

Oil Massage in Neonates: An Open Randomized Controlled Study of Coconut versus Mineral Oil

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Introduction: Oil massage for newborns is reported to improve weight gain by better thermoregulation. A role for transcutaneous absorption has also been suggested. **Aims and Objectives:** This study was undertaken to compare the effect of massage with coconut oil versus mineral oil and placebo (powder) on growth velocity and neuro-behavior in well term and preterm babies. **Study design:** Open Randomized Controlled trial. **Setting:** The Premature unit and the postnatal wards of a major teaching hospital in a metropolitan city. **Material and methods:** Intramural preterm appropriate for gestational age babies weighing between 1500 to 2000 grams and term births weighing more than 2500 grams fulfilling the inclusion criteria constituted the two gestation age categories studied. Babies in each group were randomized to receive massage with either coconut oil, mineral oil or with placebo. Oil massage was given by a trained person from day 2 of life till discharge, and thereafter by the mother until 31 days of age, four times a day. Babies were followed up daily till discharge and every week after discharge for anthropometry. Neuro-behavioral outcome was assessed by the Brazelton Score at baseline, day 7 and on day 31. **Results:** Coconut oil massage resulted in significantly greater weight gain velocity as compared to mineral oil and placebo in the preterm babies group; and in the term baby group, as compared to the placebo. Preterm infants receiving coconut oil massage also showed a greater length gain velocity compared to placebo group. No statistically significant difference was observed in the neurobehavioral assessment between all three subgroups in term babies as well as in preterm babies.

Key words: Growth, Neurobehavioral outcome, Oil massage.

TOPICAL oil massage is routinely practiced in many countries. For hundreds of years, populations especially in the Indian subcontinent have routinely applied natural oils to the skin of newborn. The practice of oil massage has gained favor in neonatal intensive care units in the developed countries as well(1).

The putative benefits to the newborn are twofold, those related to the oil application per se, and those related to tactile kinesthetic stimulation due to the massage. Topical oil application has been shown to improve skin barrier function, thermoregulation and also is suggested to have a positive effect on growth(2,3). A role for absorption of fats

through the thin skin of the preterm has also been suggested. Moreover, a number of studies have also demonstrated superior growth and development in preterm infants receiving tactile kinesthetic stimulation(4-8). Oil application may occasionally cause adverse effects in the form of skin rashes and a greater propensity for bacterial colonization(1).

This study was, therefore, undertaken to compare the effect of massage with coconut oil versus mineral oil and placebo (powder) on growth velocity and neuro-behaviour as well as adverse effects if any on well preterm and term babies.

Subjects and Method

This open randomized controlled trial was conducted in the premature unit and the postnatal wards of a major tertiary care center in a metropolitan city between 1st August 2003 to 31st January 2004. The study was approved by the hospital ethics committee.

Inclusion criteria

Intramural preterm appropriate for gestational age babies weighing between 1500-2000 grams and full term neonates weighing 2500 grams or more were included if they fulfilled the following inclusion criteria:

1. Apgar score >7 at 1 and 5 minutes with no resuscitation required at birth.
2. Medically stable with no requirement of drugs (other than mineral and vitamin supplements for the preterm babies), or any interventions/procedures.
3. On breastfeeds or 'spoon-wati' feeds with expressed breastmilk (preterms).
4. Adequate family support.

Exclusion criteria

Sick babies, those with congenital

anomalies or neuromuscular disorders were excluded. Babies of parents who were staying far away from the hospital and were therefore less likely to follow-up were excluded, as were babies of parents who refused consent for the study.

Outcome variables

The primary outcome measure was the weight gain velocity over the first thirty-one days of life. Secondary outcome measures included length gain velocity, head growth, neuro-behavioral outcome and incidence of adverse events.

Sample size

A sample size of 36 infants would be required in each group of preterm and term infants in order to detect a difference in weight gain velocity of 2 g/kg/day with a SD of 2.7 g/kg/day (based on observations from a pilot study), a power of 80% and error of 0.05 and allowing for a 20% loss to follow-up.

Randomization

Infants in preterm and term group were randomized in blocks of three by computer-generated numbers in closed opaque envelopes, to either coconut oil, mineral oil, or placebo (powder) groups

Details of the antepartum period including the obstetric history, mode of delivery, adequacy of family support, the socio-economic status, presence of risk factors for sepsis and the need for resuscitation at birth were recorded.

Massage technique

Oil massage was given by a trained person from day 2 of life till discharge, and thereafter by the mother (who was taught the technique) until 31 days of age. Babies in the placebo group received a massage using baby powder

and the method of application and the monitoring was the same as in the oil groups. Sessions began an hour after a feed. The total duration of each session was 5 minutes and was done four times a day.

The oil massage was given in the prone and supine positions to include head, neck, trunk and the extremities. At the end of the massage kinesthetic stimulation was provided in the supine position by passive flexion and extension movements of the limbs at each large joint (shoulder, elbow, hip, knee and ankle) as 5 events of 2 seconds. The procedure for the massage and stimulation were as per the procedure described by Mathai *et al.*(4). If the baby started crying or passed urine or stools during the session it was temporarily stopped till the baby was comfortable again.

During the massage, preterm infants were nursed naked and under a radiant warmer with skin mode of temperature control. Oxygen saturation was continuously monitored through out the duration of the procedure using pulse oximeter (Novamatrix 515 C). Readings were recorded of heart rate, respiratory rate, temperature and oxygen saturation in the three subgroups before, during and immediately after the massage. Term infants were massaged in a draught free room. Similar parameters were recorded.

In accordance with unit protocols all term and preterm neonates above 1700 grams were breast fed from day 1. Babies between 1500 - 1700 gram birth weight were put on enteral feeds of expressed /banked human milk starting at 80 mL/kg/day on day one. The milk was fed by *wati* and spoon or gavage till babies were able to accept full volume per feed by *wati*-spoon /breastfeeds. All preterm infants were given oral calcium, phosphorus and vitamin supplements. Mothers were allowed to touch and hold their infants as often as they

wished in all the subgroups. On discharge all mothers were advised to carry out the massage in a draught-free room and limit the procedure to 5 minutes per session.

Weight of infants was taken without clothes on an electronic weighing scale (Phillips) with an accuracy of ± 5 grams. Head circumference was measured with a non-stretchable cloth-tape and length with an infantometer.

Babies were followed up daily during their stay in the hospital and then once every week till 31 completed days of life.

Neonatal behavioral assessment

The Brazelton Neonatal Behavioral Assessment Scale (BNBAS)(9,10) was administered to each infant in the study on three occasions before the first massage, on day 7-10 and on follow-up (at 28-31 days). All the tests were done by a single trained person. Infants were tested mid-way between two feeds in a quiet room. The parameters assessed included 'habituation', 'orientation', 'motor' maturity, 'range of state', 'regulation of state', 'auto-nomic stability', 'reflexes' and 'interactive behavior'.

Statistical Analysis

Data collected was entered in Microsoft Excel 97 worksheet. Characteristics of infants included in the study were tabulated as averages (means) with standard deviation (SD). The groups were compared on each parameter using 't' test (2-tailed unpaired) for parametric data and chi square test for non-parametric data. The analysis was done using the SPSS version 11 for windows. A 'P' value of <0.05 was considered as statistically significant and <0.001 as highly significant.

Results

A total of 224 babies (112 preterm and 112

term babies) were enrolled. In each gestation strata, there were 38 babies in the coconut oil, 37 in the mineral oil and 37 babies in the placebo groups. In the preterm group, 32 (84.2%) babies completed the follow up in the coconut oil and mineral oil subgroups and 31 (83.8%) in the placebo group. In the term babies, 33 (86.8%) completed the follow up in the coconut oil group and 32 babies (86.5%) completed the follow up in the mineral oil and placebo groups. The difference was not statistically significant.

Table I shows the baseline characteristics of babies enrolled in the study groups. There was no statistically significant difference between babies enrolled in each of the groups as far as the birthweight, gestational age, total

length and head circumferences were concerned.

Table II shows the growth characteristics of preterm babies in the three groups. Weight in the coconut oil group was significantly higher as compared to the placebo group both at 14 days as well as at 31 days. Weight at 31 days was significantly higher in the coconut oil group as compared to the mineral oil group. Weight gain velocity over first 31 days was higher in the coconut oil group as compared to the mineral oil and placebo groups. There was no statistically significant difference in the length and head circumference at 14 and 31 days in the three groups. However, length gain velocity was higher in the coconut oil group as compared to the placebo group.

TABLE I—Baseline Characteristics in Preterm and Term Group

Variable	Coconut oil	Mineral oil	Placebo
Birth weight (g)			
Preterm	1792.89 ± 149.56	1758.37 ± 79.91	1789.86 ± 182.90
Term	2771.27 ± 309.40	2771.74 ± 95.27	2852.33 ± 270.35
Gestational age (wk)			
Preterm	34.89 ± 1.27	34.76 ± 1.12	34.92 ± 1.19
Length (cm)			
Preterm	42.38 ± 1.52	42.79 ± 1.53	42.76 ± 2.13
Term	48.70 ± 2.22	48.65 ± 1.98	49.26 ± 1.99
Head Circumference (cm)			
Preterm	30.03 ± 1.29	30.26 ± 1.94	30.35 ± 1.21
Term	32.53 ± 0.88	32.34 ± 0.91	32.67 ± 1.06
Chest Circumference(cm)			
Preterm	27.86 ± 1.18	28.15 ± 1.78	28.26 ± 1.27
Term	30.85 ± 0.79	30.34 ± 0.99	30.70 ± 0.89
Total subjects			
Preterm	38	37	37
Term	38	37	37

Values are as mean (standard deviation).

P>0.05 for all parameters.

TABLE II—Growth Characteristics in Preterm Group

Variable	Coconut oil	Mineral oil	Placebo
Weight (g)			
at 14 days	1990.00 ± 196.42 τ	1843.18 ± 223.76	1928.13 ± 228.01
at 31 days	2396.77 ± 208.94 τ^*	2234.38 ± 247.71	2260.94 ± 290.37
Weight gain velocity (g/kg/day)	10.99 ± 2.57 τ^*	9.02 ± 2.13	8.45 ± 2.75
Length (cm)			
at 14 days	43.78 ± 1.68	43.08 ± 1.66	43.53 ± 2.86
at 31 days	44.86 ± 1.55	44.94 ± 1.66	45.16 ± 2.40
Length gain velocity (cm/week)	0.63 ± 0.12 τ	0.59 ± 0.16	0.56 ± 0.16
Head circumference (cm)			
at 14 days	30.90 ± 1.15	30.52 ± 2.21	31.06 ± 1.12
at 31 days	31.89 ± 1.26	32.13 ± 2.13	32.31 ± 1.43
Head circumference gain velocity (cm/week)	0.49 ± 0.05	0.48 ± 0.06	0.47 ± 0.09
Chest circumference (cm)			
at 14 days	28.53 ± 1.05	28.16 ± 2.04	28.38 ± 1.41
at 31 days	29.24 ± 1.44	29.34 ± 2.04	29.59 ± 1.48

Values are as mean ± standard deviation. τ : P<0.05 coconut oil vs placebo. * : P<0.05 coconut oil vs mineral oil.

Table III shows the growth characteristics of term babies in the three groups. There was no statistically significant difference in the weight at 14 and 31 days. Weight gain velocity over the first 31 days was higher in the coconut oil group as compared to the placebo group ($P = 0.02$). However, the weight gain velocity was not significantly different between the coconut oil and mineral oil groups. There was no statistically significant difference in the length and head circumference at 14 and 31 days in the three groups. No significant difference was noted in the length and head circumference gain velocities.

Neuro-behavioral outcome as assessed by the Brazelton scale was similar in the three groups for both preterm and term babies.

Adverse events

In the preterm group, adverse events occurred in 6 babies, 2 each in the coconut oil, mineral oil and the placebo group. All the adverse events were mild rash and did not require discontinuation of application. Among the term babies, 3 in the coconut oil group, 3 in the mineral oil group and 2 in the placebo group developed mild rash that did not require discontinuation of application.

Discussion

We studied the growth and neuro-behavioral benefits of coconut versus mineral oil massage oil in term and preterm babies. Several studies have already documented the somatic and neurodevelopmental benefits of tactile kinesthetic stimulation in preterm infants(4,11). To determine whether the bene-

TABLE III—*Growth Characteristics in Term Group*

Variable	Coconut oil	Mineral oil	Placebo
Weight (g)			
at 14 days	3007.58 ± 366.60	2913.04 ± 246.90	2940.63 ± 332.27
at 31 days	3538.46 ± 413.82	3473.00 ± 289.60	3518.52 ± 336.60
Weight gain velocity (g/kg/day)	9.19 ± 1.55 τ	8.78 ± 1.67	8.22 ± 1.76
Length (cm)			
at 14 days	49.49 ± 2.37	49.49 ± 1.86	49.92 ± 2.20
at 31 days	51.13 ± 2.64	51.26 ± 1.97	51.83 ± 2.13
Length gain velocity(cm/week)	0.64 ± 0.18	0.66 ± 0.19	0.71 ± 0.21
Head circumference (cm)			
at 14 days	33.33 ± 1.09	33.15 ± 0.82	32.89 ± 1.02
at 31 days	34.42 ± 0.96	34.31 ± 0.92	34.46 ± 1.13
Head circumference gain velocity (cm/week)	0.48 ± 0.05	0.49 ± 0.06	0.47 ± 0.09
Chest circumference (cm)			
at 14 days	31.15 ± 0.94	30.64 ± 0.92	30.67 ± 1.09
at 31 days	31.77 ± 0.93	31.54 ± 0.94	31.82 ± 1.09

Values are as mean ± standard deviation. τ : $p < 0.05$ coconut oil vs placebo.

fits were due to the effect of the massage or due to the type of oil used, these two groups were compared with the placebo group who received massage with powder.

The weight of preterm babies in the three groups was comparable at baseline. However, at 14 days there was significant weight gain in the coconut oil subgroup as compared to the placebo subgroup whereas at 31 days, the weight was significantly higher in the coconut oil subgroup as compared to placebo as well as the mineral oil group. As weight gain in preterm neonates is also a function of their birth weight, we calculated the weight gain velocity over the 31-day period. We found that the weight gain velocity was significantly higher in the coconut oil subgroup as compared to the other subgroups and the difference was statistically significant. The length gain

velocity was also significantly higher in the coconut oil subgroup as compared to the placebo subgroup.

Other studies have found better somatic growth after oil application. Application of a barrier such as oil or emollient prevents insensible water loss from the skin and helps to maintain temperature(12-14). Better thermo-regulation may promote better weight gain.

Though most studies have looked at weight gain in preterm neonates, we also wanted to study the growth in term neonates after oil application so that the benefits, if any, could be extended to this group. There was no significant difference in the weight at 14 and 31 days between the three groups. On analysis of the weight gain velocity, there was a statistically significant difference between the coconut oil and placebo groups. Though babies

Key Message

- Coconut oil massage has beneficial effects on the weight gain in preterm neonates compared to mineral oil massage.

in the coconut oil group had a better weight gain velocity as compared to the mineral oil group, the difference was not statistically significant.

The findings of this study suggest that coconut oil application improves the weight gain velocity in preterm and fullterm neonates over and above the benefits of tactile kinesthetic stimulation due to massage alone (placebo group). Preterm neonates also showed a higher weight gain velocity after application of coconut oil as compared to mineral oil application. This suggests a role for transcutaneous absorption of vegetable oil through the thin skin of the preterm neonate. The skin of a preterm baby allows significant absorption of fat, as it is thinner and more vascular(15,16). This may also result in greater caloric intake and hence a better weight gain(17).

Fernandez, *et al.*(17) reported a significantly higher serum triglyceride levels in preterm neonates weighing 1500-2250 g after application of corn oil every four hours for three days suggesting the likelihood of fatty acid absorption through the skin of preterm neonates. Soriano, *et al.*(18) reported a significant increase in anthropometric parameters at one month of age in 30 consecutive preterm infants who were treated cutaneously with soybean oil compared to a control group, which received no cutaneous treatment. An increase in linoleic acid level in their blood was also observed

In preterm neonates, the length gain velocity was significantly higher in the

coconut oil subgroup as compared to the placebo group. No significant difference was observed in the head circumference in the three groups at 14 and 31 days. There was no significant difference in the rate of head growth. In term neonates, there was no statistically significant difference in the length gain, head circumference, or in the rate of head growth, between the three subgroups at 14 and 31 days. In contrast, Agarwal, *et al.*(6) observed that full term infants at 6 weeks massaged with sesame oil showed a significant increase in length, midarm and midleg circumferences compared to infants receiving herbal oil, mustard oil, or mineral oil for massage daily for 4 weeks.

In the preterm group as well as in the term group, neurobehavioral outcome as assessed by the Brazelton Neonatal Behavioral Assessment Scale (BNBAS) did not show any statistical significance in the groups receiving oil massage compared to placebo. Mathai, *et al.*(4) have shown better neurobehavioral outcome after tactile kinesthetic stimulation with oil. However they compared the benefits after tactile kinesthetic stimulation with oil or powder with a control group who did not receive stimulation at all. Therefore, the benefits observed in their study were probably because of the tactile kinesthetic stimulation rather than the oil used.

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Competing interests: Marico Industries Ltd. Is involved in the production of coconut oil. BM, AM and RS Mohile are employees of Marico Industries. None of the authors from Sion Hospital have any shares in the company.

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