendation

This study recommended that the infant oil massage may contribute toward the prevention of neonatal jaundice and control bilirubin level to within normal ranges. Future research on infant massage and its effects on immune function in infants with various medical conditions.

References:-

Abd Elataief, S. M. (2016). The effect of massage therapy on weight and length of

staying premature infants at neonatal intensive care units in sohag city, Suez Canal University, Faculty of Nursing.

Arora, J., Kumar, A. & Ramji, S. (2015). Effect of Oil Massage on Growth and Neurobehavior in Very Low Birth Weight Preterm Neonates. *Indian Pediatrics*, 42, 1092-1100.

Church, P., Cavanagh, A. & Shah, V.(2016). Academic challenges for the preterm infant: Parent and educator perspectives. Pediatric health child journals, 2016 Jun-Jul; 21(5): 274–277.

Chien- Heng, L., Hsiu- Chuan, Y., Chien-Sheng, C. & Chin-En, Y. (2015): Italian Journal of Pediatrics, Nov 25.

Field, T., Diego, M. & Hernandez-Reif M. (2011): Preterm Infant Massage Therapy Research : A Review. *Infant Behavior and Development*, 33, 115-124.

Gandhi, N. (2017). Massage child oil, Mom Junction, November, 10.

Jun, C., Mieko, S., Mayumi,I., Naoto,S. & Mitsuko,S. (2011). Baby Massage Ameliorates Neonatal Jaundice in full term newborn infants. Tohoku J. EXP. Med, 223,97-102.

Lynn, M. (2017). The benfits of massage for children, Livestrong, Jul,18.

Mandana, M., Fatemeh, S., Ziba, D., Reza, B.& Masoumeh, D.(2015). Open Journal of Pediatrics, 2015, 5, 223-231.

Michael G., Eleftheria N., Georgios T. & George P.(2015): Psychology, 2015, 6, 2091-2097.

Moghadam, M., Moghadam, K., Kianmehr, M., Jomezadeh, A.& Davoudi, F. (2012). Effects of massage on weight gain and jaundice in term neonates with hyperbilirubinemia. J Isfahan Med.;30:1–8

Puneet A., Sindhu M., Deborah R.& Narendra, A. (2011). International Journal of Clinical Medicine, 2, 593-598.

Roy, C. (2017). Massage for children step by step, Mother for life, March, 6.

Serrano, M., Doren, F.& Wilson, L. (2010). Teaching mothers to massage their full-term infants: effects on maternal breast-feeding and infant weight gain at age 2 and 4 months. J Perinat Neonatal Nurs. 24:172–81. doi: 10.1097/JPN.0b013e3181db5377.

Seyyedrasooli, A., Valizadeh, L., Hosseini, M., Asgari, M. & Mohammadzad, M. (2014). Effect of massage on physiological jaundice in infants: a randomized controlled trial. J Caring Sci. 3:165–173. **Smith S, Lux, R., Haley, S., Slater, H., Beachy, J.& Moyer-Mileur, L. (2013)**. The effect of massage on heart rate variability in preterm infants. J Perinatol.;33:59–64. doi: 10.1038/jp.2012.47.

Vnankani, B. (2016). Best massage oil for your baby, Baby center, India Medical Advisor Board, August, 10.

Vincent, S. (2011). Skin-to-Skin Contact. Part Two: The Evidence. *The Practising Midwife*, 14, 44-4

Yoshiro, N.; Hiroshi, W.& Syun-ichiro, Y.(2012). Percentile analysis of plasma total bilirubin- How different will the rate of phototherapy for jaundice of neonates be by different standards?, Open Journal of Pediatrics, 2, 133-137.