

Yakson's Massage Versus Kangaroo Mother Care on Phototherapy Duration and Serum Bilirubin Level among Neonates with Hyperbilirubinemia

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Abstract

Background: Phototherapy is the most important treatment for hyperbilirubinemia, there are attempting to reduce the duration of phototherapy through application of Yakson's massage and kangaroo mother care (KMC). **Aim:** to investigate the effect of Yakson's massage versus kangaroo mother care on phototherapy duration and serum bilirubin level among neonates with hyperbilirubinemia. **Method:** a quasi-experimental design was utilized. **Sample:** A purposive sample of 90 neonates with hyperbilirubinemia on phototherapy was randomly allocated into three groups: 30 control, 30 received KMC and 30 received Yakson's massage. **Setting:** The study was conducted at Neonatal Intensive Care Unit (NICU) of Pediatric University Hospital, Cairo University Hospitals. **Tools:** Tool (I) Neonatal and mothers' characteristics sheet and Tool (II) Record sheet for duration of phototherapy and total serum bilirubin level. **Results:** the current study revealed that the mean differences between phototherapy duration of studied neonates in Yakson's massage, KMC and control groups was (6.13 ± 1.19 , 5.49 ± 1.60 & 7.07 ± 2.06 days) respectively P value < 0.001. Also, the mean differences between duration of hospital stay of studied neonates in Yakson's massage, KMC and control groups was (6.50 ± 1.08 , 5.93 ± 1.48 & 8.17 ± 1.89 days) respectively P value < 0.001. In addition, there were a highly significance difference between the total serum bilirubin levels of studied neonates after 24, 48 and 72 hours of intervention, after 72 hours the bilirubin level in Yakson's massage group was 9.10 ± 1.62 mg/dl, KMC group was 7.20 ± 1.91 mg/dl while in the control group was 13.59 ± 3.08 mg/dl. **Conclusion:** The use of Yakson's massage or KMC with phototherapy significantly reduced the serum bilirubin levels, shorten the duration of phototherapy and hospital stay compared to use phototherapy alone and there was a highly statistical significant difference in serum bilirubin level in application of KMC with phototherapy compared to Yakson's massage among neonates with hyperbilirubinemia, also KMC reduced mean duration of phototherapy and hospitalization compared to those who received Yakson's massage with no statistical significant differences found between two interventions groups. **Recommendation:** The current study recommended that, establishment of health education program about importance of application of KMC and Yakson's massage for management of neonatal hyperbilirubinemia.

Keywords: Yakson's Massage, KMC, Neonatal Hyperbilirubinemia, Phototherapy, NICU.

Introduction

Neonatal jaundice is a yellowish discoloration of the skin, conjunctiva and the sclera resulting from accelerated serum bilirubin in the neonatal period and occurs in about two thirds of the all newborns (Ansong-Assoku & Ankola, 2018). Hyperbilirubinemia is the most common condition that requires medical attention and hospitalization in neonates (Mitra & Rennie, 2017). Worldwide, hyperbilirubinemia is occurring in approximately 60% of full term neonates and 80% in preterm neonates and develops two to four days after birth then

spontaneously recovered within one to three weeks (Okwundu, Uthman, Suresh, Smith, Wiysonge & Bhutani, 2017). While, 2% of affected neonates are at risk for severe neonatal hyperbilirubinemia in which serum bilirubin level is more than 19.9 mg/dL (McClean, Baerg, Smith-Fehr & Szafron, 2018).

Neonates at risk for jaundice are linked to maternal factors as blood group, mode of delivery and labor induction using oxytocin; and neonatal factors as gender, gestational age and birth weight could influence the incidence and severity of jaundice (Mojtahedi, Izadi, Seirafi, Khedmat

& Tavakolizadeh, 2018). Therefore, preventing susceptible predisposing factors and continuous assessment of neonates after birth could facilitate early diagnosis, management and reducing the subsequent complications to lessen the burden of the disease in the Neonatal Intensive Care Units (NICUs) (**Garosi, Mohammadi & Ranjkesh, 2016**). In addition, blood group ABO and Rh incompatibility, genetic blood disorders, breast milk and insufficient breastfeeding are causes for developing neonatal jaundice (**Lake, Abera, Azeze, Gebeyew & Demissie, 2019**). Consequently, breastfeeding associated jaundice has two different mechanisms including direct effect of mature human milk inducing accelerated intestinal reabsorption of bilirubin and starvation jaundice resulting from inadequate consumption of human milk (**Ketsuwan, Baiya, Maelhacharoenporn & Puapornpong, 2017**).

Unfortunately, jaundice can become severe in some newborn infants, progressing to acute bilirubin encephalopathy and kernicterus with a substantial risk of neonatal mortality and long-term neurodevelopmental impairments. Severe hyperbilirubinemia and its sequelae continue to arise in low-income and middle-income countries primarily due to delay in delivering effective treatments (**Olusanya, Kaplan & Hansen, 2018**). Therefore, the early use of phototherapy can reduce complications and minimize the need for exchange transfusion among term and preterm neonates with hyperbilirubinemia (**Pillai, Pandita, Osiovič & Manhas, 2020**).

Neonatal health care providers and researchers should take into consideration different treatment approach for neonatal jaundice starting from phototherapy to exchange transfusion; each approach has positive effects and drawbacks. Unfortunately, phototherapy side effects include watery diarrhea, increased insensible water loss, skin rashes, skin tanning and blue baby syndrome; also there is a debate whether phototherapy can cause melanoma. Moreover, some complications associated with exchange transfusion as allergic reactions and possible infections (**Garg, Kabra & Balasubramanian, 2019**). Also, separation of the neonate from the mother during phototherapy and exchange transfusion in NICU can emotionally affect the mother and newborn infant bonding. Therefore, it is necessary to concurrently

maintain the normal range of circulating bilirubin and control possible side effects (**Faulhaber, Procianoy & Silveira, 2019**).

Phototherapy is more effective if the length of hospital stay for treatment is shorter to reduce the risks of hospitalization (**Olusanya, Slusher, Imosemi & Emokpae, 2017**). Kangaroo mother care (KMC) is a method which influence the efficacy of phototherapy, KMC facilitating breastfeeding can lead to the early excretion of meconium and prevent bilirubin relapse into the circulatory system (**Pourabol, Mahdih & Jahani, 2019**). Continuous breastfeeding of the newborn can accelerate the milk production and improve the neonate's access to a rich a plentiful amount of calories and liquid which enhance excretion of bilirubin (**Larma'i, Ahmadpourkacho, Zahed, Hajiahmadi & Mazloomi, 2016**).

On the same line, Yakson is a Korean therapeutic touch is applied to neonates by gently massaging the abdomen with one hand while placing the other hand on the neonate's back either to relieve pain or improve circulation. In spite of clinical evidence of its usefulness, there is limited literature available on Yakson touch (**Parashar, Samuel, Bansal & Aranka, 2016**). Yakson touch has appositive effect on improve sleep duration, behavioral response and decrease the stress levels among the neonates. A simple Yakson protocol was developed by **Im and Kim (2009)** which includes some of the key aspects as warm hands, touching without pressure and slow hand movement that are appropriate for neonates and preterm infants.

Eshghi, Iranmanesh, Bahman, Borhani and Motamed (2015) recommended application of Yakson massage for neonates due to its effectiveness, particularly in the areas of pain, relaxation, energy consumption and attachment behavior. On the other hand, the vibration from the mother's skin with the neonate's body in KMC and Yakson massage can enhance the neonate's circulation and can potentially accelerate bowel movements and contribute to the excretion of bilirubin through the digestive system (**Larma'i et al., 2016**). In addition, optimal thermal control and sufficient nutrition may greatly reduce the incidence of neonatal jaundice by preventing neonatal body-weight loss (**Zaitsu, Yoshihara, Nakai & Kubota, 2018**).

Therefore, massaging newborn infant is a natural way for caregivers to improve health and lessen colic (Gözen, Karadağ, Eda, Dur & Caglayan, 2019). Additionally, massage can improve neonatal jaundice that can significantly decrease serum total bilirubin and percutaneous bilirubin levels and increasing defecation frequency (Lei, Liu, Li, Liu, Meng & Jin, 2018). In another study, there is no significant relationship was observed during days one and two of massage therapy between daily frequency of bowel movements and serum bilirubin level (Eghbalian, Rafienezhad & Farnal, 2017). Despite the study of Ibrahim, Ouda, Ismail and Elewa (2019) the study showed that, more than three quarters of nurses had a poor level of practice to care provided to neonates suffering from jaundice and undergoing phototherapy. The neonatal nurses play a critical role in providing phototherapy care by using clinical standards can enhance its effectiveness, safety, reduce phototherapy duration, shorten hospital stay and minimize phototherapy related complications (El Khateeb, Adly & Sadk, 2019).

Significance of the Study

Neonatal jaundice plays a substantial role in neonatal morbidity and mortality worldwide, accounting for 10% of neonatal deaths and 70% of neonatal morbidity (Alkén, Håkansson, Ekéus & Gustafson, 2019 & World Health Organization (WHO), 2018). About 75% of neonatal mortality because of jaundice complications occurred in Africa (Slusher et al., 2017). In Egypt, about 20.4% of full term newborns develop jaundice every year and the incidence of jaundice was found to be higher in low birth weight neonates 35.6% compared with normal birth weight neonates 16.9% (Ahmed, Kassem & Ismail, 2019). According to Abraham, Johnson, Deep, Dip, Yadav and Singh (2018) noticed that, phototherapy is a stressful experience for a neonate, which may interfere with establishing parent-infant bonding on the other hand KMC has a positive impact on establishing the bond between neonate and mother, and massage and KMC can reduce the stressors of neonates from phototherapy (Faulhaber, Procianoy & Silveira, 2019).

Kangaroo mother care demonstrated the neonates with higher scores for attention, arousal, regulation, nonoptimal reflexes and lower scores

for handling and excitability (El-Farrash et al., 2020). World Health Organization (WHO) (2018) guide the health professionals responsible for the care of high risk neonates to provide effective KMC as it was associated with 36% lower mortality, decreased risk of neonatal sepsis, hypothermia, hypoglycemia and hospital readmission. Neonates receiving KMC had lower mean respiratory rate and higher head circumference growth (Boundy et al., 2016). According to Baley et al., (2015) who reported that, skin to skin contact significantly associated with a longer duration of breastfeeding and increased parent satisfaction. Massage and KMC have many benefits, a lack of training and education greatly inhibits its provision in the neonatal environment so neonatal nurse education is imperative in order to improve KMC and massage practice in the clinical setting (Bergelson, Smith, Skotnes & Wall, 2017).

In a recent study, massage therapy was presented as a novel approach to the care of neonatal jaundice, there was a significant effect on the bilirubin levels and the duration of phototherapy mean scores (Dag & Yayan, 2019). Simple touch technique had a significant effect on physiological stability which enhances neonates' health optimization (Manzotti et al., 2019). Moreover, studies by Eghbalian, Rafienezhad and Farnal (2017) & Lin, Yang, Cheng and Yen (2015) showed that neonatal massage is effective in reducing bilirubin levels on the third and fourth days of phototherapy. Furthermore, Yakson's massage and KMC regulating blood circulation, boosting intestinal motility and enhancing bilirubin elimination that minimize the duration of phototherapy and hospitalization. Yakson's massage and KMC are non-invasive therapeutic technique that can easily be carried out and can result in a lowering treatment costs, lessen the duration of the disease and its hazards (Abo El-Magd, Dabash, El-Guindy, Masoed & Elhouchi, 2017).

From empirical observations of the researchers and previous study findings, neonates with hyperbilirubinemia experience discomfort during phototherapy, long phototherapy duration and hospitalization, the pediatric nurses in NICUs and particularly mothers should be knowledgeable about how to care for the neonates receiving phototherapy through application of Yakson's massage and KMC for

those neonates as it has a positive effect on reduction bilirubin level, phototherapy duration, hospitalization and neonates discomfort (Føreland, Rosenberg & Johannessen, 2016). Moreover, conducting the research will add to the pediatric nursing practices, so the aim of the current study was to investigate the effect of Yakson's massage versus kangaroo mother care on phototherapy duration and serum bilirubin level among neonates with hyperbilirubinemia.

Aim of the study:

The current study aimed to investigate the effect of Yakson's massage versus Kangaroo mother care on phototherapy duration and serum bilirubin level among neonates with hyperbilirubinemia.

Research hypotheses

1. Neonates with hyperbilirubinemia who receive Yakson's massage will have lower mean duration of phototherapy and lower serum bilirubin level than those who will receive phototherapy only.
2. Neonates with hyperbilirubinemia who receive Kangaroo Mother Care will have lower mean duration of phototherapy and lower serum bilirubin level than those who will receive phototherapy only.
3. Kangaroo Mother Care will have a positive effect to reduce the mean duration of phototherapy and serum bilirubin level compared to those who will receive Yakson's massage.

Materials and Methods

Operational definition:

Kangaroo Mother Care is an intervention that the researchers guided the mother to apply for their neonates undergoing phototherapy in a special warm room in the NICU for 30-45 minutes at least two times a day at the time of feeding for three days. The mother wear a sterile gown, then the assigned nurse and the researchers placed the neonate naked (wearing only a diaper) between mother's breasts and on his abdomen while lies on a vertical position and the neonate's head under the mother's chin and keep his respiration.

Yakson's massage: the term Yak means medicine and son refers to hand; Yakson's

massage is a technique that applied by the researchers inside the neonate's incubator twice a day at morning and afternoon shift before the time of feeding for three days, it includes three stages of touch that lasting for 15 minutes: (a) hand resting: 5 minutes resting the researcher one hand on the chest and abdomen of a neonate while supporting the back of the neonate with the other hand, (b) gentle caressing: is a placement of the same previous hand position for 5 minutes and the researchers caressed the neonate's chest and abdomen clockwise in a 1 cm diameter circular motion every 10 second, and (c) hand resting: is a placement of the same previous hand position for 5 minutes.

Research design:

A quasi-experimental research design was used to investigate the effect of Yakson's massage and Kangaroo Mother Care on duration of phototherapy and serum bilirubin level among neonates with hyperbilirubinemia and undergoing phototherapy.

Research setting:

The current study was conducted at the Neonatal Intensive Care Unit (NICU) of Pediatric University Hospital which affiliated to Cairo University Hospitals. The setting composed of four partitions: intensive and intermediate care, grower room, intensive care for cardiac neonates and jaundice room. The capacity of jaundice room was 12 cases receiving all management of neonates with hyperbilirubinemia.

Subjects:

A purposive sampling technique was used. The sample size was (90) who their mothers agreed to participate in the current study were divided into three groups, one control group and two intervention groups (Yakson's massage group and KMC group) each group including 30 neonates. The control group was left to hospital care and was collected data from the control group first, then the researchers collected the data of the two intervention groups (the first intervention group was Yakson's massage group and the second intervention group was KMC).

Inclusion criteria: *The inclusion criteria in the studied neonates were as follows:*

- 1- All high risk neonates who were hospitalized in NICU and were diagnosed with neonatal

jaundice regardless gestational age and birth weight.

- 2- Appearance of neonatal jaundice on the second to third day after birth.
- 3- Undergoing phototherapy and phototherapy were performed with an equal number of lamps, using the same type of phototherapy device equipped with same number of lamps at a 45-50 cm distance from the neonate with a wave length of 420-480 nm.
- 4- Had stable physiological parameters and received feeding with 3 hours interval of feeding schedule

Sample size:

The determination of the size of the sample based upon the following sample calculation:

$$n = \frac{N}{1 + N(e)^2} \quad n = \frac{120}{1 + 120(0.05)^2} = 92 \text{ subjects}$$

N= population.

e= error (0.05).

n = sample size (92 neonates with hyperbilirubinemia).

Tools for data collection:

The following tools utilized to collect the required data which developed by the researchers after reviewing the related literature of **Jiao, Jin, Meng and Wen (2018)**; **Ketsuwan et al., (2017)**; **Kanburoğlu, Çizmeçi and Akelma (2016)**; **Jalalodini, Nourian, Goodarzvand, Jahantigh and Amin (2016)**. Tool (I) Neonatal and mothers' characteristics. It included questions related to the neonatal characteristics as gender, gestational age, birth weight, admission weigh and age, age at starting jaundice manifestations, mode of delivery, duration of hospitalization, type of feeding before jaundice and during hospitalization and method of feeding during hospitalization and mothers' characteristics as age, parity, prenatal care and medical history. Tool (II) Record sheet for phototherapy duration and total serum bilirubin level which was measured as baseline data on admission and three times on three days of phototherapy.

Administrative phase:

An official permission was obtained from the director of the NICU at Pediatric University Hospital, Cairo University after clear explanation about the aim, tool, duration and expected outcomes of the study.

Exclusion criteria: The exclusion criteria in the studied neonates were as follows:

- 1- Appearance of neonatal jaundice on the first day after birth.
- 2- Had pathological jaundice, blood group incompatibility and positive Combs' test results.
- 3- Suffer from blood disorders, liver disease, sepsis and critically ill neonates with jaundice.
- 4- Had skin disorders that interfere with the application of Yakson's massage and kangaroo Mother Care.

Pilot study:

A pilot study was carried out before starting actual field work representative 10% of the neonates with hyperbilirubinemia and undergoing phototherapy including (9 neonates) who met the inclusion criteria of the study to evaluate the content and test the feasibility of tools and estimate time required to fulfill the tools. The result of pilot study confirmed that the study was feasible. The sample of the pilot study was included in the total sample size.

Tool validity:

Assessment sheet reviewed by 3 experts one professor in the field of medical high-risk neonates and two professors in the field of pediatric nursing to test content validity and according to their review few modifications were carried out in the content of the assessment sheet.

Ethical considerations:

The researchers obtained written informed consent from the mothers after informing each one about the aim, tools and duration of the study and explain the benefits of the study. Mothers were assured about confidentiality of the data which gathered from their neonates during the study. The researchers informed the mothers

about their right to withdraw their neonates from the study at any time without any effect on the care provided for their neonates.

Procedure:

The actual fieldwork was carried out for 6 months starting from the beginning of January, 2019 to the end of June, 2019. The researchers visited the study settings 3 days/week from 9 am to 3 pm. Before conducting the study an official permission was obtained from the director of the NICU at Pediatric University Hospital, after clear explanation about the aim, tool, duration and expected outcomes of the study. The researchers reviewed the related literature for developing the used tools.

Neonates who met the inclusion criteria and their mothers agreed to participate their neonates in the current study were randomly assigned into both two interventions and control groups, at the beginning of the study, the researchers fill the neonatal and mothers' characteristics from the medical and nursing sheet for each neonate.

Firstly the researchers collected the required data from the control group who left to routine care in the unit (did not receive the intervention) and was undergoing phototherapy. Then the researchers collected the data from the interventions group; (1) the first intervention group who received KMC that was applied by the mother, the researchers prepared a special warm room to apply KMC in the NICU, the mother wore a sterile gown, then the assigned nurse and the researchers placed the neonate naked (wearing only a diaper) between mother's breasts and placed on his abdomen while laying on a vertical position and the neonate's head under the mother's chin and kept his respiration, KMC was applied for 30-45 minutes at least two times a day in the morning, and afternoon shift at the time of feeding for three days.

After that the researchers collected the data from the second intervention group (2) the group who received Yakson's massage that was applied by the researchers in three stages of touch that lasting for 15 minutes: (a) hand resting: 5 minutes resting one hand on the chest and abdomen of a neonate while supporting the back of the neonate with the other hand, (b) gentle caressing; a placement of the same previous hand position for 5 minutes and the researchers caressed the neonate's chest and abdomen clockwise in a 1 centimeter diameter circular motion every 10

second, and (c) hand resting; a placement of the same previous hand position for 5 minutes), Yakson's massage applied by the researchers inside the neonate's incubator twice a day at morning, and afternoon shift before the time of feeding for three days.

The serum bilirubin level was measured and recorded in the control, KMC and Yakson's massage groups on admission before phototherapy as a baseline data at the beginning of the study, after 24, 48 and after 72 hours of the study, using a blood sample from the neonates and that sample was taken by the assigned nurse as doctor order and as a routine investigation for the neonates who were under phototherapy in the NICU. Also the duration of phototherapy and length of hospital stay were recorded from admission until discharge.

Statistical analysis: The statistical analysis of data was done by using the computer software of Microsoft Excel Program and Statistical Package for Social Science (SPSS) version 25. Data were presented using descriptive statistics in the form of frequencies and percentage for categorical data, the arithmetic mean (\bar{X}) and standard deviation (SD) for quantitative data. Qualitative variables were compared using chi square test (χ^2). Difference between three groups were assessed by one-way ANOVA, difference between two groups were assessed by paired T-test. Degrees of significance of results were considered as follows: P-value >0.05 not statistically significant difference, P-value ≤ 0.05 was statistically significant difference and P-value ≤ 0.001 was highly statistically significant difference.

Results

Table (1) more than half of the neonates were males in the Yakson's massage and KMC groups (53.3% & 60% respectively) and half of neonates (50%) were males in the control group. There were no statistically significance difference between the studied neonates characteristics namely gender and mood of delivery while, there were highly significance differences between type of feeding before jaundice and type and methods of feeding during hospitalization in Yakson's massage group, KMC group and control group where P value was (≤ 0.001).

Table (2) illustrates that there were no statistically significance differences between the studied neonates mothers' age, parity and prenatal

care while there was a highly significance difference between mothers' medical history in Yakson's massage, KMC and control groups where P value was (≤ 0.001).

Table (3) reveals that, the mean gestational age of studied neonates in Yakson's massage, KMC and control groups were (37.33 ± 2.10 , 36.87 ± 2.50 & 37.97 ± 2.23 weeks respectively), there were no statistically significance differences between the studied neonates characteristics namely gestational age, admission age, age at starting jaundice manifestations and admission's weight in Yakson's massage, KMC and control groups where P value was ($p > 0.05$).

Table (4) illustrates that, the mean differences between phototherapy duration of studied neonates in Yakson's massage, KMC and control groups were (6.13 ± 1.19 , 5.49 ± 1.60 & 7.07 ± 2.06 days respectively). The mean differences between the duration of hospital stay of studied neonates in Yakson's massage, KMC and control groups were (6.50 ± 1.08 , 5.93 ± 1.48 & 8.17 ± 1.89 days respectively). Also, there were highly statistically significance differences between the two intervention groups and control

group regarding to the duration of phototherapy and the duration of hospital stay where P value was ($p \leq 0.001$).

Table (5) there were highly significance differences between the total serum bilirubin levels of studied neonates in the first, second and third day among Yakson's massage, KMC and control groups at P value ≤ 0.001 . where on the third day the serum bilirubin level was 7.20 ± 1.91 mg/dl in KMC group and 9.10 ± 1.62 mg/dl in Yakson massage group, while 13.59 ± 3.08 mg/dl in the control group.

Table (6) shows that there were highly statistical significance differences between the total serum bilirubin levels of studied neonates in second and third day among Yakson's massage group and KMC group at P value ≤ 0.001 , where on the third day the serum bilirubin level was **7.20 ± 1.91 mg/dl in KMC group and 9.10 ± 1.62 mg/dl in Yakson massage group.** Also KMC group reduced the mean duration of phototherapy and hospitalization compared to those who received Yakson's massage while there were no statistical significant differences found between two interventions groups.

Table (1): Frequency and percentage distributions between Yakson's massage, KMC and control groups regarding to neonatal characteristics and type of milk (n= 90).

Items	Yakson's massage (n=30)		KMC (n=30)		Control group (n=30)		X ²	P-Value
	No.	%	No.	%	No.	%		
Gender								
Male	16	53.3	18	60.0	15	50.0	0.196	0.912
Female	14	46.7	12	40.0	15	50.0		
Mood of delivery								
NVD	13	43.3	14	46.7	12	40.0	0.271	0.873
CS	17	56.7	16	53.3	18	60.0		
Type of feeding before jaundice								
Brest milk	30	100.0	18	60.0	16	53.3	21.70	0.000**
Artificial milk	0	0.0	10	33.3	8	26.7		
Glucose or herbal fluids	0	0.0	2	6.7	6	20.0		
Type of feeding during hospitalization								
Breast milk	0	0.0	4	13.3	7	23.3	36.76	0.000**
Artificial milk	27	90.0	8	26.7	11	36.7		
Both breast milk and artificial milk	3	10.0	16	53.4	7	23.3		
Artificial milk and Intravenous fluids	0	0.0	2	6.6	5	16.7		
Method of feeding during hospitalization								
Oral	30	100.0	19	63.3	22	73.4	12.99	0.000**
Ryle	0	0.0	5	16.7	4	13.3		
Both oral and ryle	0	0.0	6	20.0	4	13.3		

NVD: Normal Vaginal Delivery.

C.S: Cesarean Section

X²: Chi-square test No statistically significant at $p > 0.05$.

Highly statistically significant at $p \leq 0.001$.

Table (2): Frequency and percentage distribution between Yakson's massage, KMC and control groups regarding to mothers' characteristics (n= 90).

Items	Yakson's massage (n=30)		KMC (n=30)		Control group (n=30)		X ²	P-Value
	No.	%	No.	%	No.	%		
Age/ years								
20-<30	16	53.3	13	43.3	15	50.0	1.258	0.266
30-<40	12	40.0	14	46.7	10	33.3		
≥ 40	2	6.7	3	10.0	5	16.7		
Parity								
Primipara	6	20.0	12	40.0	9	30.0	4.088	0.099
Multipara	24	80.0	18	60.0	21	70.0		
Prenatal care								
Yes	26	86.7	25	83.3	22	73.3	0.968	0.508
No	4	13.3	5	16.7	8	26.7		
Mothers' medical history								
No illness	17	56.7	8	26.7	5	16.7	12.08	0.018*
Anemia	1	3.3	7	23.4	6	20.0		
Hypertension	1	3.3	7	23.3	6	20.0		
Diabetes	1	3.3	4	13.3	6	20.0		
Placenta previa and cardiac disease	10	33.4	4	13.3	7	23.3		

NVD: Normal Vaginal Delivery.
X²: Chi-square test.

CS: Cesarean Section
No statistically significant at p > 0.05.

Table (3): Mean differences between neonatal personal characteristics in Yakson's massage, KMC and control groups (n= 90).

Items	Yakson's massage (n=30)	KMC (n=30)	Control group (n=30)	F	P
Gestational age (weeks)	37.33 ± 2.10	36.87 ± 2.50	37.97 ± 2.23	1.748	0.180
Age at admission/days	5.77 ± 2.67	4.63 ± 2.42	5.40 ± 2.58	1.527	0.223
Age at starting jaundice manifestation/days	3.53 ± 2.01	3.20 ± 1.51	3.10 ± 1.58	2.504	0.205
Admission weight (grams)	2591.1 ± 488.6	2507.6 ± 554.3	2544.3 ± 561.5	.183	0.833

F: One-Way ANOVA. No Statistically significant at p > 0.05.

Table (4): Mean differences between phototherapy and hospital stay durations of studied neonates in Yakson's massage, KMC and control groups (n= 90).

Items	Yakson's massage (n=30)	KMC (n=30)	Control group (n=30)	F	P
Duration of phototherapy/ days	6.13 ± 1.19	5.49 ± 1.60	7.07 ± 2.06	31.29	0.000**
Duration of hospital stay/ days	6.50 ± 1.08	5.93 ± 1.48	8.17 ± 1.89	23.201	0.000**

F: One-Way ANOVA. No Statistically significant at p > 0.05.

** Highly statistically significant at p ≤ 0.001.

Table (5): Mean differences in studied neonates' total serum bilirubin between Yakson's massage, KMC and control groups in different time (n=90).

Total serum bilirubin levels (mg/dl)	Yakson's massage (n=30)	KMC (n=30)	Control group (n=30)	F ¹	P
On admission (before phototherapy)	18.14 ± 2.98	19.30 ± 2.98	19.60 ± 3.09	1.946	0.149
After 24 hours of intervention (1 st day)	17.13 ± 2.37	14.50 ± 3.68	17.50 ± 3.8	8.392	0.000**
After 48 hours of intervention (2 nd day)	12.90 ± 2.04	10.80 ± 2.48	15.56 ± 2.36	32.142	0.000**
After 72 hours of intervention (3 rd day)	9.10 ± 1.62	7.20 ± 1.91	13.59 ± 3.08	27.496	0.000**

F¹: One-Way ANOVA. No Statistically significant at p > 0.05. ** Highly statistically significant at p ≤ 0.001.

Table (6): Mean differences in studied neonates' total serum bilirubin level in different time, phototherapy duration and hospital stay between Yakson's massage and KMC groups (n=90).

Items	Yakson's massage (n=30)	KMC (n=30)	Paired T-test	P
Total serum builirubin level mg/dl in different time:				
• On admission (before phototherapy)	18.14 ± 2.98	19.30 ± 2.98	1.276	0.212
• After 24 hours of intervention (1 st day)	17.13 ± 2.37	14.50 ± 3.68	2.734	.011*
• After 48 hours of intervention (2 nd day)	12.90 ± 2.04	10.80 ± 2.48	6.705	0.000**
• After 72 hours of intervention (3 rd day)	9.10 ± 1.62	7.20 ± 1.91	7.028	0.000**
Phototherapy duration/days	6.13 ± 1.19	5.49± 1.60	1.157	0.244
Hospital stay/ days	6.50 ± 1.08	5.93± 1.48	1.524	0.197

Discussion:

Neonatal hyperbilirubinemia is the most common clinical sign seen in neonatal clinical setting. Kangaroo mother care (KMC), and Yakson's massage are a supportive technique that being at the neonatal period and this methods has an important role in the management of hyperbilirubinemia, enhancing nutrition and thermal care of neonates (Sarparast, Farhadi & Sarparast, 2015).

Regarding neonatal characteristics, the study result revealed that, about more than half of the neonates were males in the Yakson's massage and KMC groups and half of neonates were male in the control group with no statistically significant differences between three groups. The study result is supported with the study of Goyal, Srivastava, Bhattacharjee, Goyal & Malhotra (2018) about "*Effect of phototherapy on serum calcium levels in neonates receiving phototherapy for neonatal jaundice*" who found that more than half of neonates were males and while the rest were females. On the same context, in Egypt Ahmed, Kassem & Ismail (2019) studied "effect of intensive phototherapy on bilirubin induced neurological defect in neonates with severe hyperbilirubinemia" and found that majority of neonates with jaundice were males.

While, the current study is contradicted with the study of Jiao, Jin, Meng & Wen (2018) about "*an analysis on treatment effect of blue light phototherapy combined with*

Bifico in treating neonatal hemolytic jaundice" and found that more than half of neonates had jaundice were females. From the researchers' point of view, the culture of the parents in Egypt give more concern to seek care for sick male newborn in appropriate hospital with adequate services as NICU in Pediatric University Hospital more often than females seek care in pharmacy and popular medicine.

Regarding to gestational age, the current study revealed that the mean gestational age of studied neonates in Yakson's massage, KMC and control groups were 37.33±2.10, 36.87±2.50 & 37.97±2.23 weeks respectively with no significant differences. The study goes on line with the study of Kenawi, Dabash, Rashad & El Houchi (2020) in Egypt about "*Behavioral responses of neonates undergoing phototherapy*" revealed that the gestational age of studied neonates ranged from 35 to 40 weeks with a mean of 37.98 ± 1.157 weeks. In addition, the mean gestational age was 37.25 ± 0.91 for jaundiced neonates admitted to Bab Alsharyaia University Hospital in Egypt (El-Farrash et al., 2020).

The current study contradicted with the study of Yang, Liu & Chen (2019) about "*Comparison of transcutaneous and serum bilirubin before, under and after phototherapy in term and late preterm infants*" who reported that, more than half of neonates had gestational age between 34 to <37 while the rest of neonates had gestational age more than 37 weeks. From the researchers point of view

and clinical observation younger high risk neonates by means less gestational age as 37 weeks or less and less weight are at higher risk for hyperbilirubinemia and hospitalization in NICU as a result those neonates are more fragile and had less developed organs, less capability of feeding intake than full term and pot term neonates as they need more concern in management of jaundice in NICUs.

The current study found that, more than half of neonates in Yakson's massage and KMC groups and nearly two thirds in control group were delivered cesarean section with no statistically significance difference between the studied neonates mood of delivery. The study supported with **Ozdemirci, Kut & Salgur (2016)** who studied "*Late Preterm and Term Birth: Neonatal Hyperbilirubinemia and Birth Model*" and concluded that, Neonates in the cesarean group had a significantly higher rate of hyperbilirubinemia. While the current study contradicted with **Farhat, Hafizi, Pourhoseini, Halim, Mohammadzadeh & Saeidi (2016)** who studied "*Comparison of bilirubin level in term infants born by vaginal delivery and cesarean section*" and stated that, the bilirubin level of term infants delivered by cesarean section was slightly higher than that of neonates delivered through normal vaginal delivery, yet this difference was not statistically significant. The researchers believe that, the cesarean delivery lead to higher rate of neonatal jaundice compared with normal vaginal delivery.

Regarding to type of feeding during hospitalization, the current study found that the majority of neonates in Yakson's massage group took artificial milk and more than half of neonates in KMC group took breast milk and artificial milk while more than one third in the control group took artificial milk and there were a highly statistically significance difference between type of feeding before jaundice and type and methods of feeding during hospitalization in Yakson's massage group, KMC group and control group. This result is in accordance with the study carried out in Egypt by **El-Hadary, Dabash, El Guindy & El Hochi (2015)** under title of "*factors affecting accuracy of measuring transcutaneous bilirubin level in the neonates with hyperbilirubinemia*" that found that the

vast majority of neonates were on formula feeding. While the result of current study was in disagreement with respect with the study conducted by **Lake et al. (2019)** studied "*magnitude of neonatal jaundice and its associated factor in neonatal intensive care units of Mekelle city public hospitals*" and found that, the vast majority of neonates were fed breast milk.

From the researchers point of view breastfeeding can reduce the level of bilirubin because it enhance proper nutritional intake that help in improving intestinal motility and excretion of toxic substance of bilirubin in urine and stool but the highest percentage of mothers in the current study had cesarean section that may lead to little attendance to the neonates in hospital to provide breastfeeding. In most neonates with Jaundice breastfeeding can and should continue more feedings can reduce the risk of jaundice. According to **Flaherman et al. (2017)**, there no significant differences in total serum bilirubin between breastfed and formula fed infants with jaundice. Breastfeeding is a very important part of caring for neonates with neonatal jaundice during hospitalization and after discharge, nurses should take measures to help the mother achieve successful breastfeeding, including consultation with a lactation specialist (**Hockenberry & Wilson, 2017**).

The current study revealed that, the mean neonates' admission weight were 2591.1 ± 488.6 , 2507.6 ± 554.3 & 2544.3 ± 561.5 grams respectively in Yakson's massage, KMC and control groups. The current study was in accordance with **Mreihil, Benth, Stensvold, Nakstad & Hansen (2017)** who studied "*Phototherapy is commonly used for neonatal jaundice but greater control is needed to avoid toxicity in the most vulnerable infants*" and found that, neonates admission weight was (2000-2449 grams) and weight on last day of phototherapy was (≥ 2500 grams) with mean age of admission 5.5 ± 3.4 days. The current study is contradicted with **El Fekey, El-Sharkawy, Ahmed, Nassar & Elgendy (2019)** who studied "*Effect of intravenous immunoglobulin in reducing bilirubin levels in hemolytic disease of neonate*" and reported that, mean birth weight was 3.21 ± 0.39 . From the researchers point of view, weight loss of

neonates normally as resulting from loss of extracellular fluids, passage of meconium and as the neonates with weak sucking reflex which leads to delayed feeding intake of the disease process and jaundice manifestations.

Regarding to the current study, there were no statistically significance difference between the studied neonates mean age at starting jaundice manifestations in Yakson's massage, KMC and control groups were 3.53 ± 2.01 , 3.20 ± 1.51 & 3.10 ± 1.58 days respectively. The current study is supported with **Ullah, Rahman & Hedayati (2016)** who studied "*Hyperbilirubinemia in neonates: types, causes, clinical examinations, preventive measures and treatments*" and found that, the physiological jaundice was the most prevalent type, most of neonates had jaundice with the clinical yellowish discoloration occurred after the third day of life.

The current study finding revealed that, the mean age of studied neonates at admission in Yakson's massage, KMC and control groups were 5.77 ± 2.67 , 4.63 ± 2.42 and 5.40 ± 2.58 days respectively. This result is supported with the study of **Kenawi et al. (2020)** who found that, the mean age of neonates on admission and starting phototherapy was 5.50 ± 3.83 days. Also, **Altuntas, Dogan & Kislal (2018)** who studied "*effect of phototherapy on neutrophil versus parameters and white blood cells*" and found that the mean age at admission is 6.05 ± 3.7 days. From the researchers point of view parents were either not alert to the hyperbilirubinemia signs or were seeking others inappropriate medical advice which may lead to delayed hospital admission for neonates with jaundice, so the neonatal nurse should give written and verbal instruction to parents about hyperbilirubinemia before discharge from maternal postpartum unit.

The current study finding revealed that, the mean differences between phototherapy duration of studied neonates in Yakson's massage, KMC and control groups were 6.13 ± 1.19 , 5.49 ± 1.60 and 7.07 ± 2.06 days respectively. Also, the mean differences between duration of hospital stay of studied neonates in Yakson's massage, KMC and control groups were 6.50 ± 1.08 , 5.93 ± 1.48

and 8.17 ± 1.89 days respectively, and there were highly statistically significance differences between the two interventions groups and control group regarding to the duration phototherapy and the duration of hospital stay. Also there were statistically significance differences between the KMC group and Yakson's massage group regarding total serum bilirubin level in second and third day of intervention while no statistical significant differences found between two interventions group regarding phototherapy duration and hospitalization.

The study goes on line with **Kenari, Aziznejadroshan, Mojaveri & Tilaki (2020)** who studied "*comparing the effect of kangaroo mother care and field massage on serum bilirubin level of term neonates with hyperbilirubinemia under phototherapy in the neonatal ward*" and found that the mean duration of phototherapy and hospitalization had no significant difference between two intervention groups and significantly higher in control group compared to intervention groups, use of massage or KMC with phototherapy compared to the phototherapy alone can reduce the bilirubin level, phototherapy duration and hospital stay.

Regarding to neonates' total serum bilirubin level between Yakson's massage, KMC and control groups, the current study revealed that there was a highly statistically significance difference between the mean total serum bilirubin levels of studied neonates after 24, 48 and 72 hours of intervention in Yakson's massage group was 9.10 ± 1.62 mg/dl, kangaroo care group was 7.20 ± 1.91 mg/dl while in the control group was 13.59 ± 3.08 mg/dl with significant reduction in total serum bilirubin in the two interventions groups compared to the control group. The current study is in congruent with **Kenari et al. (2020)** who found that, there was a significant difference between the interventions and control groups.

The current study finding goes on line with **Jalalodini et al. (2016)** who studied "*The effect of tactile-kinesthetic massage on transcutaneous bilirubin in term neonates with hyperbilirubinemia care with phototherapy*" and found the mean bilirubin in

the intervention group and pre intervention were statically significantly different. However, the mean of bilirubin and the number of meconium defecation did not show a statistically significant difference between the two groups, massage can cause an impact on bilirubin reduction in neonates. Therefore, nurses can use this method as a non-pharmaceutical method along with phototherapy for reduction of bilirubin.

From the researchers point of view, the application of Yakson's massage and KMC is not only make effective communication between mothers or nurses and neonates and improves their comfort, but also can lead to better nutrition for the neonates, increase the bowel movement, digestion, excretion of stool and prevent bilirubin reabsorption from the digestive system to the blood, which in turn leads to a rapid decrease in serum bilirubin level.

In the same context, massage with enema and phototherapy considerably reduced bilirubin at the age of 14 days; massage with bathing appears to be the most effective, but massage therapy could not eliminate the need for phototherapy in the third and fourth days of life (**Abdellatif et al., 2020**). According to the study conducted by **Gözen et al. (2019)** who discovered a linear relationship between massage and the treatment of neonatal jaundice and that the mean of bilirubin decreases as the level of intervention with massage duration and frequency increases, this relationship can strengthen the scientific basis for therapeutic intervention in the NICU for the treatment of neonatal jaundice. Last but not least, it appears that massage therapy can help prevent hospitalization in newborns with jaundice, shorten hospital stays, or avoid exchange transfusions.

Conclusion:

The current study findings concluded that, there was a highly statistically significant difference between the total serum bilirubin levels of the studied neonates receiving phototherapy in NICU after 24, 48 and 72 hours of intervention in Yakson's massage group was 9.10 ± 1.62 mg/dl, KMC group was 7.20 ± 1.91 mg/dl while in the control group was 13.59 ± 3.08 mg/dl at P value ≤ 0.001 . In

addition, KMC with phototherapy reduced the serum bilirubin levels and shortened the duration of phototherapy and hospitalization of the studied neonates with hyperbilirubinemia faster than in Yakson's massage with highly statistical significance differences between for the total serum bilirubin levels of studied neonates in second and third day among Yakson's massage group and KMC group at P value ≤ 0.001 .

Kangaroo mother care group reduced the duration of phototherapy and hospitalization compared to Yakson's massage group but there were no statistical significance differences in phototherapy duration and hospital stay between Yakson's massage and KMC groups.

Recommendations:

In the light of the findings of the current study, the following recommendations are recommended that:

1. Application of KMC or Yakson's Massage therapy combined with phototherapy as an effective method for reducing serum total bilirubin in neonates with hyperbilirubinemia.
2. Establishment of health education program about importance of the application of Yakson's massage and KMC for management of neonatal hyperbilirubinemia in clinical setting and in home care.
3. Replication of the current study on a large sample for generalization of the study.

Limitation of the study

Some of the mothers whose their deliver was cesarean section and from far areas could not able to attend more than twice a week to apply KMC and those sample where excluded from the study.

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