# Effect of Phototherapy on Behavior of Jaundiced Neonates

Ebtisam Mohamed El Sayed, Thanaa  AliEl Awanyand NohaElsayed Shams Eldeen

Pediatric Nursing Department, Faculty of Nursing, Tanta University
ebtisamelsayed@yahoo.com

**Abstract**: Jaundice is one of the most frequent problems of the neonatal period.  Phototherapy is effective and widely used for treating this problem. It is a  noninvasive and  safe  therapy,  however it  has  short  term side effects especially on the  behavior  of  the newborn    **Aim:** This studyaimed todetermine the effect of phototherapy on the behavior of jaundiced neonates. **Materials and Method**: The study was conducted on sixty neonates, who were admitted to High risk neonatal unites atTanta University Hospital, El-Mebara and El-Minshawi Hospitals with jaundice. Their gestational age between 37 - 40 weeks . Total serum bilirubin level ranged from 12 - 18 mg/dl, birth weight 2.5-3.5 kg and treated with phototherapy. Data were collected by using socio demographic and clinical datastructured sheet that included; biosocial data of jaundiced neonates and their mothers , bilirubin level and duration of phototherapy and Neonatal behavioral assessment scale ; it developed by Brazelton and Nugent 1995 and modified to assess the neonates' behavior  responses before and after phototherapy related to their orientation, social interaction, ranging of state motor system, regulation of state, and reflexes. **Results**:   The main results revealed that nearly one third of studied neonates had low behavioral responses after they received phototherapy and significant correlation between the behavior of jaundiced neonates and    their age, birth weight, gender, type of feeding, serum bilirubin level, and duration of phototherapy. **Conclusion and recommendation:** There were behavioral changed of studied neonates after  phototherapy related to their  orientation ,social  interaction, motor response , self quieting, alertness, sleeping  and crying.So establishment of health educational program to all nurses in the high risk neonatal unites are strongly recommended to reduce the effects of phototherapy on the behavior of jaundiced neonates.

## Introduction

Neonatal period is the time from birth to the first four weeks of life. It is considered one of the most vulnerable times of the human cycle. Neonates have the highest risk of death among all children .The major causes of neonatal death are prematurity, sepsis, low birth weight, asphyxia, pneumonia and congenital abnormalities.[1] Within hours after birth, newborn shows significantly preference for their mother's voice and facial features. He can actively perceive, learn, and organize information while constantly striving to control their  sensory  input. [2] The  behavior  of a healthy, full-term newborn displays a unique organized series of distinct states of consciousness over time. The state is an indicator of the newborn's general level of well-being and is a sensitive measure of the neonate's behavior. Orientation and social interaction are also another important component of newborn's behavior which enables him to interact with his  caregiver  and  environment [3]Relatively  mild illnesses in the newborn period affect newborn behavior  following separation from their mothers for a brief period for minor medical problems such as jaundice because they are in need for phototherapy. Which is stressful because it involves exposure to continuous source of light . Newborns under the lights experience different sensory inputs because they are blindfolded, undressed and are held [4].

Neonatal jaundice is the most common medical condition affecting 60% of full-term and 80% of preterm neonates and corresponds to the clinical expression of unconjugated hyperbilirubinemia. [5] Jaundice is visible when the total serum bilirubin concentration is greater than 5 mg/dl . Significant hyperbilirubinemia has been defined as bilirubin levels greater than the 95th percentile for age in hours. [6] Unconjugated bilirubin can be neurotoxin, and at high levels can cause Kernicterus: is associated with significant mortality and morbidity and is characterized by cerebral palsy, paralysis, hearing loss and intellectual handicaps.[7] Phototherapy is the primary intervention for  treat neonatal hyperbilirubinemia. It is a device deliver light in measurable doses to the skin of the newborn. It should decrease bilirubin level by 2 mg/dL or more within 4-6 hours of its initiation.  Phototherapy is generally safe procedure, although complications can occur. Short term risks include bronze baby syndrome, retinal damage, thermoregulatory instability, loose watery stools, dehydration and  skin rash [8]

Appropriate nursing care minimizes the potential side effects and complications of phototherapy. So, nurses' responsibilities include general assessment, providing protection for eyes and genital area , carefully monitoring thermoregulation, assuring effective irradiance delivery, proper positioning, maximizing skin exposure, maintaining adequate hydration, daily weighing, supporting parent- neonate interaction [9] Neonates under it needs conscious care and behavioral assessment to prevent and reduce the risk of short and long term side effects . [10] So this study aimed to determine the effect of phototherapy on behavior of jaundiced neonates.

## 2.Materials and Method
### Study design:
A descriptive research design was used in the present study.
### Setting:
The study was conducted at high risk neonatal unit ofTanta University Hospital, El-Mebara and Elminshawi Hospitals, which are affiliated to Ministry of health
### Subjects:
A convenient sample of 60 jaundiced neonates from both sex who treated with phototherapy and fulfill the following criteria:
1. Gestational age between 37 -  40 weeks of gestation
2. Birth weight from 25oogm  - 3500 gm
3. Serum bilirubin level  12 - 18 mg / dl
4. Free from  pathological findings

### Tools of the study:
Two tools were used to collect the necessary data:-
**Tool I: Socio demographic and clinical data structured sheet**
It was developed by the researcher after reviewing of literature, it consisted of two parts:-
**Part I:**
A. Sociodemographic data of neonates**;** it included: sex, gestational age, birth weight, birth order mode of delivery and type of feeding
B. Sociodemographic data of mothers:It included**:** Age, education and  occupation.
**Part II: Clinical data**:
It included; Age of the neonate when starting and ending phototherapy, total serum bilirubin level before and after phototherapy and duration of phototherapy in days.

**Tool II:    Neonatal Behavior Assessment Scale:**
It was developed by **Brazelton and Nugent (1995)**[11] It was modified by the researcher to suit Egyptian culture and facilitates its scoring and used to

assess neonatal behavior responses. It included two parts:
**Part I: Neonatal behavioral responses**
It included 6 parts and measures the following aspects in neonates:
1-Neonatal orientation response: such as orientation to object, sound, object and sound to measure the visual and auditory response of the newborn and his ability to focus onand follow the object and sound. It consisted of 3 main items, each one included 3 sub items (total 9 items)
2- Social interactive response:  to face, voice and their response to face and voice to  assess  the ability of neonates to focus onand follow the researcher faceand voice**.** It consisted of 3 main items, each one included 3 sub items (total 9 items)
3- Motor system: such as pull-to-sit, general muscle tone and activity to assess the motor activity and resistance of muscles and body parts of neonates. It consisted of 3 main items each one included 3 sub items (total 9 items)
4- State Regulation: (consoliability. self-quieting and hand to mouth) It assesses the activity that the neonate initiatesin a crying state to quiet  himself, and the maneuversused by researcher to calm  the neonate from crying state , it consist of 3 main items,  each one included 3 sub items (total 9 items)
5- Range of States: (alertness, sleep and crying) It assessed the organization of different newborn states as alertness,  sleep and cry, it consisted of 3 main items each one included 3 sub items (total 9 items)
6-Autonomic system: (tremulousness, change of skin color and amount of startle) it measured the tremors, the changing of skin color and total body startle movementduring the assessment of newborn. It consisted of 3 main items each one included 3 sub items (total 9 items)
**Scoring System:**
Each items was earned 0, 1 and 2 score.  Each part has separated total score which ranged from 0- 6. The items were summed and the response of neonatescategorized as the following:
- If the total score was ( 0 - 2) it considered low response
- If  the total score was (3 – 4) it considered moderate response
- If  the total score was  (5 – 6 ) it considered good response
**Part II: neonatal reflexes:**
It assessed the reflexes of the neonate. It consisted of 8 reflexes;  crawling , Moro , plantar grasp,  grasp of hands  , stepping  ,  sucking ,  incurvation ,  and rooting . Each reflex includes 2 sub items (total 16 items)
**Scoring system:**

Each items was earned 0 or 1 score. The total score ranged from 0 - 8. The items were summed and the responses of neonatescategorized as the following:

- If the total score was ( 0 -2) it considered low response
- If the total score was (3 - 5) it considered moderate response
- If the total score was ( 6 - 8) it considered good response

**Method:**
1. An official permission was obtained before conducting the study from the responsible authorities.
2. Parent consent for participation of their neonates in the study was obtained after explaining the aim of study.
3. Ethical considerations: - Parents were informed about the privacy and confidentiality of the information obtained from their neonates.
4. Demographic and clinical data was collected from the parents and from health sheet of each neonate using tool I.
5. Every newborn was assessed individually using tool II two times; before starting and after stopping treatment with phototherapy , each assessment required 20 - 30 minutes

**Statistical analysis:**
The collected data were organized, tabulated and statistically analyzed using SPSS statistical package version 19. Numerical variables were presented as range, mean and standard deviation for categorical variables, the number and percent distribution was calculated. Statistical analysis for neonatal behavior and reflexes before and after phototherapy was done using Wilcoxon singed rank test. For each item of behavior the total score was calculated by multiplying the number of questions by the highest score. The total score for each neonate was divided by the maximum score and multiplied by 100 to get the score percentage. The comparison of mean values of each item of behavior, total behavior score and reflexes was performed by paired t test. Correlation between some characteristics was performed using Pearson's correlation coefficient ( r) The level of significance was adopted at $p < 0.05$.

**3. Results:**
Table (1) shows percentage distribution of the studied neonates according to their socio-demographic data. It was found that more than two thirds of studied neonates (66.7%) were males while the rest (33.3%) were females. As regards their gestational age; It was noticed that 38.3% were born in 38 weeks, 30% were born in 37 weeks, while 11% of them were born 40 weeks, the mean gestational age was 38.13±0.98 weeks. Regarding birth weight it was observed that,

43.3 % of studied neonate's weight 2.8 kg and 26.7% of them weight 3.1 kg at birth, the mean birth weight was 3066±359 gm. Regarding the type of feeding the majority of the studied neonates (80%) were fed by bottle

Table (1): Percentage distribution of the studied neonates according to their socio-demographic data

| socio-demographic characteristic | No = 60 | % |
|---|---|---|
| Sex | | |
| Male | 40 | 66.7 |
| Female | 20 | 33.3 |
| | | |
| Gestational age in weeks | | |
| 37- | 18 | 30.0 |
| 38- | 23 | 38.3 |
| 39- | 12 | 20.0 |
| 40 | 7 | 11.7 |
| Mean ± S | | 38.13±0.98 |
| Birth weight in gm | | |
| 2500- | 12 | 20.0 |
| 2800- | 26 | 43.3 |
| 3100- | 16 | 26.7 |
| 3500- | 6 | 10.0 |
| Mean ± SD | 66±359 | |

Table (2) illustrates percentage distribution of studied neonates according to their clinical data

Table (2): Percentage distribution of studied neonates according to their clinical data

| Items | no= 60 | % |
|---|---|---|
| Total bilirubin level ( mg /dl ) before phototherapy | 19 | 31.7 |
| 12 ->15 | 41 | 68.3 |
| 15 - 18 | | |
| Mean ± SD | 16.97±2.03 | |
| Total bilirubin level ( mg /dl ) after phototherapy | | |
| 6 -> 9 | 38 | 63.3 |
| 9- 11 | 22 | 36.7 |
| Mean ± SD | 9.23±1.48 | |
| Age in days on starting phototherapy | 14 | 23.3 |
| 2 -> 3 | 37 | 61.7 |
| 3- > 4 | 9 | 15.0 |
| 4 - 5 | | |
| Mean ± SD | 2.80±0.68 | |
| Age in days on ending phototherapy | 20 | |
| 5->6 | 32 | 33.3 |
| 6->7 | 8 | 53.4 |
| 7- 8 | | 13.3 |
| • Mean ± SD | 6.37±0.76 | |
| Duration of PT in days | 34 | 56.7 |
| 2- >3 | 21 | 35.0 |
| 3- >4 | 5 | 8.3 |
| 4 – 5 | | |
| Mean ± SD | 3.52±0.65 | |

It was noticed that before phototherapy, the mean of total bilirubin level was 16.97±2.03 mg/dl while after phototherapy the mean value was

9.23±1.48. Nearly two thirds of studied neonates (61.7%) started treatment with phototherapy on age ranged between 2 to > 3 days while 15% started treatment on age ranged between 4 to 5 days with mean age 2.80±0.68 days. As regards the age of neonates on ending phototherapy, it was noticed that more than half of studied neonates ( 53.3%) ended on to >7 days of age and the mean duration of treatment with phototherapy was 3.52±0.65 days.

Table (3) and figure 1-3 represents effect of phototherapy on behavioral responses of studied neonates ( orientation, social interaction and motor system)It was observed that, nearly two thirds of studied neonates (61.7%) had good orientation response and 38.3% had moderate response and none of them had low response before phototherapy, compared to 5.0% , 56.7 % and 38.3% respectively after phototherapy. Concerning the social interaction response before phototherapy, It was found that about two thirds of studied neonates (63.3%) had good response , 35% had moderate response and 1.7% had low response. Compared to 3.3 %, 60.0% and 36.7% after phototherapy respectively. As regarding motor system response, it was noticed that 62.7% of studied neonates has good response, 37.3% had moderate response before phototherapy .Compared to 6.7 % and 55.0 % after phototherapy respectively. The differences before and after phototherapy was statistically significant as( p= 0.001).

Table (4) and figure 4-7 demonstrates: Effect of phototherapy on behavioral responses of studied neonates ( state regulation, range of state, autonomic system and reflexes)It was observed that, before phototherapy, more than half of neonates (58.3%) had good state regulation response, 35% had moderate response and the least percentage (6.7 %) had low response compared to 10.0 %, 51.7% and 38.3% respectively after phototherapy. Regarding the neonates rang of state it was found that, more than two thirds of studied neonates(68.3%) had good response , 25% had moderate response and 6.7% had low response before phototherapy compared to 50.0 % had moderate response ,38.3% had low response and 11.7% good response after phototherapy. Regarding the neonates autonomic system response before phototherapy, It was clear that, nearly two thirds of neonates (61.7%) had good response, 23.3% had moderate response. This percentage was slightly changed after phototherapy to be 58.3 %and 25.0 % respectively. The differences was not statistically significant (p= 0.931) .Regarding to reflexes it was found that, the majority of studied neonates (90%) had good reflexes response before phototherapy compared by 86.7% after phototherapy with no significant differences(p= 0.570)

Table (5) demonstrates the relationship between mean values of total scores differences of studied neonates' behavioral responses before and after phototherapy regarding their age on starting phototherapy. It was observed that the mean of total score differences for orientation, social interaction and motor system response were 2.05±0.300, 2.89±0.36 and 1.79±0.40 respectively of studied neonates who were in age group ranged from 2 to < 4 days on started phototherapy , compared to 1.47±0.54, 1.14±0.45, 1.16±0.61 respectively of those in the age group ranged from 4 to 5 days. The differences were statistically significant (p = 0.01, 0.034, 0.010 respectively). As regards range of states and reflexes of neonates in 2 to <4 days of age, the mean of total score differences were 1.09±0.300 and 6.76±1.86 compared to 0.87±0.34 and 5.43±1.60 for neonates who were aged 4 to 5 days. The differences were statistically significant (p = 0.014, 0.004 respectively).The result also revealed that the mean of total score differences of state regulation and autonomic system responses were 0.97±0.62, 0.52±0.75 in studied neonates of less than four days of age while they were 0.76 ±0.36, 0.49±0.51 of studied neonates who aged more than 4 days . The differences were not statistically significant as (p = 0.163 and 1.000 respectively).

Table (6) shows relationship between mean values of total scores differences of studied neonates' behavioral responses before and after phototherapy regarding duration of phototherapy. It was observed that the mean values of total score differences for orientation , social interaction, motor system and range of states were (2.06±0.24, 2.09±0.29, 2.12±0.32 and 1.06±0.24 respectively ) for studied neonates who received phototherapy from 3 to 5 days compared to (1.77±0.65, 1.85±0.54, 1.69±0.74, 0.80±0.40 respectively) in studied neonates who received phototherapy from 2 to less than 3 days. The differences were statistically significant (p= 0.020, 0.030, 0.010, 0.007 respectively)This table also demonstrates that studied neonates who stayed from 3 to 5 days under phototherapy had higher mean values of total score differences for state regulation, autonomic system and reflexes responses (0.96±0.50, 0.73±0.00, 6.47±1.50 respectively), while studied neonates who stayed from 2 to less than 3 days under phototherapy had the following values ( 0.85±0.45, 0.42±0.63, 6.05±1.91 respectively ). No statistical significant differences was detected (p= 0.386, 1.000, 0.068) respectively.

Table (7) demonstrates relationship between mean values of total scores differences of studied neonates' behavioral responses before and after phototherapy regarding gender. It was observed that the boys had higher mean values of total score

differences in relation to orientation , social interaction , motor system , range of states and reflexes response (2.05$\pm$0.22 , 2.07$\pm$0.27, 2.10$\pm$0.30, 1.05$\pm$0.22 and 6.48$\pm$1.39 respectively ) compared to (1.70$\pm$0.73, 1.80$\pm$0.61, 1.60$\pm$0.82 , 0.75$\pm$0.44, 5.75+1.99 respectively) of girls , with statistically significant differences where p= 0.049, 0.039, 0.015,

0.009, 0.006 respectively . Regarding state regulation and Autonomic system responses it was clear that the mean values of total score differences before and after phototherapy were 0.95$\pm$0.46 and 0.15$\pm$0.27 in boys neonates while in girls neonates they were 0.89$\pm$0.51 and 0.08$\pm$0.58, with no statistically significant differences where p= 0.570 and 0.166 respectively.

Table (3): Effect of phototherapy on behavioral responses of studied neonates (orientation, social interaction and motor system)

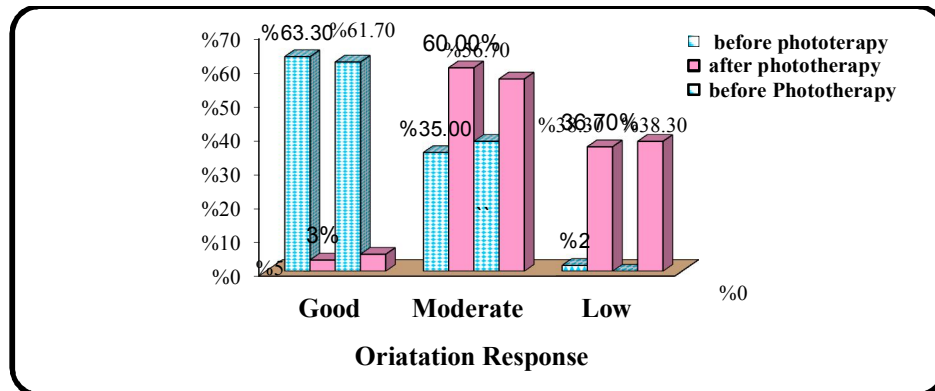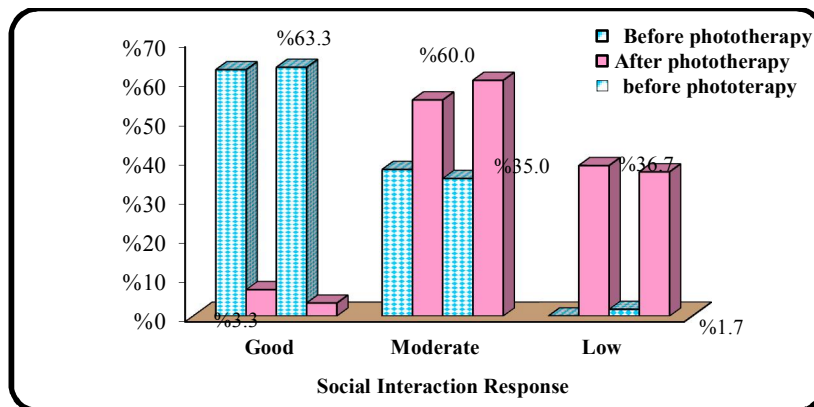| Behavioral items | Before phototherapy | | After phototherapy | | $X^2$ | p |
|---|---|---|---|---|---|---|
| | no=60 | % | no=60 | % | | |
| **Orientation** | | | | | | |
| - Good | 37 | 61.7 | 3 | 5.0 | | |
| - Moderate | 23 | 38.3 | 34 | 56.7 | | 0.001* |
| - Low | 0 | 0.0 | 23 | 38.3 | 54.02 | |
| **Social interaction** | | | | | | |
| - Good | 38 | 63.3 | 2 | 3.3 | | |
| - Moderate | 21 | 35.0 | 36 | 60.0 | 55.52 | 0.001* |
| - Low | 1 | 1.7 | 22 | 36.7 | | |
| **Motor system** | | | | | | |
| - Good | 37 | 62.7 | 4 | 6.7 | 51.35 | 0.001* |
| - Moderate | 23 | 37.3 | 33 | 55.0 | | |
| - Low | 0 | 0.0 | 23 | 38.3 | | |



Figure 1: Orientation Response



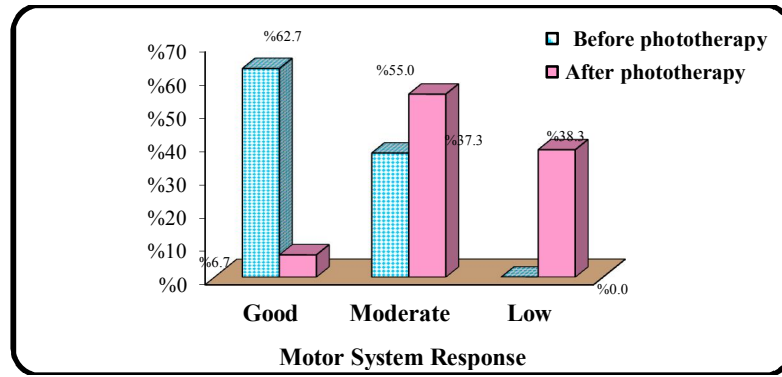Figure 2 : Social Interaction Response

Figure 3: Motor System Response

**Table (4):** Effect of phototherapy on behavioral responses of studied neonates (state regulation, range of state, autonomic system and reflexes)

| Behavioral Items | Before phototherapy | | After phototherapy | | X2 | p |
|---|---|---|---|---|---|---|
| | No=60 | % | No=60 | % | | |
| **Regulation of state** | | | | | | |
| - Good | 35 | 58.3 | 6 | 10.0 | 35.81 | 0.001* |
| - Moderate | 21 | 35.0 | 31 | 51.7 | | |
| - Low | 4 | 6.7 | 23 | 38.3 | | |
| **Range of state** | | | | | | |
| - Good | 41 | 68.3 | 7 | 11.7 | 31.23 | 0.001* |
| - Moderate | 15 | 25.0 | 30 | 50.0 | | |
| - Low | 4 | 6.7 | 23 | 38.3 | | |
| **Autonomic system** | | | | | | |
| - Good | 37 | 61.7 | 35 | 58.3 | 0.141 | 0.931 |
| - Moderate | 14 | 23.3 | 15 | 25.0 | | |
| - Low | 9 | 15.0 | 10 | 16.6 | | |
| **Reflexes** | | | | | | |
| - Good | 54 | 90.0 | 52 | 86.7 | 0.322 | 0.570 |
| - Moderate | 2 | 3.3 | 3 | 5.0 | | |
| - Low | 4 | 6.7 | 5 | 8.3 | | |
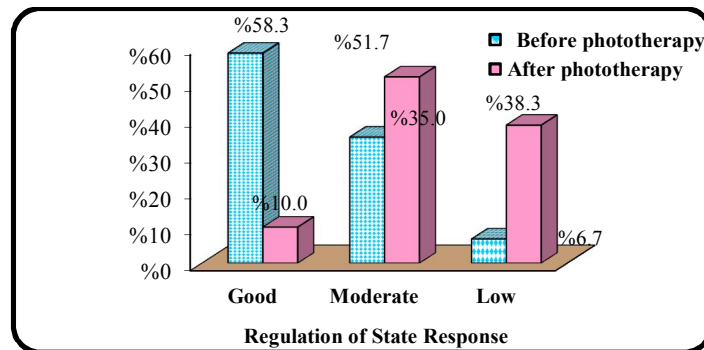


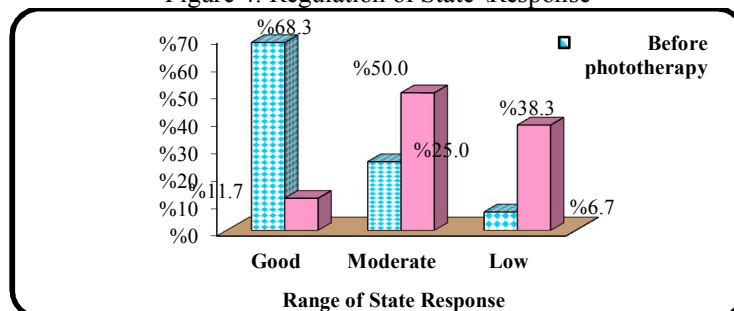Figure 4: Regulation of State \Response
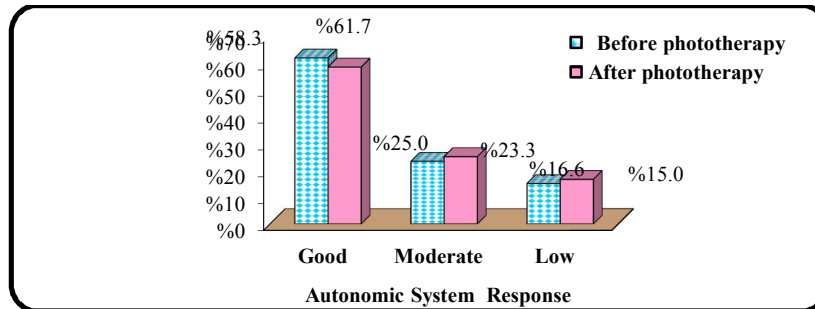


Figure 5:Range of State Response
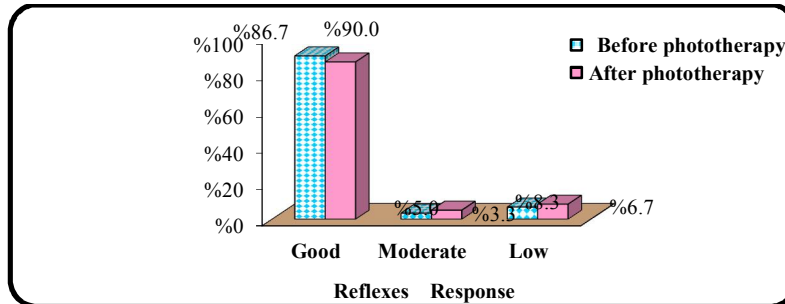
**Figure 6:** Autonomic System Response



**Figure 7:** Reflexes Response

**Table (5):** Relationship between mean values of total scores differences of studied neonates' behavioral responses before and after phototherapy regarding age on starting phototherapy

| Neonates' behavioral responses | Age of starting phototherapy | | t | P |
|---|---|---|---|---|
| | 2-<4 days | 4 - 5days | | |
| - Orientation | 2.05+0.300 | 1.47+0.54 | 1.952 | 0.016* |
| - Social interaction | 2.89+0.36 | 1.14+0.45 | 2.166 | 0.034* |
| - Motor system | 1.79+0.40 | 1.16+0.61 | 2.654 | 0.010* |
| - State regulation | 0.97+0.62 | 0.76 +0.36 | 1.434 | 0.163 |
| - Range of states | 1.09+0.300 | 0.87+0.34 | 2.531 | 0.014* |
| - Autonomic system | 0.52+0.75 | 0.49+0.51 | 0.884 | 1.000 |
| - Reflexes | 6.76+1.86 | 5.43+1.60 | 3.202 | 0.004* |

**Table (6):** Relationship between mean values of total scores differences of studied neonates' behavioral responses before and after phototherapy regarding duration of phototherapy

| Neonates' behavioral responses | Duration of phototherapy | | t | P |
|---|---|---|---|---|
| | 2- <3 days | 3-5 days | | |
| - Orientation | 1.77+0.65 | 2.06+0.24 | 2.158 | 0.020* |
| - Social interaction | 1.85+0.54 | 2.09+0.29 | 2.225 | 0.030* |
| - Motor system | 1.69+0.74 | 2.12+0.32 | 2.747 | 0.010* |
| - State regulation | 0.85+0.45 | 0.96+0.50 | 0.873 | 0.386 |
| - Range of states | 0.80+0.40 | 1.06+0.24 | 2.827 | 0.007* |
| - Autonomic system | 0.42+0.63 | 0.73+0.00 | 2.974 | 1.000 |
| - Reflexes | 6.05+1.91 | 6.47+1.50 | 2.956 | 0.068 |

**Table (7):** Relationship between mean values of total scores differences of studied neonates' behavioral responses before and after phototherapy regarding   gender

| Neonates' behavioral responses | Neonates' gender | | t | P |
|---|---|---|---|---|
| | boys | girls | | |
| - Orientation | 2.05+0.22 | 1.70+0.73 | 2.089 | 0.049* |
| - Social interaction | 2.07+0.27 | 1.80+0.61 | 1.910 | 0.039* |
| - Motor system | 2.10+0.30 | 1.60+0.82 | 2.636 | 0.015* |
| - State regulation | 0.95+0.46 | 0.89+0.51 | 0.571 | 0.570 |
| - Range of states | 1.05+0.22 | 0.75+0.44 | 2.849 | 0.009* |
| - Autonomic system | 0.15+0.27 | 0.08+0.58 | 1.632 | 0.166 |
| - Reflexes | 6.48+1.39 | 5.75+1.99 | 2.905 | 0.006* |

## 4. Discussion:

The neonatal period is one of biolological vulnerability in which a successful outcome depends largely on appropriate neonatal adjustments to the extra uterine environment. Postpartum system balance in newborns is dependent on the achievement of three tasks: newborn must establish homeostasis through self-regulation by making changes in state and sleep patterns. process, store, and organize multiple stimuli and he must establishes a reciprocal relationship with a primary caregiver and with the environment.[12]The behavior of a healthy, full-term newborn displays a unique organized series of distinct states of consciousness over time. The state is a behavior pattern of organization is an important indicator of the newborn's general level of well-being and is a sensitive measure of the neonate's response to external events e.g. a bright lights. [13]The findings of the present study revealed thatmore than two thirds of the newborns were males while the rest were females. This finding is in agreement with Onyearugha (2011) who found that the incidence ratio of neonatal jaundice was a male/female of 1.5: 1[14]Also**Bahgat et al(2004)** reported that, the majority of jaundiced newborns were males[15] this could be related to increase risk of neonatal jaundice in male sex and probably due to better medical attention given to males in our social setup. The findings of this study showed that there was significance correlation between the behavior of neonates and their gender; Boys showed more behavioral changing than girls after phototherapy.

Gestational age at delivery is defined as the number of complete weeks from the first day of the last menstrual period to the date of delivery. The present study revealed that the gestational age of studied neonates ranged from 37 to 40 weeks with a mean of 38.13+0.98 weeks . This is comparable to **Sciuto et al., ( 2009)** Who observed that newborns of 35 to 37 weeks gestation were 2.4 times more likely to develop significant hyperbilirubinemia than those of 38 to 42 weeks gestation, and thus they should be considered a high-risk group. [16] This also in agreement with the result of another study which reported that the incidence of hyperbilirubinemia increased with decreasing gestational age [17] The result of this study demonstrated that, the birth weight of studied neonates ranged between 2.5 kg and 3.5 kg with a mean of 3066+359 kg. This findings is supported by **Maisels et al.,(1999)** who concluded that the threshold levels for defining significant hyperbilirubinemia and starting phototherapy treatment in full term neonates increased with decreasing the birth weight [18]. Also similar findings were reported by **Bakr et al (2003)**in his study stated that birth weight is a significant risk factor for

hyperbilirubinemiaand is known to be a basis for increased biologic vulnerability to risk of bilirubininduced neurotoxicity. [19]

The findings of this research showed that the total bilirubin level of studied neonates at 2-5 days of age was ranged from 12 - 18 mg/dl with mean of 16.97 + 2.03 mg/dl before receiving phototherapy This Attributed to **Korejo et al ( 2010)** who found that a TSB level at 2-3 days of age was 17 mg/dl. [20] This results also in agreement with **Kaushal et al.,(2002)** who stated that the maximum value of TBL which indicated for phototherapy ranged from 12 to 14 mg/dl in the first 72 hours of life[21] this could be due to physiological jaundice and this rang of TBL can be classified as moderate jaundice. Phototherapy is highly effective in the treatment of neonatal jaundice and decline the rate of serum bilirubin levels. The light waves convert the bilirubin to water soluble nontoxic forms which are then easily excreted. In this study the duration of phototherapy was ranged from 2 to 5 days with a mean of 3.52+0.65 days. This finding is in congruent with the fact that that phototherapy had its greatest effect during the first 42 to 48 hours of treatment. This finding is in agreement with **Brown et al., (1994)**, who reported a similar result. [22]This also in agreement with **Vinod et al (2011)**who reported that the clinical impact of phototherapy should be evident within 4 to 6 hours of initiation with an anticipated decrease of more than 2 mg/dL in serum bilirubin level. [23] The present study revealed that there was significant correlation between change of behavioral responses and duration of phototherapy. It was found that in long duration of phototherapy showed more changes in neonate's behavior than short duration. These results was confirmed by **Vohr et al., ( 1990 )** who found that the longer duration of treatment with phototherapy leading to more behavioral affected in neonates. [24] This might be related to continuous exposure to light of phototherapy which produce over stimulation in neonates resulting in irritability and stress which lead to worse effect on the behavior of the neonates.

Regarding the orientation response, the studied neonates showed significant differences before and after phototherapy for orientation response in visual and auditory response to object.This results agreed with **Paludetto et al (2004)** who found that significantly poorer performances in visual and auditory orientation response for newborn who had terminated phototherapy. [25] In consistence with these results **Abrol et al (1998)** who found similar finding. [26]This is may be due to phototherapy; it is the primary choice for treatments of neonatal jaundice, neonates under phototherapy undressed are held and his eyes were covered by eye patches. Blind folding is stressful for newborns.[27] Concerning the social

interaction response of studied neonates, the results revealed that there were decreased in visual response to human face , and visual & auditory response to human face and voice after phototherapy. This findingwas supported by the finding of **Telzrow et al (1982)** who found that  newborns who terminated phototherapy had significant low scores in social interaction response.[4] These can be attributed to maternal separation which includes more than simple maternal absence: the newborn is also deprived of the normal visual, verbal and tactile experience that non separated neonates  receive [28]**Hofer (2007)** stated that the maternal regulators of newborn physiology and behavior, and classified them into nutrient-interceptive and behavioral-sensorimotor which   regulated the neonate's activity level.    From this perspective, newborn's  responses to maternal separation were viewed as a release from maternal regulation.[29] The finding of this study showed that about two thirds of studied neonates had good motor response before phototherapy and more than half of them had moderate response after phototherapy.  These findings were consistent with **Raimondi (2002)** who demonstrated that there was decreases in neonates' motor response after they treated by phototherapy.[30]

**Conclusion**

There were behavioral changed of jaundice neonates after they    received phototherapy in their orientation, social interaction, motor response, state regulation, alertness, sleeping and crying.  There was significant correlation between the behavior of jaundiced neonates and their age, birth weight, gender, type of feeding, serum bilirubin level, and duration of phototherapy.

**Recommendations**
- Establish nursery protocols for identifying , effective treatment  and follow up for jaundiced neonates
- Standardized nursing care of jaundiced neonates under  phototherapy
- In-service training programs should be conducted for nurses working in pediatric intensive care units related toneonates behaviors and capabilities

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