Effect of Umbilical Cord Care Intervention Program on mothers' Performance and Occurrence of Cord Problems among Their Newborn Infants

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Abstract: *WHO recommends essential newborn care practices including promotion and support for early initiation of exclusive breastfeeding, thermal protection including promoting skin-to-skin contact, hygienic and umbilical cord care to reduce neonatal mortality and morbidity.* **The aim** *of this quasi-experimental study was to evaluate the effect of umbilical cord care intervention program on mothers' performance and occurrence of cord problems among their newborn infants. A total of 400 mothers with their newborn infants who attended the postnatal units at Ismalia University Hospital and General Hospital, Ismalia, Egypt, were recruited for this study.* **Data** *was collected through a structured interview questionnaire; newborn follow-up sheet and an observation checklist.* **Results** *indicated that before implementation of intervention program lake of satisfactory knowledge and practice was found among mothers in both groups related to cord care and the total mean scores for immediate post and follow up tests of intervention group were statistically significantly higher(p<0. 001), compared to their pre-intervention and control group scores. Regarding newborn follow-up, the results revealed that the minority of newborns in intervention mothers' group (0.5%) developed umbilical cord infection signs and 99.5% their cord sloughed off before the end of the two weeks. It could be* **concluded** *that, mothers who received umbilical cord care intervention program had higher total mean score of knowledge and practice than pre-intervention and control group with highly statistical significant differences. The results also concluded that nearly all of newborn infants of intervention mothers group not exposed to the occurrence of cord infection signs and their cord slough off within normal expected time. The study* **recommended** *that educational intervention regarding neonatal care is required during the period of antenatal visit. Researches, study the effect of newborn cord care practices on the incidence of newborn morbidity.*
Keywords: *newborn cord care, cord problems*

I. Introduction

        Neonates died in the first month of life from conditions and diseases associated with lack of quality care at birth or skilled care and treatment immediately after birth **(Castalino et al., 2014)**.Globally, about 130 million babies are delivered annually, 4 million die within the first 4 weeks of life and 25 percent of these deaths are as a result of umbilical cord infection In developing countries, most of newborn cord care is home based since two third of births take place at home **(lawn et al., 2012)**. Evidence-based reports have shown that, globally, about150, 000 neonates die annually from omphalitis **(Easter, 2014)**. Pregnant women and young children in Egypt face persistent health challenges. In Egypt, Neonatal mortality has been declining more slowly than under-five mortality and now accounts for 52% of all under-five deaths **(lawn et al., 2010; WHO, 2017)**.

        Neonates are at risk for various health problems, even though they are born with average birth weights. The morbidity and mortality rates in newborn infants are high, and they need optimal care for improved survival **(Ministry of Health and Population, 2014)**. being spread to more sensitive individuals in the family. Newborn babies are also at risk from maternal infection if hygiene is not adequate and good hygiene by nurses; mothers would reduce the likelihood of cold, dermatitis, herpes, and skin diseases. The daily cleansing of the infant affords an excellent opportunity for making the observation that necessary during the immediate postnatal period **(Shahjahan et al., 2012)**. Neonatal care is highly cost-effective because saving the life of a newborn baby is associated with survival and productivity of the future adult. Although parents are ultimately responsible for this care, nurses usually assume a major care-giving role while the infant is in the nursery **(Khadduri et al., 2008; Gathara et al., 2011)**.

        Newborn survival has become an important issue to improve the child health status and for achieving the millennium developmental goals. Neonatal health and survival is enhanced by providing essential newborn care such as cleanliness, thermal protection, initiation of breathing, early and exclusive breastfeeding, eye care,

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immunization, and management of newborn illness, Care provided by the mothers to their newborn depends on knowledge and practice of the mothers regarding newborn care and determines the newborn's heath status **(Shrestha et al., 2013)**.

The umbilical cord stump is colonized by bacteria from environmental sources such as the mother's birth canal, skin flora, and the hands of caregivers **(Nourian et al., 2009)**. The unhealed umbilical cord is an important portal for local and invasive infections through the patent vessels that provide direct communication of microorganisms **(Sawardekar, 2004; Mullany et al., 2007)**. The mother should be aware of danger signs of umbilical cord infection including pus discharge, reddening around umbilical stump and/or the surrounding skin and other signs of infection including fever, lethargy and difficulty in breathing **(WHO, 1996)**.

In many cultures, some substances are applied to the cord stump and are associated with high risk of infection **(Zupan, 2004 ; sinah et al., 2015)**; as ashes, oil, butter, spice pastes, herbs and mud **(Adebami, 2014)**. These substances are often contaminated with bacteria and bacterial spores that increase the frequency of complications like cord sepsis, septicemia, umbilical cord granuloma, excessive bleeding, Omphalitis and tetanus. These conditions contribute significantly to neonatal morbidity and mortality **(Mahrous et al., 2012)**. Appropriate cord care therefore, contributes largely to the well-being of the newborn **(Adebami, 2014)**.

Umbilical cord separation time is affected by how clean umbilical cord care, humidity cord, environmental sanitation around the newborn. In addition, factors that delay the process of cord stump separation are the application of antiseptics to the stump, the incidence of infection of the umbilical cord and caesarean section **(Whaly & Wong, 2003)**.

So, an important role of nurses is practicing cord care at birth and in the days following birth which is effective in preventing cord infections. Clean cord care practices include washing hands with clean water and soap before delivery and wear sterile gloves before cutting the cord, cutting the cord with a sterile instrument, keeping the cord stump dry, exposed to air or loosely covered with clean clothes **(Swardekar, 2004)**.Another practices which the nurses do that may reduce the risk of cord infection are the use of 24-hours rooming-in instead of nurseries in institutions and skin-to-skin contact with the mother at birth to promote colonization of the newborn with non-pathogenic bacteria from the mother's skin flora. Also, nurses should encourage early and frequent breast feeding that will provide the newborn with antibodies against infections **(Nandrup-Bus et al., 2003)**.

Education programs with effective teaching strategies motivate mothers to follow healthy practices in day-to-day life. The educative role of the nurse needs to be emphasized. Furthermore, newborn health is directly linked to maternal health and hence improving birth outcomes depends on also improving maternal health care during pregnancy through antenatal care, skilled delivery, and the postpartum period by providing postpartum care **(Moyer et al., 2012)**.

Significance of the Study

The neonatal mortality rate in Egypt was 14 deaths per 1,000 births. Neonates who die within the first 28 days of birth suffer from conditions and diseases associated with lack of quality care at birth or skilled care and treatment immediately after birth **(Ministry of Health and Population, 2014)**. Mother's education of newborn-care practices and the enhancement of the role of nurse can lead to improvements of the mother's outcome and process of care during postnatal period. However, fewest researches regarding newborn cord care practices among mothers in Egypt, and most newborn-care practices such as cord care are performed by their mothers. Therefore this study aimed to evaluate newborn cord care knowledge and practices among mothers in order to inform policy and development of feasible and sustainable maternal and child health-based interventions that can improve the survival of newborn infant.

Aim of the Study

The study aimed to evaluate the effect of umbilical cord care intervention program for mothers on their performance and occurrence of cord problems among their newborn infants.

Objectives

1-Assess mothers' knowledge and practice regarding umbilical cord care.
2- Implement the designed umbilical cord care intervention program for mothers'   intervention group.
3-Evaluate the outcome of implemented umbilical cord care intervention program.

The Research hypotheses

H1. Mothers who received umbilical cord care intervention program will have higher mean score of knowledge and practice than mothers in control group.
H2. Newborn infants of mothers who received umbilical cord care intervention program will expose to less umbilical cord problems than newborn infants of mothers in control group.

Operational Definition

Knowledge: Ability to describe the procedure of umbilical cord care and also the level of education of the care taker. .

Practice: It refers to the activities which are undertaken by care taker in relation to the umbilical cord care

Umbilical Cord Care: In this study the umbilical cord care refers to the care given to the umbilicus of neonates at birth like cutting, tying and caring for the cord.

Umbilical Cord Infection (Omphalitis): Defined as either pus discharge with erythema of the abdominal skin, redness with or without pus and or foul smelling.

Management outcome: entails cord separation time and healing in relation to material used for cord care. If there was any infection (red skin around the base of the cord, yellow discharge from the cord, foul smelling cord, pain when touched the skin around the cord, and how it was managed.

II. Subjects and Methods

Research design: Two-group pre-posttest quasi-experimental design was used in the current study.

Setting

The study conducted at both settings first one was, Ismailia University Hospital, postpartum unit, affiliated to Suez Canal University and second one was General Hospital in postpartum unit affiliated to Ministry of Health, Ismailia, Egypt. This is providing free health care to maternity as well as gynecological and family planning services.

Subjects:

A non-probability purposive sample of 400 mothers participated in the current study sample and were recruited from the postpartum units in the both previous mentioned settings based on simple random sampling technique with the following inclusion criteria: healthy full term neonates (38-42 weeks gestation); free from congenital anomalies; roomed-in with their mothers and all babies were fed by their own mother's milk ,birth weight 2500 to 4000 grams; Apgar score at first and fifth minute equal 7or more, and they were delivered with vaginal and cesarean section included in the study. Neonates who develop medical complications as respiratory distress, asphyxia, or metabolic disorders also, mother whose neonate delivered with cord or skin disorders, or mothers attended a previous similar training were also excluded from the study. Up on inclusion criteria in the study sample, mothers with their newborn infants were randomly assigned into two equal groups; intervention and control groups, each group was constituted (200) mothers with their newborn infants.

Tools for data collection

Three tools were used for data collection. A structured interview questionnaire, newborn follow-up sheet (both of them were developed by the researcher based on an extensive review of relevant literature) and an observation checklist.

Structured interview questionnaire: This tool included three parts: the first part included data related to the mothers (e.g., mother's age and educational level); the second part included data related to the neonate as gestational age, gender and birth weight; Third part included mother knowledge about umbilical cord care (e.g., meaning of standard cord care, material used for tying cord, solution used for cleaning cord , umbilical cord time detachment, umbilical cord infection signs(omphilitis) and umbilical cord care benefits). Researcher asked questions in a simple Arabic language and recorded the answers in the structure interview tool. Interview consumed about 15 minutes for each mother.

For the knowledge correct response was scored 1 and the incorrect 0 for, the scores of questions were summed up and divided by the number of the items giving a mean score. These scores were converted into a percent score, means and standard deviation. The mothers' knowledge was considered satisfactory if percent score was 50% or more and unsatisfactory if less 50%.

Follow up sheet for signs of cord infection

This sheet was developed and filled by the researcher. This tool included check for early signs of infection (e.g., redness, swelling, secretion of blood or pus, odor or tenderness), the routine check was performed till the cord detachment occurs and time of cord separation.

An observation checklist: adopted from **Hockenberry and Wilson, (2014)** this was for cord care (12 items).Each step was checked as "correct" or "incorrect" these were scored one and zero respectively. The scores of checklist for total practices were summed-up and converted into percent scores. And then categorized as following: the total score of practice less than 50% was considered as unsatisfactory while score of 50% and more of practice was considered as satisfactory level.

Tools Validity

The adapted tools were reviewed by jury of experts in the field of Obstetrics and Gynecology nursing & pediatric nursing Faculty staff for clarity, relevance, comprehensiveness, understanding, applicability and ease for implementation. They were requested to express their opinions and comments on the tool and provide any suggestions for any additional or omissions of items. Then necessary modifications were done. Validation was performed through experts' majority agreement. Measuring their internal consistency by determining Cronbach alpha coefficient = 0.823.

Pilot study

A pilot study was carried out on 10% of the total sample to check clarity of items and determine the feasibility of the research. All mothers with their neonates participated in the pilot research were excluded from the study sample.

Procedure: Agreement to conduct the study was obtained from the head of the postpartum units in both previous settings in Ismalia, Egypt, also, nurses and mothers' agreement to participate in the study was obtained after mothers had been fully informed about the study. Data were collected through four phases: assessment, planning, implementation, and evaluation & follow-up phases. *Assessment phase:* pretest was done for all (400) mothers in both groups to evaluate mothers knowledge and practice in relation to newborn cord care. The researcher met with mothers and their newborn infants in the postnatal units for a clear and simple explanation of the aim and nature of the study. Those who fulfilled the eligibility criteria and gave their written consent were participated in the study sample. Each mother was asked to carry out the newborn cord care as a pretest and was observed using the corresponding checklist; it took about 20 to 30 mints. *Planning phase:* during this phase, the researcher prepared and designed intervention program in simple Arabic language based on pertinent literature review; it included knowledge and the steps of newborn cord care practices with illustrated pictures to facilitate teaching of practices.

Implementation phase: the program for theory and practice was implemented to mothers in two sessions; each mother in intervention group was informed about the importance of the newborn cord care-practices under the current study. Researcher gave mothers instructions and educational message regarding hygienic of umbilical cord care and the surrounding skin every 8 hours and as needed during diaper changes. Intervention mothers group were instructed to wash the umbilical stump with ethyl alcohol three times a day for two days after umbilical separation. A cotton swab is usually the easiest way to clean the umbilical cord. Gently wipe around the sides of the stump and the skin around it. Wipe along the entire cord from the umbilical base upward. Wipe away any wet, sticky, or dirty substances. After the stump falls off continue cleaning around the navel at least once a day until the navel has completely healed (about 2 days after stump falls off). Moreover, sponge bath is preferable during the healing process.

Steps of cord care were explained with teaching materials and demonstrated by the researcher and re-demonstration was carried out by each mother individually on a small doll. The researcher observed each mother, and reassured the mother if any mistakes were committed, and discussed it took about 20 to 30 mints for each mothers group that composed of five mothers.

Follow up for signs of cord infection, researcher follow up the compliance of mothers regarding instructions of cord care using checklist, signs of cord infection and Omphalitis (inflammation of the umbilical cord region) were examined by naked eye and recorded and the day of cord separation by daily phone call until cord fall off. The duration for umbilical cord separation was measured from the date of birth to the date of separation. All mothers had educational leaflet which developed by the researcher before discharge from the hospital included: method of cord care, time of cord detachment and when to call the researcher to make referral to the pediatrician (if the baby develops a fever or if the umbilical area appears red and swollen around the cord; crying when the mother touches the cord or skin around it; continues to bleed; or oozes yellowish pus; and produces a foul smelling discharge).

Evaluation & follow-up phase: the effect of cord care intervention program on mothers' practice was assessed immediately after the implementation phase it took about 20 mints, as well as one month later (follow-up). This study was conducted in a period of 6 months from January 2018 up to June 2018. Researcher collected data four days per week (Monday, Tuesday, Wednesday &Thursday) (8 am – 2pm), to collect data from both groups.

Ethical Consideration

An official permission was granted from the director of the Maternity units. The researcher introduced themselves to mothers who had meeting the inclusion criteria and informed them about the purpose of this research in order to obtain their acceptance to share in this research and assured that, the research posed no risk or hazards on their neonates. All mothers were informed that, participation in the research is voluntary and can withdraw from this research anytime. Consent was obtained from mothers who were willing to participate in the research and permission sought from nurses in charge of postpartum units.

Statistical Analysis

Collected data were coded and tabulated using personal computer. Data were analyzed using the Statistical Package for Social Science (SPSS) version 13 (SPSS Inc. Chicago, IL). Numerical data were expressed as the mean and standard deviation (SD) while qualitative data were expressed as frequency and percentage. For quantitative data, while Fisher's exact test was used for comparison of non-parametric data. For multiple group comparison of quantitative data one way analysis of variance test (ANOVA). Probability (p-value) less than 0.05 was considered significant and less than 0.01 was considered highly significant.

The study results

The aim of the current study was to evaluate the effect of umbilical cord-care intervention program on mothers' performance and occurrence of cord problems among their newborn infants. Finding of this quasi experimental study will be presented in three main parts: description of the sample, mothers' knowledge and practice pre, immediate post and follow up tests of the intervention program and follow-up of the newborn cord problems after one month of intervention program.

Part I: Description of Mothers and their newborn infants

Table 1: illustrates that, the mean age of the mothers in intervention group were 25.9±5.2, half (50%) of the mothers were highly educated level and (40%) of them educated to middle level. While in control group, the mean age of the mothers was 21.4±5.4, and the highest percentage of the mothers (75%) got diploma and 16% of them had high education. Concerning parity, the majority (78%) of the mothers in intervention group had from 2 to 3 children, nevertheless the mothers in control group, more than two thirds (65%) had from 4to 5 children. The same table shows that boys constituted more than half (51%) in intervention group, where girls constituted (53%) in control group.

Table (1): Mothers and their newborn infants characteristics among intervention and control groups of the study (n=400).

variables	Intervention group N=200		Control group N=200	
Mother's Age/years Mean± SD	25.9±5.2		21.4±5.4	
Education Level	NO	%	NO	%
terate	00	00	8	4
ad & write	10	5	10	5
ddle	80	40	150	75
th	110	55	32	16
Resident Urban	88	44	100	50
rural	102	56	100	50
Parity Primi Para		5	12	
2-3		8	22	
3-4			24	
4-5			130	
>5			12	
Gender Boys	102	51	94	
Girls	98	49	106	
Birth weight in kilogram Mean ± SD	3.250± 450.14		3.010 ±100. 12	

Part II: Mothers' knowledge and practice pre, immediate post and follow up tests of intervention

Table2: presents satisfactory knowledge about umbilical cord as reported by mothers in the intervention and control groups pre, post and at the follow up (after one month) of the intervention, it was found that there were no statistical significant differences between the both groups regarding satisfactory knowledge of umbilical cord before implementation of the intervention program, while it was noticed that percentage of studied mothers with satisfactory knowledge regarding umbilical cord were higher in the intervention group compared with their pre intervention mothers in control group immediately after implementation of the intervention program and the follow up posttest(after one month)of the intervention program. There was statistical significant differences between both groups immediate post and at the follow up posttest (after one month)of the intervention program regarding satisfactory knowledge about umbilical cord (P<0.001).

Table (2): Satisfactory knowledge about umbilical cord care as reported by mothers in the intervention and control groups pre, post and at the follow up (after one month) of the intervention program(n=400).

Items	Time	Intervention group N=200		Control group N=200		Chi-square test	P -value
		NO	%	NO	%		
Meaning of standard cord care	PRE	2	1.0	3	1.5	Fisher	1.00
	POST	196	98.0	1	0.5	380.37	<0.001
	FU	96	48.0	2	1.0	119.42	<0.001
Material for tying umbilical cord	PRE	8	4.0	13	6.5	1.26	0.26
	POST	198	99.0	13	6.5	343.29	<0.001
	FU	197	98.5	13	6.5	339.41	<0.001
Solution used for cleaning cord	PRE	59	29.5	83	41.3	6.29	0.01
	POST	198	99.0	89	44.5	146.54	<0.001
	FU	197	98.0	95	47.5	131.96	<0.001
Umbilical cord separation time	PRE	3	1.5	10	5.0	3.90	0.05
	POST	199	99.5	11	5.5	354.33	<0.001
	FU	198	99.0	12	6.0	346.83	<0.001
Umbilical cord infection signs	PRE	4	2.0	2	1.0	Fisher	0.69
	POST	197	98.5	2	1.0	380.26	<0.001
	FU	196	98.0	2	1.0	376.40	<0.001
Umbilical cord care benefits	PRE	3	1.5	7	3.5	1.64	0.20
	POST	197	98.5	5	2.5	368.68	<0.001
	FU	110	55.0	6	3.0	131.33	<0.001
Total	PRE	7	3.5	13	6.5	1.89	0.17
	POST	195	97.5	13	6.5	331.77	<0.001
	FU	192	96.0	14	7.0	317.13	<0.001

Table3:shows the mean scores of satisfactory knowledge about umbilical cord care among studied mothers in the intervention and control groups pre, post and follow up tests (after one month) of intervention program. before implementation of the program knowledge of mothers in intervention group was satisfactory and the mean scores were reached (25.9 ± 3.0).Meanwhile the highest mean scores of satisfactory mothers knowledge regarding umbilical cord were in immediate post intervention(72.6 ± 8.0) followed by follow up mean scores(67.4 ± 7.5).All the differences were statistical significant(P<0.001). However, in control group, it was found that mother's knowledge about umbilical cord through pre , immediate post intervention and follow up tests (after one month)of intervention program was unsatisfactory and the mean scores were(27.2 ± 3,5 - 27.4 ± 3.4 and 27.8 ± 4.5) respectively with no statistical significantly differences.

Table (3):Mean scores of satisfactory knowledge about umbilical cord care among studied mothers in the intervention and control groups pre, immediate post and follow up tests (after one month) of intervention program(n=400).

Satisfactory knowledge	Pre Mean ± SD	Post Mean ± SD	FU Mean ± SD	ANOVA test	P-value
Intervention group (n=200)	25.9 ± 3.0	72.6 ± 8.0	67.4 ± 7.5	3024.53	<0.001
Control group (n=200)	27.2 ± 3,5	27.4 ± 3.4	27.8 ± 4.5	1.2	0.30

Practices related to cord care was observed for studied mothers in both groups are presented in **table (4)**, before implementation of program, the practice of mothers in intervention group was unsatisfactory and the mean score was reached (16.9 ± 4.1). Immediate post intervention program the results showed much

improvement in practices of mothers and the mean score was (85.7 ± 8.4) of satisfactory practice related to cord care. The satisfactory practice mean scores at the follow up posttest(after one month) were less than that of immediate post intervention (48.6 ± 10.5).All the differences between pre ,immediate post and follow up tests (after one month)of intervention program were statistically significant(P<0.001).In control group the same table shows that the practice was unsatisfactory and the mean scores were similar in pre ,immediate post and follow up tests(after one month)of the intervention program, with no statistical significant differences.

Table (4):Mean scores of satisfactory practice regarding cord care among studied mothers in the intervention and control groups pre, immediate post and follow up tests (after one month) of intervention program(n=400).

Satisfactory practice	Pre	Post	FU	ANOVA test	P-value
	Mean ± SD	Mean ± SD	Mean ± SD		
Intervention group(n=200)	16.9 ± 4.1	85.7 ± 8.4	48.6 ± 10.5	3602.2	<0.001
Control group (n=200)	19.0 ± 3.8	19.3 ± 3.6	19.3 ± 3.6	0.37	0.69

Part III: Follow-up of the newborn infant after one month of intervention
        Table 5: indicates the minority of newborn infants (0.5%) of mothers in the intervention group had delayed cord slough off compared with those newborn infants (5.0%) of mothers in control group, with statistical significant differences between both groups also, the same table shows that 0.5% & 3.5% of newborn infants of mothers in the intervention and control groups exposed to umbilical cord infection respectively, with no statistical significant difference between both groups.

Table (5): Umbilical cord problems among newborn infants of studied mothers in the intervention and control groups after one month from intervention program (n=400).

Umbilical cord problems	Intervention group (n=200)		Control group (n=200)		Chi-square test	p-value
	NO	%	NO	%		
Delay cord slough off	1	0.5	10	5.0	7.57	0.006
Umbilical cord infection	1	0.5	7	3.5	Fisher	0.07

III. Discussion:
        The current study the researcher attempted to evaluate the effect of umbilical cord care intervention program on mothers' performance and occurrence of cord problems among their newborn infants. The study findings indicated unsatisfactory knowledge and practices among mothers in intervention group related to umbilical cord care in pre intervention results, while after the implementation of intervention program these mothers their knowledge and practices had improved, compared with those mothers in control group with statistical significant difference between both groups, with no cord problems among their newborn infants.
        As regards to umbilical cord mothers' knowledge, the majority of mothers in both groups (intervention and control) had unsatisfactory knowledge before the intervention, but immediate and follow up post intervention there were statistically significant improvements in knowledge of intervention mothers' group compared to their pre intervention program and the control group. The researcher attributed this result to lack of mothers preparation during prenatal period. But post intervention; due to the effect of intervention program that lead to improve in mothers' knowledge immediate and follow up (after one month) of intervention program and this result is in accordance with **Kudachi et al. (2017)** who evaluated the impact of health education on knowledge of newborn care in India and reported that knowledge of newborn care as eye care, cord care, breast feeding among primigravida women increased significantly after providing health education.
        Also, the results revealed that a statistically significant difference has been found between mean scores of mothers knowledge in intervention group pre ,immediate post and follow up posttest of intervention as (p<0. 001). These findings are matched with studies done by **Shrestha et al. (2013)** who studied knowledge and practice of postnatal mother on newborn care and reported poor cord care practices before the intervention and great improvement after intervention.
        In this present study, a statistically significant improvement was found between mean scores of mother's practice in intervention group pre ,immediate post and follow up posttest of intervention related to cord care, while mothers in control group had no improvement in their practice through phases of intervention program(pre immediate post and follow up posttests), which agrees with **(Eraky and Hassan, 2018)** who studied effect of newborn care practices for postnatal mothers on occurrence of selected problems among their newborn infants, and found that the most of mothers had incorrect performance before the intervention, while the majority of them had correct performance after the intervention.

Also, the results revealed that a highly statistically significant difference has been found between means of mothers practice in intervention group pre ,immediate post and follow up posttest of intervention as (p<0. 001) compared with mothers in control group. This result is congruent with **(Eraky and Hassan, 2018)** who found a highly statistically significant difference has been found between means of mothers performance pre and post intervention as (p<0.0001).Also, these findings are matched with **Senarath et al.(2007)** who studied the effect of training for care providers on practice of essential newborn care in hospitals in Sri Lanka and resulted in the proportion with any undesirable health events has declined from 32 to 21 per 223 newborns in the intervention group (p > .05) and from 20 to 17 per 223 newborns in the control group (p > .05).

This findings goes in line with **Thairu and Pelto (2008)** who studied newborn care practices in Pemba Island (Tanzania) and their implications for newborn health and survival, illustrated that eighty percent of study participants had good knowledge on essential new born care and more than ninety percent had the good practice of essential new born care.

Moreover, these findings are in agreement with that found by the study done by **Waiswa et al. (2010)** studied poor newborn care practices - a population based survey in eastern Uganda and the results concluded that to improve newborn survival, newborn care should be integrated into the current maternal and child interventions, and should be implemented at both community and health facility level as part of a universal coverage strategy.

Regarding to development of umbilical cord problems after one month from intervention, the results showed that almost all of the newborn had no delayed cord slough off and umbilical cord infection signs. This result is matched with**(Eraky and Hassan, 2018)** who indicated that the minority of newborns developed diaper redness, eye discharge and had no delayed cord slough off. Moreover, empirical evidence and previously cited research literatures about umbilical cord antiseptics for preventing sepsis and death among newborns by **Imdad et al., (2013)** who studied application of antiseptics on umbilical cord for preventing sepsis and death among newborns recommended that maintenance of clean and dry cord care will help in early slough off the cord and prevent infection. Additionally **WHO (2016)** recommends the application of topical antiseptics to the cord stump where the risk of infection is high.

In relation to timing of cord slough off, the results showed that almost all of the newborns in both groups (intervention and control) their cord sloughed off before the end of the two weeks (8.56 ± 0.01 & 8.48 ± 1.07 days respectively). These findings were very close to that is reported by **Azzam et al. (2011)** who examined the effect of topical application of alcohol 70% versus distilled water on umbilical cord stump separation time they reported that, separation time of umbilical cord stump occurred early for neonates in the Alcohol group vs. neonates in the distilled water group (6.70+ 1.03 days & 7.92 + 1.08 days respectively).

Results in present study showed that there was no statistically significant relation between mothers residence, age, educational level and total mean score of their knowledge and practice among both groups. On the same line, **Bhandari and Paudyal (2016)** assessed knowledge and practice of postnatal mothers on newborn care at hospital Setting and reported that there is no any association between practice about newborn care and education of the mothers. The proportions of practice of mothers residing in urban and rural are not significantly different.

Also, this finding agrees with **(Eraky and Hassan, 2018)** who indicated that there was no statistically significant relation between postnatal mother`s residence, educational level and total mean score of practice., more than half of the study sample in the middle age (20<25) and there was a significant relation between mother`s age and total mean score of practice.

Lastly, the intervention program provided to mothers in the present study succeeded in improving their knowledge and practice regarding umbilical cord care. The improvement in mothers' knowledge and practice relative to their pretest of intervention program and the control group is due to knowledge and practice gained through the intervention program. So, there is an urgent need to educate mothers and train health care providers including traditional birth attendants on newborn care.

Conclusion: The current study results concluded that mothers who provided with umbilical cord care intervention program had higher total mean score of knowledge and practice than before and the majority of them had satisfactory level of knowledge and practice regarding the umbilical cord care of the newborn infants compared to mothers in control group. The results also concluded that most of newborn infants of the mothers who received the intervention program not exposed to the occurrence of umbilical cord infection, and their cord slough off within expected normal time.

Recommendation

Mothers can gain skills related to newborn care through simple education associated with practical training. Therefore, educational intervention regarding neonatal care is required during the period of antenatal

visit. Further researches need to study the effect of newborn cord care practices on the incidence of newborn morbidity.

Study can be replicated on large sample size with longer duration in different setting so that the findings can be generalized to large population.

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