



Topical Application of Coconut Oil as Neonatal Management: A Review

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ABSTRACT

Neonates or children under 28 days of age, are at the highest risk of dying. There were 4 million neonates who reported deaths each year in 2000 and 2.4 million in 2019 at the first 4-week of their life. It arises especially in low-income and middle-income countries. The cause of neonatal deaths was related to a preventable and treatable condition indeed postnatal management. Coconut oil proved as one of the herbals which safe and efficient for neonatal management. It's had a low-cost, reachable, and widely produced in developing countries. This review collects and analyzes randomized controlled trial published studies. The database used from PubMed. The result demonstrates that coconut oil as a topical treatment is safe for neonatal management. It's also feasible for use and has various benefits in reducing the risk of infant weight problems, apnea, hypothermia, trans-epidermal water loss (TEWL), and increasing the quality of skin conditions, vitamin D3 serum level, and increasing motor-mental development. Coconut oil could be considered a proven therapeutic option.

1. Introduction

Neonate, or a newborn infant, is a child under 28 days of age. During this first period of their life, neonates are at the highest risk of dying^{1,2}. There were 4 million neonates who reported deaths each year in 2000 and 2.4 million in 2019 at the first 4-week of their life^{3,4}. In the other study, the proportion of deaths was 709 (17%) from 4182 neonates in St. Luke Wolisso Hospital, Ethiopia from January 2014 to December 2017⁵. Commonly, the direct cause of neonatal deaths is estimated from preterm birth (28%), severe infection (26%), and asphyxia (23%), while tetanus neonatal has a smaller proportion of deaths (7%). It arises especially in low-income and middle-income countries.³

The major cause of neonatal deaths was related to a preventable and treatable condition. Knowledge, education, neonatal resuscitation, postnatal management, and high-risk deliveries might have any

issues that can influence neonatal mortality⁵ including immaturity of skin organs what act as a barrier for infants⁶. One of postnatal management could be an alternative way is herbal treatment. But, for the attention, herbal management that would use for neonates must prove the safety and efficacy. Coconut oil was one of the herbals that can use for postnatal alternating management. Coconut oil as a topical treatment was proved for the safety and efficacy in neonates indeed very preterm or extremely low birth-weight neonates⁷⁻¹⁰. As research develops, it's also have been already known as a treatment, like as decrease risk of infant weight problems, apnea, hypothermia, Trans-Epidermal Water Loss (TEWL), decrease infections rate, prevent hypothermia, increase of skin conditional, neurodevelopmental, and antimicrobial pathogenic agent indeed antibacterial

and fungal infection^{7,11,12,13}.

Low cost relatively is the superiority that makes this alternative treatment could applicable in many places especially in low-income and middle-income countries. Besides that, coconut oil can be able to produce in many countries, especially tropic regional like as Philippines, Indonesia, India, Vietnam, Mexico, many more. Coconut oil is an edible oil composite from saturated fatty acids and melting at room temperature¹⁴⁻¹⁶.

Based on the background, the author has been interested to collect and analyze the benefits of coconut oil as a topical treatment for newborns' neonate management. Analyzed will perform from a recent study that has been existing before.

2. Methods

This review was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement by Moher et al., (2009)¹⁷. Ethics approval was not required.

Eligibility criteria

1. Types of studies: Published studies were eligible for issue.
2. Types of participants: neonate or postnatal infant
3. Intervention and comparison: Coconut oil application vs standard management.
4. Outcomes: Skin maturity, prevention of sepsis, hypothermia and apnea on the preterm infant, Trans-epidermal Water Loss (TEWL) status on Very Low Birth-weight (VLBW)

Search strategy

The database used from PubMed (www.ncbi.nlm.nih.gov). The reference lists of eligible

studies and review articles were searched to identify additional studies.

Following the term were used for searching in PubMed: "preterm infants" OR "preterm newborns" AND "coconut oil" OR "virgin coconut oil" AND "hypothermia" OR "transepidermal water loss" OR "TEWL" OR "skin condition". Within the filter of "full text" TEXT AVAILABILITY, "randomize control trial" ARTICLE TYPES, "10 years publication" DATE, "Newborn: birth-1 month" AGE and sorted by "the best match". But, we also were searching for relevant keywords and suggestion articles. Study selection performs by reading the abstract of a citation to identify potentially eligible studies.

3. Results

The initial search resulted in 20 citations. After excluding duplicates and non-relevant studies, four were considered eligible and hence included in this review. A further search by suggestion article, and similarly terminology for the relevant article, finally have five Studies for asses and analyzes about coconut oil treatment on neonates. General characteristics and information were explained in table 1 and other information explain more.

Intervention Specification

Coconut oil is composed of saturated fat. This has a firm texture at cold (room temperatures). Fat is a herd of smaller molecules called fatty acids, and there are several types of saturated fatty acids. The predominant type is lauric acid (49%). And also, some others like caprylic acid C-8:0(8%), capric acid, C-10:0(7%), myristic acid C-14:0(8%), palmitic acid C-16:0(8%), stearic acid C-18:0(2%), oleic acid C-18:1(6%) and 2%C-18:2.

Table 1. Characteristics and outcomes of included studies

Author and publish description	Sample and population	Intervention and comparison	Outcome
Salam Ra, Darmstadt G1, Bjutta Za. 2015, Pakistan	258 Preterm infants	Coconut oil 5ml, twice daily vs Control	↓ Risk of bloodstream infection and blood culture positivity rate ↓ Risk of switch first to second-line antibiotics ↑ Weight gain ↑ Skin condition
Nangia S, et all. 2015, India	74 Very Low Birth Weight (VLBW) Infants	Coconut oil 4ml, twice daily Without massage vs Control	↓ Trans-Epidermal Water Loss (TEWL) ↑ Skin score and condition (Skin maturity) ↓ Risk of skin infection
Strunk T, et all. 2017, Australia	72 Preterm infants	Coconut oil 5ml/kg, twice daily Without massage vs Control	↓ Trans-Epidermal Water Loss (TEWL) ↑ Skin condition Feasible to use No adverse event
Konar Mc, Islam K, Roy, Gosh T. 2019, India	2249 Preterm infants	Virgin coconut oil 5ml, twifour times daily Massage vs Control	↓ Weight loss on few days ↑ Weight gain ↓ Incidents of hypothermia ↓ incidents of apnea ↑ Serum D3 level on 30-days ↓ Motor-mental development (no significant) ↑ Skin condition (no significant) ↓ Late-onset sepsis (no significant) ↓ Rash (no significant) ↑ Accidence of slippage

linoleic acid¹⁵¹⁸¹⁶. The Food and Agriculture Organization (FAO) of the United Nation on wikipedia.com and United State Department of Agriculture (USDA) on indexmundi.com reported coconut oil widely produce in Philippines, Indonesia, India, Vietnam, Mexico, many more Figure.1^{19,20}.

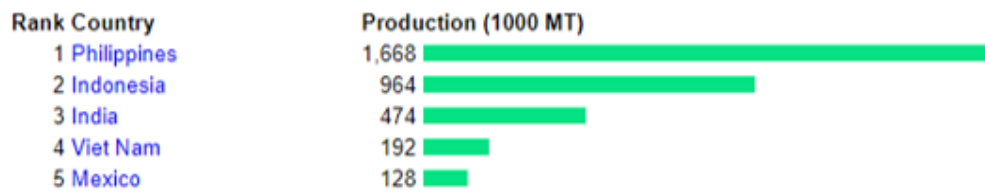
Recent Study

1. Strunk T, et all.(2017)⁸. Randomized 72 very preterm infants (<30 weeks) randomly as 2 groups of treatment. Infants in the intervention group received topical coconut oil (5 mL/kg) twice daily for 21 days after starting from 24 h of age, while the control group received routine care. The median (IQR) gestations were 27.9 weeks (26.3–29.3) and 27.9 (25.4–29.1), respectively. The median (IQR) birth weights were 1070g with a range of 879–1202g, and 950 with a

range of 726–1155g. The primary outcomes of this study were safety, feasibility, and efficacy in terms of topical treatment in skin integrity scores.

The coconut oil group did not have any adverse events and all of the enrolled participants completed the trial. Incident of skin irritation was comparable, coconut oil group n = 9 (25%) vs n = 8 (27,8%) control group; p=0,779. As also incident of temperature instability was similar result, coconut oil n = 14(38,9%) vs n = 10 (27,8%) control group.

Figure 1. Coconut oil production rank by country. Year estimate 2021. (MT=Metric Tones)



2. Nangia S, et al.(2015)21. Randomized 74 very low birthweights (VLBW) neonates divided into two groups, Oil (n= 37) and control (n= 37) to measured trans-epidermal water loss (TEWL). The oil group neonates received coconut oil (4ml) twice-daily topical application without massage, and a control group received standard care. Measuring TEWL do every 12h using an evaporimeter till Day-7 when skin swabs were obtained for bacterial growth and skin condition was assessed using a validated score.

ΔTEWL calculate from baseline reduce 6,8g/m²/h in oil group compared control group. (CI: 95%: 3.48, 10.15). reduces skin colonization and results in a better skin condition. The oil group was 81% skin swab cultures were sterile as better than the control group on 45% swab culture sterile.

3. Konar M, et al.(2019)11. Randomized 2294 preterm infants and divided into two groups, group A (n=1146) receive virgin coconut oil (5ml) four times daily, Coconut oil was applied all over the body excluding face and scalp after proper hand-washing by gentle massaging by the on-duty staff nurse. Group B (n=1148) receives gentle massaging by the on-duty nurse (during hospitalization) or by the primary caregivers (after discharge) without any application over the skin.

All of them (staff nurses, mothers, and caregivers) were trained. The follow-up to measured Skin condition was assessed by using Neonatal Skin Condition Score (NSCS) on the 7th, 14th, 21st, and 28th day. Serum vitamin D3 level was estimated on the 30th day.

The result from this study obtained that mean weight loss in the first few days of the preterm infant was significantly less in group A, 4.71% 6 0.39% vs. 7.82% 6 0.55% (p<0.01). Mean weight gain was

significantly more in group A, 1.21% 6 0.17% vs. 0.89% 6 0.12% (p<0.01). Incidence of hypothermia significantly lesser in group A, 1.9% vs. 5.8% (p<0.01) and apnea (1.2% vs. 5.1%, p < 0.01). Mean serum vitamin D3 level on day 30 was more among newborns of group A than group B. (32.3 6 1.2 vs. 24.6 6 0.8 ng/ml, p < 0.01). There was no significant difference in mean NSCS. But, the score was significantly better in group A than group B on multiple occasions on days 7, 14, 21, and 28 (p < 0.01). It's also noticed that the skin of newborns of group A matured early. Both motor and mental developmental quotients were significantly higher among newborns of group A than Group B at 3rd, 6th, and 12th months.

Incidence of late-onset sepsis no significant difference between group A and B (2.7% vs. 3.2%, p > 0.01), rash (1.8% vs. 2.0%, p > 0.01), and accidental slippage of the baby (0.3% vs. 0.1%, p>0.01). Otherwise, mothers complained that the method of applying coconut oil was cumbersome.

4. Salam RA, et al.(2015)13. Randomized 258 preterm newborns to either the intervention (n=128) or control groups (n=130). Baseline characteristics of the newborns in both groups were comparable. Coconut oil was applied by the assigned nurse to the newborns in the intervention group (5mL/kg) twice daily over the newborn's body surface. Newborns in the control group received routine skincare.

Based on blood culture, significantly fewer infants developed an infection in the intervention group 7% (9 of 128) compared with the control group 21% (27 of 130). The blood cultures positivity rate was also lower in the intervention, 40.9%, (9 of 22) compared with the control, 71.1%, (27 of 38). It also a significantly greater proportion to switch first to second-line antibiotics in the control group compared with the CO application

group ($p < 0.0001$).

There was no significant difference in risk of death among both groups. The mean daily weight gain of infants in the intervention group was 11.3 g/day higher (95% CI 8.1 to 14.6, $p < 0.0001$), greater than for infants in the control group at day 28 after childbirth. CO applications significantly improved the skin condition ($p < 0.0001$). No adverse events like skin reactions, phototherapy burns, or any other infections were reported in the intervention group during the study.

Selection and bias

The studies we collected using only a randomized trial design with similar outcomes. The funnel plots for the benefits of coconut oil compared with comparison intervention for topical treatment on newborn postnatal management. But this study still has bias because some studies were done from a different population, sample, method of intervention, purpose.

4. Discussion

This review examined four studies that assessed the impact of coconut oil for topical treatment as alternative postnatal management by randomized control trial. They had demonstrated beneficence, without significant adverse events at the newborn infant. The newborn was a child under 28 days of age. They are at the highest risk of dying in this period. Coconut oil applied to be an alternative treatment can use for inexpensive cost modality, reachability, feasibility, and safety. Based on this aspect, this intervention is expected to be considered as a therapeutic option for the newborn.

Safety

Some studies have proven that coconut oil can use as a topical treatment with no adverse event, because of that this intervention is used to repeat as an intervention in any study. Some studies obtain that coconut oil still has a mild adverse event like rash, irritation, temperature instability without significantly, but no further treatment is needed.

Konar, et al., 1146 preterm newborns applied coconut oil 5ml four times daily from 2294 preterm enroll the study explain no significant adverse effect was noted. Only 1,8% of an incident of rash in oil group vs 2% in the control group¹¹. It also the study from Trunk, et. All., they have the conclusion that topically applied coconut oil maintained better skin conditions without adverse effects in the very preterm infant⁸. Meanwhile, in a trial from Sankaranarayanan, et. all., adverse events occurred in 6 preterm babies from 3 groups, coconut oil has 2 of 38 (5,3%) preterm babies were mild rash and did not require discontinuation of application. Among the term babies, the coconut group has 3 of 33 (9%) term babies were mild rash too⁹.

Feasibility

Topical application of coconut oil in body surface of infant newborn is method could be done in all trials, whether with a massage or not. Strunk et al., the coconut oil was applied by trained staff (5ml/KgBB) every 12h for 21 days to the entire skin, excluding the face, scalp, and sites of any catheters or drains, and involved gentle strokes without massage. This application was highly feasible and completed in 2-3 min⁸.

On the other side, Konar, et al., reported that the trial significantly complained from 23 (2%) of the infant's mother. It is because the method to apply all over the body excluding face and scalp 5ml of Virgin Coconut Oil four times daily was cumbersome if compared with massage without any application over the skin in control group 4 (0,3%)¹¹.

Efficacy

There is evidence from animal trials that topical application of coconut oil enhances the capability of skin healing²². Even another study on sunflower seed oil, might enhance skin barrier function and improve outcomes in neonates with compromised barrier function²³.

It's so proven from 4 studies already collect and analyze. Application of coconut oil or virgin coconut oil

in neonates has many benefits, significantly reduce mean body weight loss in the first few days of the preterm infant, and increase mean body weight in the next days of their life^{11,13}. Coconut oil as a topical treatment also plays a role in reduce of trans-epidermal water loss (TEWL), hypothermia, apnea, risk of skin infection^{11,21}, indeed the risk of switch first into second-line antibiotic¹³. A review from Field, et al. (2010), The indirect effect of weight gain was associated with shorter hospital stays and, thereby, significant cost savings²⁴.

The second information sought but did not directly affect neonatal mortality rate, coconut oil as well significantly escalate of skin healthy by neonatal skin condition score (NSCS)⁸, and have good score skin quality if graded by "Lane and Drost"²¹. The benefits of coconut oil were useful to increase motor-mental development and D3 serum level on 30-days¹¹.

5. Conclusion

Efforts to reduce the preventable infant mortality rate should be a concern, especially in developing countries. Coconut oil, which tends to be low-cost and reachable in some developing countries what could be considered a proven therapeutic option. the results of existing studies, there is evidence about the safety and efficiency of coconut oil in reducing the risk of infant weight problems, apnea, hypothermia, Trans-Epidermal Water Loss (TEWL), and increasing the quality of skin conditions, vitamin D3 serum level, and increasing motor-mental development.

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