

# STUDY OF HYPOCALCEMIA AND THROMBOCYTOPENIA ENCOUNTERED AFTER INITIATION OF PHOTOTHERAPY IN TREATMENT OF NEONATAL JAUNDICE

By

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## ABSTRACT

**Background:** Jaundice is one of the most common problems in neonatal period. In 60% of term and 80% of preterm neonates seen during the first week of birth and most cases are physiologic. Phototherapy is used to treat it, which seems to be safe. Some studies showed that thrombocytopenia is one of the side effects of phototherapy.

**Aim and objectives:** the aim of the present study was to determine the incidence of hypocalcaemia and thrombocytopenia after initiation of phototherapy in treatment of neonatal jaundice.

**Patients and methods:** The present study was carried out on 50 full term and 50 preterm neonates having unconjugated hyperbilirubinemia treated with phototherapy. They were selected from neonatology unit of Al Hussein university hospital during the period from 1<sup>st</sup> of March to 1<sup>st</sup> of September 2020. Neonates were divided into two equal groups: Group I: 50 full term neonates (26 males and 24 females). Group II: 50 preterm neonates (27 males and 23 females). They were selected by simple random method. All the studied group were subjected to complete clinical examination and laboratory evaluation including Complete Blood Picture (CBC), serum Calcium level, Total serum bilirubin, Direct serum bilirubin, Blood grouping (ABO) and Rh factor.

**Results:** There were 46% of neonates in group II (preterm) developed hypocalcaemia after 48 hrs. of use of phototherapy, while there were only 30% in group I. Also, there were 80% of hypocalcaemia neonates in group II developed jitteriness, while there were 66% in group I. There was 30% of neonates in group I developed thrombocytopenia (73.3% mild, 26.7% moderate) compared to 36% of neonates in group II developed thrombocytopenia (77.8% mild, 22.2% moderate) after 48 hrs. of phototherapy.

**Conclusion:** phototherapy can significantly decrease the levels of calcium in jaundiced term and preterm infants undergoing phototherapy for 48 hours. Phototherapy in newborns with Indirect Hyperbilirubinemia leads to decrease in platelet count both in term and preterm baby.

*Keywords: Hyperbilirubinemia, Jaundice, Newborn, Phototherapy, Platelet count.*

## **INTRODUCTION**

Neonatal hyperbilirubinemia continues to be a leading cause of morbidity and mortality in resource-limited countries (Satrom et al., 2014).

Phototherapy has been accepted as the standard treatment for neonatal jaundice, and there are various methods of delivering phototherapy. The efficiency of phototherapy depends on the emission range, peak wave length of the light source, irradiance and exposed body surface area (Bhutani et al., 2011). However, this treatment modality also has some complications such as insensible water loss, mutation and DNA strand break, hyperthermia, tremor, retinal damage, bronze baby syndrome, maternal infant interaction, hypocalcaemia and thrombocytopenia (Martin and Cloherty, 2008).

Hypocalcaemia has been reported as a reaction to phototherapy in premature and full-term newborns. Some complications of hypocalcaemia in newborns are apnea, convulsion, muscle cramps, tremors, and tetany. Hypocalcaemia causes long-term complications such as mental retardation, physical

disability (Ehsanipoor et al., 2008).

In some infants platelet turnover may be increased resulting in lowering mean platelet counts but bleeding does not occur (Martin and Cloherty, 2008).

## **AIM OF THE STUDY**

The aim of this study is to determine the incidence of hypocalcaemia and thrombocytopenia after initiation of phototherapy in treatment of neonatal jaundice.

## **PATIENTS AND MATERIALS**

This prospective study was carried out in NICU of Al Hussein hospital, Al-Azhar University and it was conducted on 100 neonates in the period from 1st of March to 1st of September they were selected by simple random method and divided into 2 groups:

**Group I:** 50 full term neonates (26 males and 24 females).

**Group II:** 50 preterm neonates (27 males and 23 females).

### **Inclusion criteria:**

- Infants with pathological neonatal jaundice indicated for phototherapy according to Bhutani nomogram, full term and pre term infants.

- Birth weight between 2500-4000 g and newborns with normal examination were enrolled to the study.
  - Neonates with hemolytic jaundice not receiving intravenous immunoglobulin (IVIG) and did not undergo exchange transfusion.
4. The authors received no financial support for the study or the publication.
  5. The authors declared that there is no conflict of interest regarding the study and publication.

### **Methods:**

**All patients were subjected to the following:**

#### **i. History taking: Including:**

1. Socio-demographic data.
2. Detailed history about perinatal circumstances: - Mode of delivery- Maternal disease-Gestational age (according to last menstrual period or antenatal sonar) and onset of jaundice.

#### **ii. Physical examination:**

Weight and duration of phototherapy was recorded gestational age, body weight, pallor score, cephalhematoma, systemic examination including: chest, heart and abdomen.

#### **iii. Investigations:** Including: CBC for platelets count, serum bilirubin (total, direct), serum calcium level (total and ionized), blood grouping and RH.

A sample of 3ml venous blood was sent to the laboratory for

### **Exclusion criteria:**

- Neonates with recurrent apneas and respiratory distress.
- Sepsis, congenital anomalies, ABO incompatibility, need for transfusion, direct hyperbilirubinemia and metabolic disease.
- Elevated direct bilirubin or cholestasis.
- Neonates with hypocalcaemia or thrombocytopenia before starting phototherapy.

### **Ethical consideration:**

1. Approval from the ethical committees of both pediatric department and Faculty of Medicine Al-Azhar University.
2. Written consent for the study was obtained from the parents of these neonates participating in this study.
3. The data of the patients and the results of the study are confidential and the patients have the right to keep them.

serum calcium level before starting conventional phototherapy and after 24 hours of continuous phototherapy.

### Statistical analysis:

Analysis of data was done using Statistical Program for Social Science version 20 (SPSS Inc., Chicago, IL, USA). Quantitative variables were described in the form of mean and standard deviation. Qualitative variables were described as number and percent. In order to

compare parametric quantitative variables between two groups, Student t test was performed. Qualitative variables were compared using chi-square (X<sup>2</sup>) test or Fisher's exact test when frequencies were below five. Pearson correlation coefficients were used to assess the association between two normally distributed variables. When a variable was not normally distributed, A P value < 0.05 is considered significant.

## RESULTS

Our result will be demonstrated in the following tables.

**Table (1): Comparison between the two studied groups regarding demographic data**

Infant History		Group I (full term)		Group II (preterm)		P-Value
		No	%	No	%	
Sex	Male	26	(52%)	27	54%	0.841
	Female	24	(48%)	23	46%	
Gestational Age/weeks	Mean ± SD	36.5 ± 0.51		34.43 ± 1.54		<0.001
Birth Weight/kg	Mean ± SD	2.61 ± 0.41		2.33 ± 0.32		<0.001
Length/cm	Mean ± SD	48.31 ± 1.73		46.6 ± 1.25		<0.001
Head Circumference/cm	Mean ± SD	33.85 ± 1.11		31.23 ± 0.65		<0.001
Post natal age	Mean ±SD	3.37 ± 0.72		3.66 ± 0.72		0.046

There were no significant differences between the two studied groups regarding sex with male predominance. There

was a significant difference regarding gestational age, body weight and length.

**Table (2): Comparison between two studied groups regarding to CBC**

			Group I (full term)	Group II (preterm)	P- Value
CBC at admission	HB	Mean±SD	14.63 ± 1.72	14.13 ± 1.54	< 0.001
	platlet	Mean±SD	273.5 ± 81.7	311.2 ± 75.6	< 0.001
CBC 24h after phototherapy	HB	Mean±SD	14.28±1.73	13.85±1.23	< 0.001
	platlet	Mean±SD	241.5±87.5	273.2±98.5	< 0.001
CBC 48h after phototherapy	HB	Mean±SD	14.03± 1.34	13.54±1.54	< 0.001
	platlet	Mean±SD	229.2±95.6	265.6±101.6	< 0.001
CBC 48h after discontinuation of phototherapy	HB	Mean±SD	14.71±1.45	14.16±1.43	< 0.001
	platlet	Mean±SD	277.3±85.6	308.9±74.9	< 0.001

There was no significant difference between the two studied groups regarding CBC.

**Table (3): Comparison between the two studied groups regarding hours spent on phototherapy, levels of TSB and DSB**

			Group I (full term)	Group II (preterm)	P- Value
Duration on phototherapy(hrs)		Mean ± SD	71.5 ± 13.41	85.63 ± 12.73	< 0.001
Serum bilirubin at admission	TSB	Mean± SD	18.8 ± 2.53	17.75 ± 1.54	0.013
	DSB	Mean± SD	1.11 ± 0.36	1.1 ± 0.27	0.875
Serum bilirubin 24h after phototherapy	TSB	Mean± SD	13.41± 1.89	12.45 ±1.25	< 0.001
	DSB	Mean± SD	0.88 ± 0.42	0.59 ±0.18	< 0.001
Serum bilirubin 48h after phototherapy	TSB	Mean± SD	8.35 ± 1.94	9.4 ±1.25	< 0.001
	DSB	Mean± SD	0.48 ± 0.16	0.61±0.17	< 0.001
Serum bilirubin 48h after discontinuation of phototherapy	TSB	Mean± SD	4.76 ± 1.21	4.13±0.73	< 0.001
	DSB	Mean± SD	0.37 ± 1.23	0.28±0.13	< 0.001

There was a significant difference between the two studied groups regarding levels of TSB at admission.

**Table (4): Comparison between the two studied groups regarding the levels of total calcium and ionized calcium**

			Group I (full term)	Group II (preterm)	P- Value
Serum Calcium at admission	total	Mean± SD	9.64 ± 0.68	8.92 ± 0.76	< 0.001
	ionized	Mean± SD	4.36 ± 0.23	4.12 ± 0.13	< 0.001
Serum Calcium 24h after phototherapy	total	Mean± SD	9.19 ± 0.75	8.91 ± 0.67	< 0.001
	ionized	Mean± SD	4.87 ± 0.26	4.43 ± 0.27	< 0.001
Serum Calcium 48h after phototherapy	total	Mean± SD	7.45 ± 1.87	8.16 ± 1.54	< 0.001
	ionized	Mean± SD	4.47 ± 0.67	4.65 ± 0.76	< 0.001
Serum Calcium 48h after discontinuation of phototherapy	total	Mean± SD	9.61 ± 0.68	9.12 ± 0.75	< 0.001
	ionized	Mean± SD	4.29 ± 0.25	4.13 ± 0.54	< 0.001

There was slight significant difference between the two studied groups regarding levels of total and ionized calcium at

admission, 24hours, 48hours after initiation of phototherapy& 48hours after phototherapy stoppage.

### **DISCUSSION**

Neonatal jaundice or hyperbilirubinemia is an unpreventable condition in 60% - 80% of newborns worldwide. In a proportion of infants, jaundice may become severe progressing to acute bilirubin encephalopathy or kernicterus with a significant risk of neonatal mortality. Surviving infants may acquire long-term neurodevelopmental sequelae such as cerebral palsy, sensor neural hearing loss, intellectual difficulties or gross developmental delay (**Olusanya et al., 2015**).

Phototherapy plays a significant role in the treatment and prevention of

hyperbilirubinemia in neonates (**Stokowski, 2006**).

In the recent years, limited research showed that phototherapy should be considered as a risk factor for hypocalcemia (**Thomas et al., 2006**).

Phototherapy may also affect the hematological system. Certain past and recent studies have documented thrombocytopenia as a side effect of phototherapy (**Scott, 2015**).

The present study was carried out on 50 full term and 50 preterm neonates having unconjugated hyperbilirubinemia treated with phototherapy. Neonates were

divided into two equal groups: Group I: 50 full term neonates (26 males and 24 females). Group II: 50 preterm neonates (27 males and 23 females). The duration of the study ranged from 6-12 months.

### The main results of this study were:

There was 30% of neonates in group I (full term) developed hypocalcemia after 48 hrs. of use of phototherapy. Also, there were 66% of hypocalcemic neonates in group 1 developed jitteriness.

In an Iranian study, 7.5% neonates developed hypocalcemia after receiving phototherapy (**Tehrani et al., 2014**). In their study, hypocalcemia was observed in 35.0% of neonates after phototherapy. **Shrivastva et al, 2015** also observed hypocalcemia effect of phototherapy in 30.0% of term neonates. **Sethi et al, 1993** observed hypocalcemia in 75% of term neonates after phototherapy.

The present study showed that there was 12% of neonates in group I (full term) developed thrombocytopenia after 24 hrs. of phototherapy. All of them were mild thrombocytopenia. None of neonates developed complications of thrombocytopenia. There was 30% of neonates in group I (full term) developed thrombocytopenia (73.3% mild, 26.7% moderate) after 48 hrs. of

phototherapy. None of neonates in developed severe thrombocytopenia.

Our results were supported by study of **Khera & Gupta, 2011** as they reported that the incidence of thrombocytopenia was seen in 35 (35%) neonates undergoing phototherapy (after 48 hrs.). Majority of neonates had mild thrombocytopenia (74%). Moderate and severe thrombocytopenia was seen in 23% and 3% cases, respectively.

The current study showed that there was a statistically high significant decrease in the levels of TSB and DSB after 24 hrs. and 48 hrs. of phototherapy. Also, there was high significant decrease in the levels of total and ionized calcium after 24 hrs. and 48 hrs. of use phototherapy compared to before initiation of phototherapy while significant hypocalcemia occurred after 48 hrs. of phototherapy use.

Our results were supported by study of **Goyal et al., 2018** as they reported that mean total serum bilirubin levels before and at the end of phototherapy was  $19.48 \pm 2.78$ mg/dl and  $11.18 \pm 3.11$ mg/dl respectively. Mean serum calcium levels before phototherapy was  $9.14 \pm 0.78$ mg/dl and it reduced to  $8.53 \pm 0.77$ mg/dl after phototherapy. It was found that

there was significant reduction ( $p < 0.001$ ) in mean total serum bilirubin and mean serum calcium levels after phototherapy as compared to pre phototherapy levels. Serum calcium levels after phototherapy was  $> 8\text{mg/dl}$  in 65.0% of subjects and hypocalcemia i.e., serum calcium levels  $< 8\text{mg/dl}$  was noted in 35.0% of subjects.

In the study in our hands, there was highly significant decrease in platelet counts after (24 hrs., 48 hrs.) of initiation of phototherapy, while there was no difference regarding platelet counts after discontinuation of phototherapy compared to the level at admission.

Our results were supported by study of **Vafaie et al., 2018** as they reported that of all neonates, 55% were boy and 45% were girl with mean age of 8.86 days. The mean platelet count before phototherapy, 24 hours late, at the end of phototherapy, and 48 hours after phototherapy were 298170, 288540, 282620 and 266310, respectively which was statistically significant during time.

However, in the study of **Ghaffarpour et al., 2006** there was a significant increase in platelet count after phototherapy but the changes in retic ulocyte

and lymphocyte and neutrophil were not meaningful.

The present study showed that there were 46% of neonates in group II (preterm) developed hypocalcaemia after 48 hrs. of use of phototherapy. Also, there were 80% of hypocalcaemia neonates in group II developed jitteriness.

Our results were in agreement with study of **Chandrashekar, 2014** as they revealed that incidence was 48% in preterm and 14% in term neonates. Incidence of hypocalcaemia according to duration of phototherapy being, 2 out of 24 (8%) at 24hrs of PT, 15 out of 73 (21%) at 36 hrs of PT, 45 out of 103 (44%) at 48hrs of phototherapy. Out of which incidence was more in preterm than in term neonates, more in SGA neonates then AGA.

The current study showed that there were 10% of neonates in group II (preterm) developed thrombocytopenia after 24 hrs. of phototherapy. All of them were mild thrombocytopenia. None of neonates in both developed complications of thrombocytopenia. There 36% of neonates in group II (preterm) developed thrombocytopenia (77.8% mild, 22.2% moderate) after 48 hrs. of phototherapy. None of neonates developed severe thrombocytopenia. There



was highly significant decrease in platelet counts after (24 hrs., 48 hrs.) of initiation of phototherapy, while there was no difference regarding platelet counts after discontinuation of phototherapy compared to the level at admission.

Our results were supported by study of **Sonawane et al., 2018** as they reported that for Preterm neonates mean Platelet Count was decreased 24 hrs. after Phototherapy when compared with the Platelet Count before starting Phototherapy which was statistically significant ( $p = 0.018$ ).

In the study in our hands, there was a statistically high significant decrease in the levels of TSB and DSB after (24, 48 hrs.) of phototherapy use. Also, there was high significant decrease in the levels of total and ionized calcium after 24 hrs. and 48 hrs. of initiation of phototherapy compared to before initiation of phototherapy while significant hypocalcaemia occurred after 48 hrs. of phototherapy use.

Our results were supported by study of **Gaafar et al., 2020** as they reported that evaluation of the average level of serum bilirubin in subjects measured at two different times (at hospitalization and after 48 hours of exposure to phototherapy)

showed a significant decrease in the level of bilirubin; level of bilirubin in those subjects after phototherapy had an average value of  $16.76 \pm 2.99$  mg/dL, which was less than that of hospitalization time  $11.0 \pm 2.45$  ( $P < 0.001$ ). They showed that showed those 48 hours after phototherapy, average serum calcium level in the subjects was  $9.04 \pm 0.78$  mg/dL, which was less than that of the hospitalization time ( $9.63 \pm 0.79$  mg/dL). This decrease was statistically significant.

The present study showed that there was no significant difference between the two studied groups regarding blood groups of the mother and the baby of the two studied groups and mode of delivery. There was no significant difference between the two studied groups regarding sex with male predominance. There was a significant difference regarding gestational age, body weight and length. Our results were in line with study of **Bahbah et al., 2015** as they revealed that there was no statistically significant difference between both groups regarding gestational age, postnatal age, sex, and mode of delivery ( $P > 0.0$ ).

The current study showed that there was a significant difference between the two studied groups regarding levels of TSB at admission. Also, there was a

significant difference regarding day of life and hours spent on phototherapy.

Our results were supported by study of **Abdelhakeem et al., 2015** as they demonstrated that there was statistically significant difference between the two studied groups regarding levels of TSB.

The present study showed that there was highly significant difference between the two studied groups regarding levels of total and ionized calcium at admission. There was statistically significant difference between the two studied groups regarding levels of total and ionized after 48 hrs. of phototherapy initiation. Neonates were compared using multivariate logistic regression analysis. Only two of these factors were statistically significant (gestational age with P- value =0.002, odds ratio 0.736, 95% CI 0.608 to 0.890 and hours spent on phototherapy with P- value < 0.001, odds ratio 1.010, 95% CI 0.970 to 0.979). This means that there was a trend for the development of hypocalcaemia with prematurity and with more hours spent on phototherapy.

Our results were supported by study of **Gaafar et al., 2020** as they showed that the level of calcium in term and preterm infants undergoing phototherapy

with average of 9.04 mg/dL was less than that of the hospitalization time with an average of 9.63 mg/dL and this decrease was statistically significant. The present study showed that there was no significant difference between the two studied groups regarding levels of platelets 24 hrs. and 48 hrs. after phototherapy initiation. There was 30% of neonates in group 1 (full term) developed thrombocytopenia (73.3% mild, 26.7% moderate) compared to 36% of neonates in group 2 (preterm) developed thrombocytopenia (77.8% mild, 22.2% moderate) after 48 hrs. of phototherapy. None of neonates in both groups developed severe thrombocytopenia. Neonates were compared using multivariate logistic regression analysis. Only one of these factors was statistically significant (hours spent on phototherapy with P- value = 0.044, odds ratio 1.010, 95% CI .988 to 1.032). This means that there was a trend for the development of thrombocytopenia with more hours spent on phototherapy.

Our results were supported by study of **Sonawane et al., 2018** as they reported that in their study population the platelet counts before phototherapy was 252935.48 / mm<sup>3</sup> (SD ± 75640.407) and 223368.42 / mm<sup>3</sup>

(SD  $\pm 48455.285$ ) in the term and preterm neonates respectively. Term had higher platelet counts as compared to pre-term babies which were similar to findings of **Tawab et al. 2014** However; similar facts were not observed by **Khera et al., 2011**.

### CONCLUSION

**We conclude from this study the following:**

1. Phototherapy can significantly decrease the levels of calcium in jaundiced term and preterm infants undergoing phototherapy for 48 hours.
2. Phototherapy in newborns with Indirect Hyperbilirubinemia leads to decrease in platelet count both in term and preterm baby.
3. Platelets Count decrease after Phototherapy is transient, and more significant in Preterm neonates.

### RECOMMENDATION

- Further studies on larger sample size in different geographical area to detect the effect of phototherapy on serum ionized calcium.
- Follow up & monitoring of serum ionized calcium in newborn infants under phototherapy for early detection of hypocalcaemia.

- Monitoring & follow up by CBC for detection of thrombocytopenia and other hematological disorders in newborns under phototherapy.

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## دراسة معدل انخفاض الصفائح الدموية ونسبة الكالسيوم بالدم بعد بدء العلاج الضوئي للصفراء في حديثي الولادة

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اليرقان هو أحد أكثر المشاكل شيوعًا في فترة حديثي الولادة والذي لوحظ في 60% من الولدان الناضجين و80% من الخدج.

العلاج بالضوء يستخدم لعلاج فرط بيليروبين الدم عند الرضع ويتسبب في انتقال البيليروبين من الجلد إلى بلازما الدم وإفرازه.

كان الهدف من هذه الدراسة هو تحديد حدوث نقص كالسيوم الدم ونقص الصفائح بعد بدء العلاج بالضوء.

أجريت الدراسة الحالية على 50 خديجًا على المدى الكامل و50 خديجًا يعانون من فرط بيليروبين الدم غير المقترن المعالج بالعلاج الضوئي. تم تقسيم الولدان إلى مجموعتين متساويتين: المجموعة الأولى: 50 وليدًا كامل المدة (26 ذكرًا و24 أنثى). المجموعة الثانية: 50 خديجًا (27 ذكرًا و23 أنثى). تراوحت مدة الدراسة من 6 إلى 12 شهرًا.

## الإستنتاج:

## أظهرت النتائج الرئيسية للدراسة ما يلي:

- كان هناك 30% من الولدان في المجموعة الأولى (كامل المدة) أصيبوا بنقص كالسيوم الدم بعد 48 ساعة من استخدام العلاج بالضوء. أيضا كان هناك 66% من الولدان الذين يعانون من نقص كالسيوم الدم في المجموعة 1 يعانون من العصبية.
- كان هناك 12% من الولدان في المجموعة الأولى (كامل المدة) أصيبوا بنقص الصفائح بعد 24 ساعة من العلاج بالضوء. كلهم يعانون من قلة الصفائح الخفيفة. لم يصاب أي من الولدان بمضاعفات قلة الصفائح.
- كان هناك 30% من الولدان في المجموعة الأولى (كامل المدة) يعانون من نقص الصفائح (73.3% خفيف، 26.7% متوسط) بعد 48 ساعة من العلاج بالضوء. أيا من الولدان في حالة نقص الصفائح المتقدمة.
- كان هناك انخفاض ذو دلالة إحصائية عالية في مستويات TSB و DSB بعد 24 ساعة و48 ساعة من العلاج بالضوء. كما كان هناك انخفاض معنوي كبير في مستويات الكالسيوم الكلي والمؤين بعد 24 ساعة و48 ساعة من العلاج بالضوء مقارنة بما كان عليه قبل بدء العلاج بالضوء.
- كان هناك انخفاض في عدد الصفائح الدموية بعد (24 ساعة، 48 ساعة) من بدء العلاج بالضوء، بينما لم يكن هناك فرق فيما يتعلق بعدد الصفائح الدموية بعد التوقف عن العلاج بالضوء مقارنة بالمستوى عند القبول.
- أصيب 46% من الولدان في المجموعة الثانية (الخدج) بنقص كالسيوم الدم بعد 48 ساعة من استخدام العلاج بالضوء. كما كان هناك 80% من

الولدان المصابين بنقص كالسيوم الدم في المجموعة الثانية يعانون من التوتر.

● أصيب 10% من الولدان في المجموعة الثانية (الخدج) بنقص الصفائح بعد 24 ساعة من العلاج بالضوء. كلهم يعانون من قلة الصفائح الخفيفة. لم يتطور أي من الولدان في كليهما من مضاعفات قلة الصفائح.

● أصيب 36% من الولدان في المجموعة الثانية (الخدج) بنقص الصفائح (77.8% خفيف، 22.2% متوسط) بعد 48 ساعة من العلاج بالضوء. لم يصاب أي من الولدان بنقص الصفائح الحاد.

● كان هناك انخفاض في مستويات الكالسيوم الكلي والمؤين بعد 24 ساعة و48 ساعة من بدء العلاج بالضوء مقارنة بما كان عليه قبل بدء العلاج بالضوء.

● كان هناك انخفاض معنوي كبير في عدد الصفائح الدموية بعد (24 ساعة، 48 ساعة) من بدء العلاج بالضوء.

● لم يكن هناك فرق معنوي بين المجموعتين المدروستين فيما يتعلق بفصيلة دم الأم والطفل من المجموعتين المدروستين وطريقة الولادة وكذلك الجنس مع غلبة الذكور.

● كان هناك فرق كبير فيما يتعلق بعمر الحمل ووزن الجسم والطول.

● كان هناك فرق كبير بين المجموعتين المدروسة فيما يتعلق بمستويات TSB عند القبول. كما كان هناك فرق كبير فيما يتعلق بيوم الحياة وساعات العلاج بالضوء.

● كان هناك فرق كبير بين المجموعتين المدروستين فيما يتعلق بمستويات الكالسيوم الكلي والمؤين عند القبول وكذلك بعد 48 ساعة من بدء العلاج بالضوء.

● لم يكن هناك فرق معنوي بين المجموعتين المدروستين فيما يتعلق بمستويات الصفائح الدموية 24 ساعة و48 ساعة بعد بدء العلاج بالضوء.

### التوجيهات:

على ضوء نتائج دراستنا نستطيع أن نوصي بإجراء مزيد من الدراسات الطولية على نطاق جغرافي كبير وعلى حجم عينة أكبر للتأكيد على استنتاجنا.