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Research Article

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Kangaroo Mother Care –Differences and Quantitative Benefits in Different Subgroups of Low Birth Weight Babies

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Abstract

Objectives: *To determine the effectiveness of Kangaroo Mother Care in subgroups of LBW babies-Preterm AGA, Preterm SGA and Term SGA, To assess any differences in benefits of KMC in relation to duration in the subgroups, To assess weight gain difference in NICU and at home at first follow up visit and up to 40 weeks of follow up to Preterm AGA, Preterm SGA and till gain of 2500g in Term SGA babies.*

Study design: *Prospective observational study.*

Setting: *NICU in a large teaching institute, department of pediatrics, Mahatma Gandhi Memorial Hospital, North Telangana.*

Subjects and Methods: *240 neonates with birth weight <2500g, hemodynamically stable.*

Intervention: *The subjects are classified into three subgroups-based on gestational age (by new Ballard's score) and by weight (Lubchenco's charts) into Preterm Appropriate for gestational age (PT AGA) (102), Preterm Small for Gestational Age (PT SGA) (88) and Term Small for Gestational age (T SGA) (50). Further categorized into <=32 wks,33-34wks,35-36wks,>=37wks.KMC was given to all subgroups at hospital and home with mean duration of 9+2hrs at hospital and 5+2hrs at home.*

Outcome Measures: *Growth measured by average daily weight gain, mean weight gain, (weight was measured by electronic weighing scale (seca), head circumference (measured by non-stretchable and non-metallic tape) and total length (measured by infant meter) in follow up to 40 weeks of corrected gestational age in Preterm and up to gain of 2500g in Term SGA were assessed with KMC.*

Results: *Better weight gain was noticed in all the 3 subgroups of LBW neonates with KMC at hospital and home. In spite of lower duration of KMC at home PT AGA (33-34 weeks) subgroup has the highest weight gain (24.5+5.5g/day, p=0.003), highest head circumference gain (0.70+0.5cm/week, p=0.002), highest length gain (0.90+0.6cm/week, p <0.008). The time taken to reach full feeds and the time to reach initiation of direct breastfeeds were comparable in all subgroups but attained much earlier in PT AGA (33-34wks) and PT AGA (35-36wks). Duration of hospital stay is least in PT AGA with mean of 12.68 ± 6.37 days.KMC significantly reduced the incidence of apnea in all subgroups of LBW babies. All babies were on exclusive breastfeeds at the end of the study (98%).*

Conclusion: *We conclude by this present study that KMC improves growth in all sub groups of LBW infants. KMC has significantly reduced the incidence of co mortifies like apnea, hypothermia, hypoglycemia in all the subgroups of LBW babies. KMC is cost effective, easily accessible and acceptable not only to mothers but also by majority of the family members.*

Keywords: Kangaroo Mother Care, Low Birth Weight, Postnatal Growth

Introduction

According to WHO, annually about 20 million LBW infants are born around the world. Over 60% LBW births occurs in Africa and South Asia. In terms of regional variations, South Asia had the highest incidence of LBW, with 28% newborns weighing <2,500gm. At 28% India had the highest percentage of LBW newborns after Mauritania (35%), Pakistan and Yemen (32% each) KMC was first suggested bin 1978 by Dr.Edgar Rey in Bogota, Colombia [1, 2]. The term Kangaroo care is derived from practical similarities to marsupial caregiving i.e. the infants kept warm in the maternal pouch and close to the breasts for unlimited feeding.

The advantages of KMC

For the Baby

It reduces the overall mortality of the baby. It facilitates early breast feeding and prevents hypothermia, and infections. Better somatic growth and psycho motor development is observed. KMC will reduce the duration of the hospital stay.

For the Mother

This will Increase the confidence and self-esteem in the mother. The skin to skin contact will promote the bonding between mother and baby.

For the Community

KMC is the most cost effective and economical care which can be given to the LBW babies. It does not require hospital staff other than for conventional care. It can be given at home.

Materials and Methods

Source of Data

Neonates with birth weight <2,500g with or without any specific complaints are admitted between January 2017 to November 2018 in Neonatal Intensive Care Unit in Mahatma Gandhi Memorial Hospital, Kakatiya Medical College, Warangal.

Inclusion Criteria

Neonates with low birth weight (<2,500g), hemodynamically stable (not on oxygen or respiratory support, no apnea for 72hrs, not on any intravenous fluids).

Exclusion Criteria

Newborns with all major malformations,
Hemodynamically unstable.

Type of Study

Retrospective observational study.

Period of Study

January 2017 to November 2018.

Method of Collection of Data

This study was conducted in Neonatal Intensive Care Unit in MGM hospital, Kakatiya Medical College, Warangal between January 2017 to November 2018. All the eligible neonates both term and preterm with low birth weight of <2,500g, admitted to the neonatal intensive care unit with or without any complaints.

All the eligible low birth weight new-borns are classified into three subgroups-based on gestational age (by new Ballard's score) and by weight (Lubchenco' s charts) into

1. Preterm, AGA
2. Preterm, SGA
3. Term, SGA

Preterm Infant

Infant born before 37 weeks of gestational age.

Preterm Infant Appropriate for Gestational age (AGA)

Infant born preterm with birth weight between 10th and 90th percentile for his/her gestational age.

Preterm Infant Small for Gestational Age (SGA)

Infant born preterm with birth weight bellow 10th percentile for his/her gestational age.

Term Infant Small for gestational Age (SGA)

Infant born at term i.e. >37weeks with birth weight less than 10th percentile foe his/her gestational age. The new-borns with complaints like respiratory distress, apnea, hypoglycaemia, sepsis etc were treated and once the babies are stable they are included in the study for kangaroo mother care.

Monitoring at Hospital , On Follow Up

The babies are monitored throughout KMC, they are watched for any discomfort, hypothermia, hyporthermia, hypoglycaemia, apnea, dull activity, seizures.

Duration of KMC by each mother, any complaints during KMC, type and times of feed are documented daily in KMC record.

Each baby is checked for daily weight gain by electronic weighing scale Smart weigh (+1 to 5 g) with minimal clothing, Weekly head circumference measured by non-stretchable and non-elastic tape by cross tape method and maximum circumference from occipital protuberance to the supra orbital ridges on forehead was recorded, head circumference measured in centimeters. Weekly Length was measured using infant meter (SECA) with the help of another health staff.

Data collection of maternal variables included Education, parity, maternal age, caesarean section, occupation, maternal nutrition.

Infant variables evaluated included birth weight, gestational age, weight at start of KMC, HC at birth ,length at birth, daily weight gain, weekly HC and Length increments documented during hospital stay till admission and further by follow up till 40weeks GA in Preterms, AGA and Preterm, SGA and gain up to 2,500g in Term, SGA. Gestational age was calculated based on mothers last menstrual period and new Ballard score.

Figure 2: Mothers doing KMC in KMC ward at MGM hospital

Figure 3: Measuring length of an infant using SECA infanto meter

Statistical Analysis

Appropriate statistical tests were applied using software SPSS version 21. Percentages, mean values, p values were calculated and results analyses

Results and Observations

240 neonates with Low birth weight and satisfying the inclusion criteria from January 2017 to November 2018 were taken up for the present study and results are analyses as follows.

Table 1: Distribution of study subjects according to Gestational Age

Gestation Age	Males	Females	Number	Percent
<32 wks	23	23	46	19.1%
33-34wks	35	38	73	30.4%
35-36 wks	33	38	71	29.5%
>37 wks	21	29	50	20.8%
Total	91	99	240	100%

Of the total 240 neonates, 46 neonates (19.1%) belong to gestational age <32 weeks, 73 neonates (30.4%) belong to gestational age 33-34 weeks, 71 neonates (29.5%) belong to gestational age 35-36 wks, 50 neonates (20.8%) belong to gestational age >37 weeks.

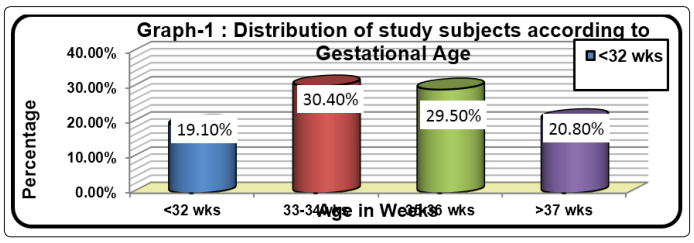
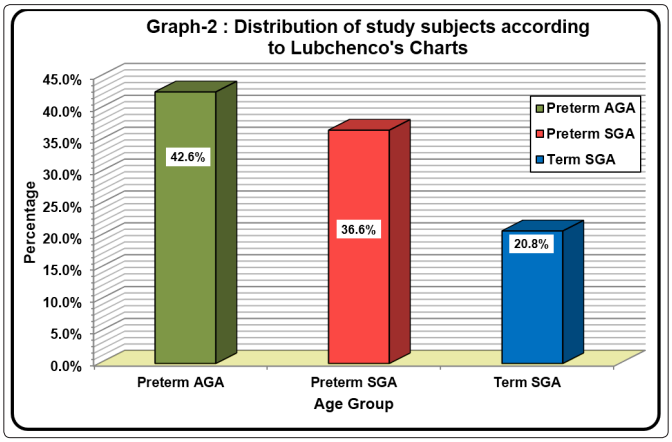


Table 2: Distribution of study subjects according to LUBCHENCO'S CHARTS

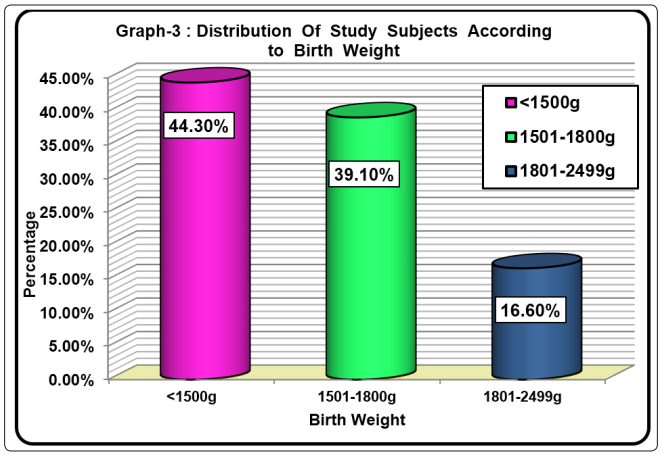
LUBCHENCO'S CHART	MALES	FEMALES	NUMBER	PERCENT
PRETERM AGA	45	57	102	42.6%
PRETERM SGA	46	42	88	36.6%
TERM SGA	21	29	50	20.8%
TOTAL			240	100



Of the total neonates, 102 neonates (42.6%) belong to Preterm AGA, 88 neonates (36.6%) belong to Preterm SGA, 50 neonates (20.8%) belong to Term SGA according to Lubchenco' s charts. Majority of study population belong to Preterm, AGA (42.6%) and Preterm, SGA (36.6%) of the gestational age 33-34 weeks (30.4%) and 35-36 weeks (29.5%). Term, SGA corresponding to 20.8% of the total population, <32 weeks corresponding to 19.1% and > 37 weeks corresponding to 20.8% of the total population.

Table 3: Distribution of Study Subjects according to Birth Weight

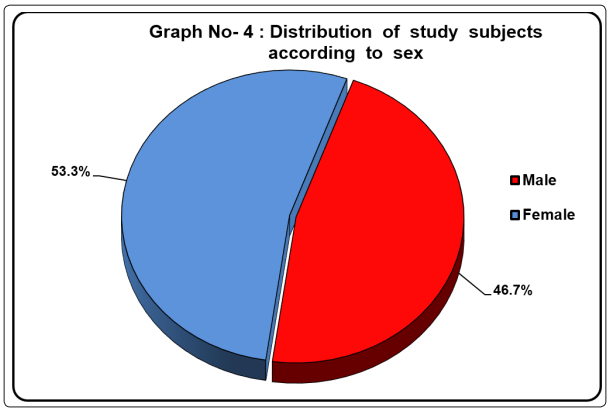
Birth Weight	Number	Percent
<1500g	106	44.3%
1501-1800g	94	39.1%
1801-2499g	40	16.6%
Total	240	100



Of the total 240 study population, nearly half of the neonates (n = 106, 44.3%) were having birth weight <1500 grams, less than half were having birth weight 1501-1800 grams. Only 40 neonates (16.6%) were weighing 1801-2499grams.Mean birth weight of study population is 1987.10 grams. Lowest weighing 790 grams and highest weighing 2100 grams.

Table 4: Distribution of study subjects according to sex

Gestation Age	Number	Percent	P value
Male	112	46.7%	<0.00001
Female	128	53.3%	
Total	240	100	



112 (46.7%) of total subjects were males and 128 (53.3%) were females. Female neonates are more in number compared to male neonates (p = 0.00001).

Table 5: Basic Demographic Features of the Study

VARIABLE	MEAN AND TOAL PERCENT
Weight at enrolment in KMC (gm), (mean+SD)(PT AGA)	1190±215
Age at enrolment in KMC (days) (mean ± SD)(PT AGA)	3±2
Gestation age (wk) (mean ± SD)	33±0.5
Male	112(46.6%)
Mean length at enrolment (cm)	41.55
Head Circumference at enrolment (cm)(mean +SD)	30.29±1.5
Caesarean section	167 (68.72%)
Duration of KMC(Mean + SD) in days	33.78 ±15.12 days
Hypothermia	1(0.4%)
Hyperthermia	4(1.6%)
Hypoglycemia	2(0.8%)
Apnea	2(0.8%)
Sepsis	3(1.2%)
Time to full feeds in days (Mean +SD)	5.5 ± 5.65
Time to start breast feeding from full feeds In days (Mean +SD)	3.66 ± 3.59

Table 6: Distribution of study subjects according to Mean weight in PT and Term, SGA

Anthropometry (mean+SD)	<32wks	33-34wks	35-36wks	>=37wks
Mean Weight(g) (PT AGA)	1190±215	1578±235	2000±230	--------
Mean weight(g) (PT SGA)	1090±210	1220±230	1360±235	--------
Mean weight(g) (T SGA)	---------	----------	---------	1435±215

Weight of all the eligible neonates at start of KMC was recorded with electronic weighing scale with minimal dressing with a variation of +5g. Mean of these weights was taken in the 3 subgroups of LBW babies separately and documented. Of which Mean weight at admission was highest (2000+235gm) in PT AGA(35-36wks) and least (1090+210gm) in PT SGA (<32wks).

Table 7: Distribution of Study Subjects according to Mean Head Circumference in PT and Term, SGA

Anthropometry (mean+SD)	<32wks	33-34wks	35-36wks	>37wks
Head circumference (cm)	1190±215	1578±235	2000±230	--------
(PT AGA)	27.2±1.2	30.29±1.5	32±1.5	---------
Head circumference (cm)	---------	----------	---------	1435±215
(PT SGA)	27.2±1.1	29.2±1.4	32.0±1.4	----------
Head circumference (cm)				
(T SGA)	--------	---------	--------	29.5±1.2

Head circumference of all the eligible neonates at start of KMC was recorded with non-elastic and non-stretchable tape at occipital frontal circumference by cross tape method. Mean of these head circumference was taken in the 3 subgroups of LBW babies separately and documented. Of which Mean head circumference at admission was highest (32+1.5cm) in PT AGA (35-36wks) and least in PT SGA (<32 weeks).

Table 8: Distribution of study subjects according to mean length in PT and TERM, SGA

Anthropometry (mean+SD)	<32wks	33-34wks	35-36wks	>37wks
Mean Length (cm) (PT AGA)	40.88 +2.2	41.55 + 3.4	43 + 3.2	-------
Mean Length (cm) (PT SGA)	39.16 + 2.0	40.12 + 2.8	43.66 + 2.6	-------
Mean Length(cm)(T SGA)	-------	----------	---------	42.12 + 2.1
Head circumference (cm)				
(T SGA)	--------	---------	--------	29.5±1.2

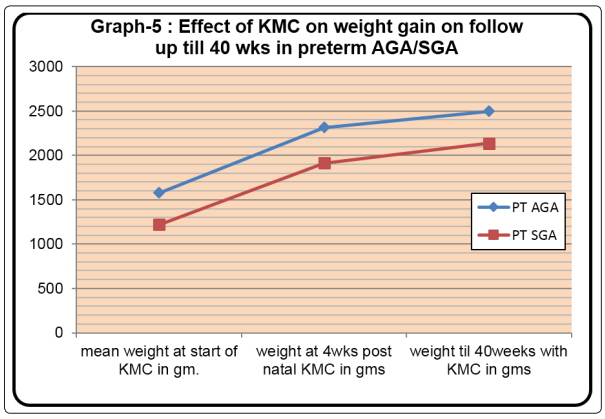
Length of all the eligible neonates at start of KMC was recorded with Seca infant meter. Mean of these length were taken in the 3 subgroups of LBW babies separately and documented. Of which Mean length at admission was highest (43cm+3.2cm) in PT AGA (35-36wks) and least (39.16cm+ 2cm) in PT SGA (<32wks).

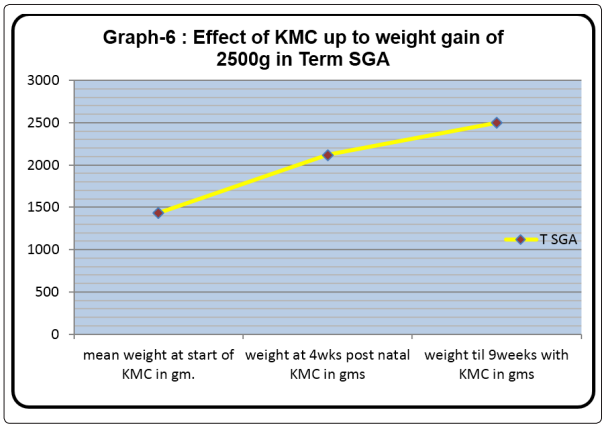
Table 9: Effect of KMC on weight gain on follow up at 40 wks. In PT, and up to gain of 2500g in Term SGA

Anthropometry (mean+SD)	<32wks	p value	33-34wks	p value	35-36wks	p value	>37wk	p value
Weight gain(gm/day) (PT AGA)	22.5±4.5	0.001	24.5±5.5	0.003	23±3.8	0.007	-----	-----
Weight gain(gm/day) (PT SGA)	19.1±3.5	0.004	23.1±4.5	0.002	22.8±3.5	0.004	-----	-----
Weight gain(gm/day) (T SGA)	-----	-----	-----	-----	-----	-----	20.8±3.2	0.001

All the enrolled Preterm AGA, Preterm SGA and Term SGA were followed up to 40 weeks in Preterms and till gain of 2500g in Term SGA .During their first visit and till end of follow up, their anthropometry was taken, of which there is better weight gain due to KMC given at home is documented in all the 3 subgroups of LBW babies.

Highest weight gain (24.5+5.5gm/day) is documented in PT AGA (33-34 weeks) on follow up till 40wks corrected gestational age with significant p value.





The above graph depicts the weight at enrollment of KMC at hospital and weight gain per day at hospital, weight at first follow up visit and till the end of follow up i.e. till 40weeks of corrected Gestational age.

In Preterm AGA mean weight at start of KMC was 1578±235 gm, with an mean weight gain of 24.5±5.5gm/day at hospital. Weight at first follow up visit was 2313±4.2gm and at end of follow up average weight is 2498g i.e.an average weight gain per day was 24±5gm/day at home.

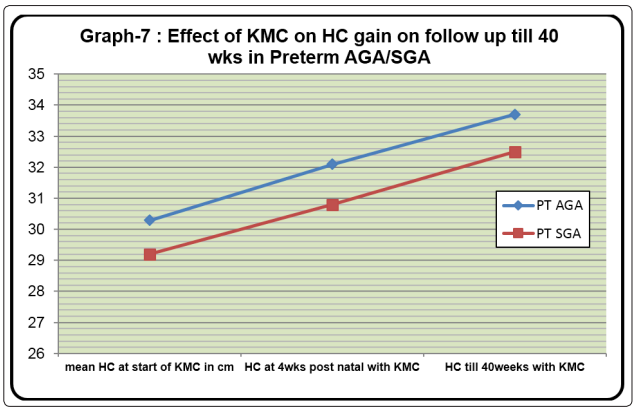
In Preterm SGA mean weight at start of KMC was 1220±230gm, with mean weight gain of 23.1±4.5gm/ day at hospital. Weight at first follow up visit was 1913±4.5gm and at the end of follow up i.e. at 40 weeks of corrected Gestational age average weight is 2136gm i.e an average weight gain per day at home is 22.8±3.5gm/ day at home. In Term SGA mean weight at start of KMC at Hospital was 1435±215gm, with mean weight gain of 20.8±3.2gm/day at hospital. Weight at 4 weeks of follw up was 2119±3 gm, and at 9 weeks of postnatal age, average weight is 2496gm i.e an average weight gain per day at home due to KMC given at home was 20.5±2.8gm/day which is approximately same at the hospital.

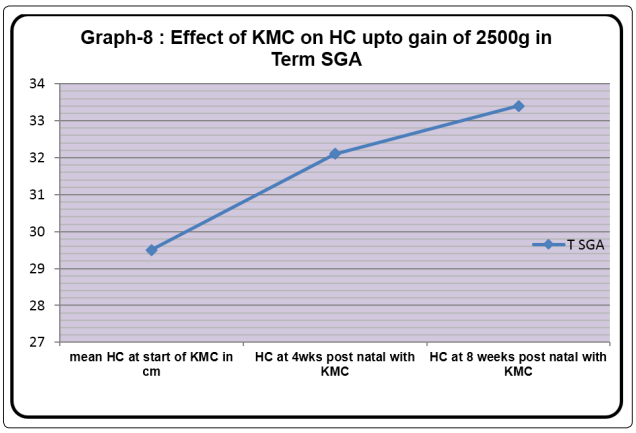
Table 10: Effect of Kmc on Hc Gain on Follow up at 40 Wks in Pt, and up To Gain of 2500g in Term Sga

Anthropometry (mean+SD)	<32 wks	p value	33-34wks	p value	35-36 wks	p value	>37wk	p value
HC gain(cm/wk) (PT AGA)	0.62±0.5	0.005	0.70±0.5	0.002	0.68±0.5	0.002	-----	-----
HC gain(cm/wk) (PT SGA)	0.60±0.5	0.005	0.65±0.5	0.002	0.61±0.5	0.005	-----	-----
HC gain(cm/wk) (T AGA)	-----	-----	-----	-----	-----	-----	0.65±0.5	0.005

All the enrolled Preterm AGA, Preterm SGA and Term SGA were followed up to 40 weeks in Preterms and till gain of 2500g in Term SGA .During their first visit and till end of follow up their anthropometry was taken, of which there is better Head Circumference gain due to KMC given at home is documented in all the 3 subgroups of LBW babies. Of which highest head circumference gain (0.70+0.5cm/ week) is documented in PT AGA (33-34wks) with significant p value.

Effect of KMC on HC gain on follow up at 40 wks in PT, up to gain of 2500g in Term SGA





The above graph depicts the Head Circumference at enrollment of KMC at hospital and HC gain per day at hospital, HC at first follow up visit and till the end of follow up i.e. till 40 weeks of corrected Gestational age.

In Preterm AGA mean HC at start of KMC was 30.29±1.5cm, with a mean HC gain of 0.70±0.5cm/week at hospital. HC at first follow up visit was 32.09±0.4cm and at end of follow up average HC is 33.7cm i.e.an average HC gain per day at home was 0.69±0.5cm/ week.

In Preterm SGA mean HC at start of KMC was 27.2±1.1cm, with mean HC gain of 0.65±0.5cm/ week at hospital. HC at first follow up

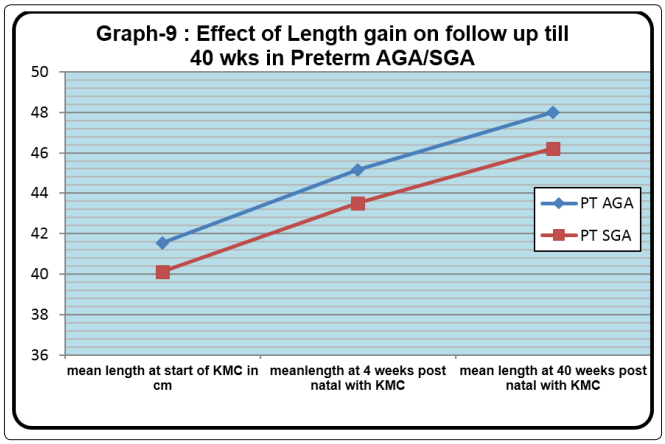
visit was 30.8±0.5cm and at the end of follow up i.e. at 40 weeks of corrected Gestational age average HC is 32.5cm i.e. an average HC gain per day at home is 0.62±0.5cm/ week at home. In Term SGA mean HC at start of KMC at Hospital was 29.5±1.2cm, with mean HC gain of 0.65±0.5cm/ week at hospital. HC at 4 weeks of follow up was 32.1±1.0cm, and at 8 weeks of postnatal age, average HC is 33.4cm i.e. an average HC gain per day at home due to KMC given at home was 0.65±0.3cm/ week which is approximately same as at hospital.

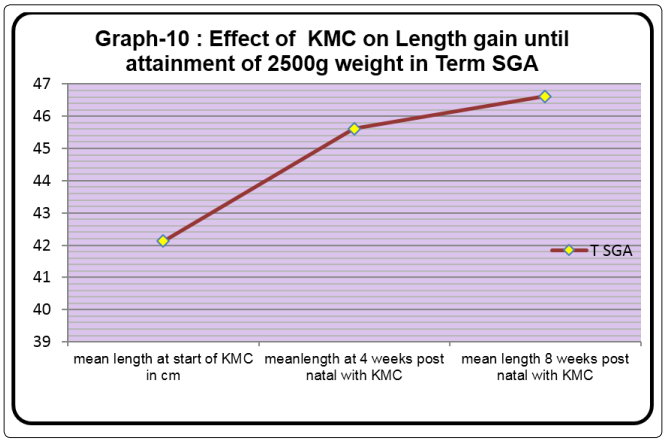
Table 11: Effect of KMC on length gain on follow up till 40wks in PT, up to gain of 2500g weight in Term SGA

Anthropometry (mean+SD)	<32 wks	p value	33-34wks	p value	35-36 wks	p value	>37wk	p value
Length gain (cm/wk) (PT AGA)	0.80±0.4	0.045	0.90±0.6	0.008	0.85±0.6	0.007	-----	-----
Length gain (cm/wk) (PT SGA)	0.82±0.6	0.048	0.85±0.6	0.007	0.84±0.5	0.0068	-----	-----
Length gain (cm/wk) (T SGA)	-----	-----	-----	-----	-----	-----	0.75±0.6	0.005

All the enrolled Preterm AGA, Preterm SGA and Term SGA were followed up to 40 weeks in Preterms and till gain of 2500g in Term SGA .During their first visit and till end of follow up their anthropometry was taken, of which there is better Length gain due to KMC given at home is documented in all the 3 subgroups of LBW babies. Of which Highest length gain (0.90+0.6cm/week) is documented in PTAGA (33-34 weeks) with significant p value.

Effect of KMC on length gain on follow up till 40wks in PT, up to gain of 2500g weight in Term SGA





The above graph depicts the Length at enrolment of KMC at hospital and Length gainer day at hospital, Length at first follow up visit and till the end of follow up i.e. till 40weeks of corrected Gestational age.

In Preterm AGA mean Length at start of KMC was 41.55, with mean Length gain of 0.90±0.6cm/week at hospital. Length at first follow up visit was 45.15±0.5cm and at end of follow up average Lengths 48.8cm i.e.an average Length gain per day at home was 0.90±0.5cm/week.

In Preterm SGA mean Length at start of KMC was 40.12cm, with mean Length gain of 0.85±0.6cm/ week at hospital. Length at first follow up visit was 43.52±0.5cm and at the end of follow up i.e. at 40 weeks of corrected Gestational age average Lengths 46.22cm i.e. an average Length gain per day at home is0.84±0.4cm/week at home.

In Term SGA mean Length at start of KMC at Hospital was 42.12cm, with mean Length gain of 0.75±0.6cm/ week at hospital. Length at 4 weeks of follow-up was 45.62±0.4cm, and at 8 weeks of postnatal age, average Length is 46.62cm i.e. an average Length gain per day at home due to KMC given at home was 0.72±0.3cm/week which is approximately same as at hospital.

Table 12: Differences and Quantitative Benefits of Kmc in 3 Subgroups of low Birth Weight Babies

	PT AGA	PT SGA	T SGA
Mean age in days at start of KMC	3±2 days	5±2days	3±2 days
KMC Duration at hosp./day. (mean+ SD)	9±2hrs	9±2hrs	9±2hrs
KMC Duration at home on follow up/ day (mean+SD)	5±2hrs	8±2hrs	6±2hrs
Weight gain/day in gms. (mean+SD)	24.5±4.5	22.8±3.5	20.8±3.2
Time to full feeds in days	5.5 ± 5.65	8.5 ± 5.65	5.5 ± 5.80
Time to start breast feeds from full feeds in days	3.66 ± 3.59	4.76 ± 4.59	4.86 ± 3.15
Duration of hospital stay in days	12±5	15±6	15±6

Differences and Quantitative benefits of KMC in different subgroups of LBW babies' is compared.

Mean age at enrolment of KMC is less in PT AGA and T SGA with 3±2 days where as in PT SGA it took 5±2 days to start KMC at hospital. KMC was given for equal duration of 9±2 hours in all subgroups of LBW babies at hospital, but mothers of PT AGA provided less duration of KMC was provided when compared to PT SGA and T SGA. The time taken to reach full feeds and the time to reach initiation of direct Breast feeds were comparable in all subgroups but attained much earlier in PT AGA (33-34wks) and PT AGA (35-36wks). Duration of hospital stay is also less in all subgroups but comparatively less in PT AGA sub group. Weight gain is also better in all subgroups of LBW babies with effect of KMC but much higher in PT AGA (24.5±4.5gm/day) than PT SGA (22.8±3.5gm/day) and T SGA (20.8±3.2gm/day) subgroups.

Discussion

This is one of the prospective studies about the short term benefits of KMC and any differences and quantitative benefits of KMC in different subgroups of LBW babies. This study includes 240 preterm and Term neonates, admitted from January 2016 to November 2018. Of the total 240 neonates, males were 112 (46.7%) and Females were 128 (53.3%). Where as in Rao et al study, the study population was 103 KMC group with Male: Female (55:48). In Acharya N et al study, study population was 63 in KMC group with Male: Female (40:23). In all other studies comparison was made between KMC and Conventional group, but in the present study all eligible neonates were subjected only to KMC and the subjects are sub divided into three subgroups like Preterm AGA, Preterm SGA, Term SGA as is done in Rao et al study. Mean birth weight of study Population is 1987.10 grams. Lowest weighing 790 grams and highest weighing 2100 grams.

Table 15: Comparison of weight gain in different studies

Study	Average weight gain
Ramanathan et al[7,28]	15.90gm/day
Mukesh Gupta et al[35]	21.30 gm/day
Suman Rao et al[27]	21.30 gm/day
Madhavi K et al[32]	19.66 gm/day
Rao et al[27]	23.99+9.84gm/day
Subedi et al[30]	30.35gm/day
Present study	24.5+5.5gm/day

Higher daily weight gain recorded in all subgroups of LBW infants, mainly in PT AGA, who received KMC intervention. This beneficial effect was reflected in other growth parameters and is comparable with other studies. Head circumference has been emphasized to be one of the most important growth parameters in LBW babies, being a reflection of the underlying brain growth. Kangaroo care by promoting exclusive breastfeeding, ensuring temperature maintenance, facilitating physiologic stability and decreasing neonatal morbidities, result in improved physical and cognitive growth. In the present study, maternal acceptance of KMC was good and even majority of grandmothers also participated in KMC. All the mothers were able to practice KMC at home with good family support.

Conclusion

Effect on Growth

We conclude by this present study that KMC improves growth in all Sub groups of low birth weight infants and the weight gain is comparable in all Sub groups but comparatively better gain is documented in Preterm AGA subgroup of LBW infant with less duration of KMC on follow up.

In our study not only mothers but also family members especially Grandmothers have also participated in giving KMC at hospital and also at Home and have given good support to the mothers in spending time for KMC at home.

Morbidities

KMC significantly reduced the incidence of apnea, hypothermia, hypoglycemia in all subgroups of LBW babies. All babies were on exclusive breastfeeds at the end of the study (98%). The time taken to reach full feeds and the time to reach initiation of direct breastfeeds were comparable in all subgroups but attained much earlier in PT AGA (33-34wks) and PT AGA (35-36wks).

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