Original Research Article

Effect of kangaroo mother care in preterm versus term intra uterine growth restriction neonates

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ABSTRACT

Background: Low Birth Weight newborns are either Preterm or IUGR. These both have different morbidities and outcomes. KMC is an effective intervention for LBW infants. Here authors study the effectiveness of KMC in preterm babies and full term IUGR babies.

Methods: Prospective, Observational, comparative study in which 50 Preterm AGA and 50 Term IUGR included which are hemodynamically stable. effective KMC given and their daily weight gain were observed.

Results: Term IUGR having average birthweight is 2083.7 ± 177.9 gm and discharge weight 2179.4 ± 183.8 and preterm AGA are having average birthweight 1972.9 ± 198.9 gm and weight on discharge 1962.2 ± 201.0 . IUGR term newborns had mean weight loss for 0.90 ± 1.05 days with mean weight loss of 17.94 ± 28.8 grams with average weight loss of 0.9% followed by mean weight gain of 26.6 ± 14.2 grams per day for mean 4.36 ± 0.74 days. Preterm AGA shows weight loss for 3.54 ± 1.5 days with mean weight loss of 98.06 ± 80.83 grams and average 5.4% followed by mean weight gain of 20.4 ± 8.9 grams 4.22 ± 0.97 per day for mean 4.36 ± 0.74 days. With average hospital stay of 5.26 ± 1.2 and 7.76 ± 1.51 days respectively for Term IUGR and Preterm AGA.

Conclusions: KMC helps in decreasing the morbidities, achieving physiological weight gain and early discharge in both IUGR term and preterm AGA new-borns but maintaining their physiological pattern of weight gain.

Keywords: Intra uterine growth restriction, Kangaroo mother care, Low birth weight, Preterm

INTRODUCTION

Low Birth Weight (LBW) is defined by the world health organization as a birth weight of a live born infant of 2,499 gm or less, regardless of gestational age.¹

In 2013, as many as 22 million newborns, an estimated 16% of babies born globally had LBW, according to the UNICEF. In terms of regional variations, South Asia had the highest incidence of LBW, with 28% newborns weighing less than 2.5 kg. At 28%, India had the third highest percentage of LBW newborns.²

Effective interventions are limited for LBW babies. Moreover, in developing country modern technology is either not available or cannot be used properly, often due to the shortage of skills or financial issues. Under such circumstances good care of preterm and LBW babies is difficult: hypothermia and nosocomial infections are frequent, aggravating the poor outcomes. Frequently and often unnecessarily, incubators separate babies from their mothers, depriving them of the necessary contact. Moreover health of an infant is closely linked to the mother's health and the care she receives in pregnancy and childbirth.

Kangaroo Mother Care (KMC) is an effective way to meet baby's needs for warmth, breastfeeding, protection from infection, stimulation, safety and love. Newborn with a birth weight of 2000 gm or less and who are unable to regulate their own temperature KMC is at least as safe and effective as traditional incubator care and offers the ideal conditions for LBW infants to develop. More than two decades of implementation and research have made it clear that KMC is more than an alternative to incubator care. It has been shown to be effective for thermal control, breastfeeding and bonding in all newborn infants, irrespective of setting, weight, gestational age, and clinical conditions.^{3,4}

Low birth weight contains two different groups:

- Preterm
- Intra uterine growth restriction

Preterm define by world health organization as Live birth infants delivered before 37 weeks from 1st day of last menstrual period.⁵ Intra Uterine Growth Restriction (IUGR) is define as babies with a birth weight under the 10th percentile for gestational age according to standards set by the World Health Organization.⁶

These both groups have different morbidities and outcomes. Preterms are having high immediate mortality but good prognosis in a view of physical and mental development as compare to IUGR babies.⁷ So it is more likely that they are having different outcome of same the intervention.

METHODS

It is a prospective, observational, comparative study carried out at KMC ward of dept, of pediatrics at GMERS Medical College and Hospital, Gotri, Vadodara between June 2017 to December 2018. After ethical and scientific approval, inform consent was taken from the parents of enrolled babies and 50 preterm SGA and 50 Term IUGR babies were enrolled as per inclusion and exclusion criteria.

Inclusion criteria

- Hemodynamically stable preterms neonates who are born less than 37 weeks of gestational age, Birth weight 2500 gm to 1500 gm and appropriate for gestational age (preterm AGA).
- Hemodynamically stable full term IUGR neonates weight less than 2500 gm and more than 1500 gm weight (term IUGR).

Exclusion criteria

- Neonates having other ongoing comorbid conditions (like sepsis, pathological jaundice, RDS, etc.).
- Neonates having any congenital anomalies.

- Parents of neonate who are not willing to participate in study.
- Preterm SGA (Small for Gestational Age).

After enrolling, significant history and examination of newborn was done to exclude any underline comorbidity or significant congenital anomalies. KMC was started in first day of life in inborn newborn and by first or second day of life of extramural newborns. Long time KMC was given for eight hours a day at KMC ward with child in vertical prone position between mothers breast under her cloths with skin-to-skin contact. Adequate and exclusive breast feeding was assured. Mother comfort and privacy was insure. Accurate vital monitoring was done and weight was recorded daily. Newborn who fulfilled discharge criteria were discharged.

Discharge criteria: adequate weight gaining (15-20 gm) a day for three consecutive days and establishment of feeding.

Data was entered in Microsoft Excel and analysis was done using software named statistical Package for Social Science (SPSS) version 17. Comparison done between weight gaining pattern of two groups (preterm AGA and term IUGR newborns).

RESULTS

Out of total 50 newborns in Term IUGR Group 26 (52%) were female and 24 (48%) were male, while in Preterm AGA Group out of 50 newborns 27 (54%) were female and 23 (46%) were male. Male and female children ration were almost equal in both groups.

Term IUGR, 39 (78%) children were born after 38 weeks of gestational age followed by 11 (22%) children were born after 37-38 weeks of gestational age.

Preterm AGA, 21 (42%) children were born between 35-36 weeks of gestational age followed by 15 (30%) children between 34-35 weeks of gestational age, 7 (14%) children between 36-37 weeks of gestational age, 5 (14%) children between 32-33 weeks of gestational age and 2 (4%) children between 33-34 weeks of gestational age.

Term IUGR mean birth weight was 2083.7±177.9 grams and in preterm AGA it was 1972.9±198.9 grams (Table 1).

In Term IUGR mean weight on discharge was 2179.4±183.8 grams and in Preterm AGA it was 1962.2±201.0 grams (Table 2).

Mean days of admission in Term IUGR was 5.26±1.2 days and in Preterm AGA 7.76±1.51 days (Table 3).

The difference of birth weights, weights on discharge and days of admission in both groups was statistically significant ($p < 0.0001$). In Term IUGR group, mean days

of weight loss was 0.90 ± 1.05 days while in Preterm AGA group mean days of weight loss was 3.54 ± 1.5 days (Table 4).

Table 1: Distribution of the newborns as per their birth weight in both groups.

Birth weight (In grams)	Term IUGR	Preterm AGA
1600-1799	5 (10.0)	10 (20.0)
1800-1999	4 (8.0)	9 (18.0)
2000-2199	20 (40.0)	23 (46.0)
2200-2399	21 (42.0)	8 (16.0)
Total	50 (100)	50 (100)
Mean $\pm$ SD	2083.7 $\pm$ 177.9	1972.9 $\pm$ 198.9

Unpaired t test value: 2.936, Degree of freedom: 98, p value: 0.0041 p<0.01

Table 2: Distribution of the newborns as per their weight on discharge in both groups.

Weight on discharge (In grams)	Term IUGR	Preterm AGA
1600-1799	3 (6)	10 (20)
1800-1999	5 (10)	18 (36)
2000-2199	14 (28)	13 (26)
2200-2399	25 (50)	9 (18)
2400-2599	3 (6)	0
Total	50 (100)	50 (100)
Mean $\pm$ SD	2179.4 $\pm$ 183.8	1962.2 $\pm$ 201.0

Unpaired t test value: 5.639, Degree of freedom: 98, p value: <0.0001

Table 3: Distribution of the newborns as per their days of admission in both groups.

No. of days	Term IUGR	Preterm AGA
4	14 (28.0)	1 (2.0)
5	19 (38.0)	2 (4.0)
6	12 (24.0)	6 (12.0)
7	2 (4.0)	12 (24.0)
8	1 (2.0)	15 (30.0)
9	2 (4.0)	9 (18.0)
10	0	3 (6.0)
11	0	1 (2.0)
12	0	1 (2.0)
Total	50 (100)	50 (100)
Mean $\pm$ SD	5.26 $\pm$ 1.2	7.76 $\pm$ 1.51

Unpaired t test value: 9.165, Degree of freedom; 98, p value: <0.0001

After loosing weight in Term IUGR group, mean minimum weight was 2065.8 ± 176.9 grams while in Preterm AGA group, mean minimum weight of 1874.9 ± 202.7 grams. The difference of Minimum weights in both groups was extremely statistically significant. (p<0.0001) (Table 5).

Table 4: Distribution of the newborns as per their days of weight loss in both groups.

No. of days	Term IUGR	Preterm AGA
0	32 (64)	6 (12)
1	11 (22)	2 (4)
2	3 (6)	4 (8)
3	2 (4)	12 (24)
4	1 (2)	13 (26)
5	1 (2)	8 (16)
6	0	4 (8)
7	0	1 (2)
Total	50 (100)	50 (100)
Mean $\pm$ SD	0.90 $\pm$ 1.05	3.54 $\pm$ 1.5

Unpaired t test value: 10.195, Degree of freedom: 98, p value: <0.0001

Table 5: Distribution of the newborns as per their minimum weight in both groups.

Minimum weight (In grams)	Term IUGR	Preterm AGA
1500-1599	0 (0)	2 (4.0)
1600-1699	1 (2.0)	10 (20.0)
1700-1799	4 (8.0)	6 (12.0)
1800-1899	3 (6.0)	6 (12.0)
1900-1999	4 (8.0)	13 (26.0)
2000-2099	10 (20.0)	3 (6.0)
2100-2199	12 (24.0)	6 (12.0)
2200-2299	13 (26.0)	4 (8.0)
2300-2399	3 (6.0)	0 (0)
Total	50 (100)	50 (100)
Mean $\pm$ SD	2065.8 $\pm$ 176.9	1874.9 $\pm$ 202.7

Unpaired t test value: 5.021, Degree of freedom: 98, p value: <0.0001.

Table 6: Distribution of the newborns as per their weight gain in both groups.

Weight gain in grams	Term IUGR	Preterm AGA
0-50	4 (8)	6 (12)
51-100	25 (50)	30 (60)
101-150	12 (24)	11 (22)
151-200	6 (12)	3 (6)
201-250	1 (2)	0
251-300	0	0
301-350	1 (2)	0
Total	50 (100)	50 (100)
Mean $\pm$ SD	113.3 $\pm$ 57.5	87.4 $\pm$ 39.7

Unpaired t test value: 2.621, Degree of freedom: 98, p value: 0.0102 (<0.05)

Once newborn start weight gaining, in Term IUGR group, mean weight gain was 113.3 ± 57.5 grams. while in Preterm AGA group, mean weight gain was 87.4 ± 39.7 (Table 6).

Table 7: Distribution of the newborns as per their weight gain per day in both groups.

Weight gain/day in grams	Term IUGR	Preterm AGA
0-10	3 (6)	4 (8)
11-20	17 (34)	26 (52)
21-30	15 (30)	14 (28)
31-40	10 (20)	5 (10)
41-50	2 (4)	1 (2)
51-60	1 (2)	0
61-70	1 (2)	0
71-80	0 (0)	0
81-90	1 (2)	0
Total	50 (100)	50 (100)
Mean±SD	26.6±14.2	20.4±8.9

Unpaired t test value: 2.616, Degree of freedom: 98, p value: 0.0103 (<0.05).

Mean weight gain per day in Term IUGR was 26.6±14.2 grams and in Preterm AGA 20.4±8.9 grams after they start weight gaining (Table 7).

The difference of weight gain in both groups was statistically significant (p<0.05).

In Term IUGR group, mean weight loss was 17.94±28.8 grams and in Preterm AGA it 98.06±80.83 grams (Table 8).

Table 8: Distribution of the newborns as per their weight loss in both groups.

Weight loss in grams	Term IUGR	Preterm AGA
0	32 (64)	6 (12)
1-50	13 (26)	6 (12)
51-100	5 (10)	20 (40)
101-150	0	12 (24)
151-200	0	3 (6)
201-250	0	1 (2)
251-300	0	0
301-350	0	1 (2)
351-400	0	1 (2)
Total	50 (100)	50 (100)
Mean±SD	17.94±28.8	98.06±80.83

Unpaired t test value: 6.602, Degree of freedom: 98, p value: <0.0001

In percentage Term IUGR loss 0.9% and Preterm IUGR loss 5.4% of their birth weight (Table 9).

Mean weight loss per day was 13.81±25.5 grams in Term IUGR. while in Preterm AGA it was 26.6±20.14 grams (Table 10).

The difference of weight gain in both groups was statistically significant (p<0.05).

Table 9: Distribution of the newborns as per weight loss percentages in both groups.

Weight loss in percentages	Term IUGR	Preterm AGA
0	32 (64)	6 (12)
0.1-4.9	17 (34)	22 (44)
5-9.9	1 (2)	17 (34)
10-14.9	0	3 (6)
15-19.9	0	1 (2)
20.24.9	0	1 (2)
Total	50 (100)	50 (100)
Average	0.9%	5.4%

Table 10: Distribution of the newborns as per their weight loss per day in both groups.

Weight loss/day in grams	Term IUGR	Preterm AGA
0	32 (64)	6 (12)
1-10	3 (6)	5 (10)
11-20	4 (8)	7 (14)
21-30	0	14 (28)
31-40	0	11 (22)
41-50	9 (18)	3 (6)
51-60	1	2 (4)
61-70	0	0
71-80	0	1 (2)
81-90	0	0
91-100	1 (2)	1 (2)
Total	50 (100)	50 (100)
Mean±SD	13.81±25.5	26.6±20.14

Unpaired t test value: 2.783, Degree of freedom: 98, p value: 0.0065(<0.01).

Figure 1: Distribution of the newborns as per their average weight gain (cumulative) per day in both the groups.

In Term IUGR group highest average weight gain 48.3 grams was observed between day 7 to day 8 followed by 37.38 grams between day 2 to day 3. In Preterm AGA

group weight loss was observed during the first four days with highest average weight loss of -26.18 grams between day 3 to day 4. In Preterm AGA group highest average weight gain 28.03 grams was observed between day 7 to day 8 followed by 27.4 grams between day 6 to day 7n (Figure 1).

As per the graph, weight loss was observed in Preterm AGA groups during the first 4 days of the life then weight gain started while in Term IUGR group weight gain was observed from first day of the life. Average weight gain was significantly higher in Term IUGR group then in Preterm AGA group.

DISCUSSION

In this study, out of 50 newborns in Term IUGR group, majority (82%) had birth weight between 2000-2399 grams with mean birth weight was 2083.7 ± 177.9 grams while in Preterm AGA group, out of 50 newborns, 23 (46%) children had birth weight between 2000-2199 grams followed by 10 (20%) children had 1600-1799 grams, 9 (18%) children had 1800-1999 and 8 (16%) children had birth weight between 2200-2399 grams with mean weight of 1972.9 ± 198.9 grams. The difference of birth weights in both groups was extremely statistically significant ($p < 0.0001$).

In Rao et al, out of 103 newborns, 41 (41.8%) children had birth weight between 1800-1999 grams followed by 39 (37.9%) children had 1500-1799 grams, 23 (23.3%) children had birth weight < 1500 grams with mean weight of 1683.4 ± 235 grams.⁸ The difference of birth weights in CMC and KMC groups was not statistically significant. ($p = 0.23$) In Ali SM et al, mean birth weight in KMC group was 1607 ± 211 grams.⁹ In Subedi K et al, the birth weight of the babies were ranged between 1200 grams to 2000 grams and 50% of total included babies had weight more or equal to 1800 grams.¹⁰ In Udani Rekha et al, mean birth weight in KMC group was 1625.59 ± 284 grams.¹¹

In this study, out of 50 newborns in Term IUGR group, majority (78%) had weight on discharge between 2000-2399 grams with mean weight on discharge was 2179.4 ± 183.8 grams while in Preterm AGA group, out of 50 newborns, majority (62%) had weight on discharge between 1800-2199 grams with mean weight on discharge was 1962.2 ± 201.0 grams. The difference of weights on discharge in both groups was extremely statistically significant ($p < 0.0001$).

In Rao et al, KMC babies achieved significantly better growth at the end of the study. For preterm babies, weight, length and head circumference were significantly higher in the KMC group (weight 2388 g, length 47.8 cm and head circumference 33.4 cm) than in the CMC group (weight 2065 g, length 46.4 cm and head circumference 32.1 cm) at the end of follow-up ($p < 0.05$).⁸

In this study, out of 50 newborns in Term IUGR group, majority (90%) children admitted for 4-6 days with mean days of admission was 5.26 ± 1.2 days. In these 32 children had no weight loss and 14 (28%) children had lost their weight between 1-2 days with mean days of weight loss was 0.90 ± 1.05 days. majority (78%) children had gained weight between 4-5 days with mean days of weight gain was 4.36 ± 0.74 days. while in Preterm AGA group, out of 50 newborns, majority (84%) children was admitted for 6-9 days with mean days of admission was 7.76 ± 1.51 days. In these 6 children had no weight loss, 33 (66%) children had lost their weight between 3-5 days with mean days of weight loss was 3.54 ± 1.5 days. majority (88%) children had gained weight between 4-5 days with mean days of weight gain was 4.22 ± 0.97 days. The difference of days of admission in both groups was extremely statistically significant ($p < 0.0001$).

In Rao et al, mean duration of hospital stay was 12.78 ± 6.27 days in KMC group.⁸ In Subedi K et al, average days of weight gain in Preterm SGA group was 4 days, in Preterm AGA group was 3.4 days and in Term SGA was 3.27 days.¹¹ In their study average days of hospital stays in Preterm SGA group was 10.33 days, in Preterm AGA group was 8.2 days and in Term SGA was 8.44 days.

In Ali SM et al, infants in the KMC group had a shorter duration of stay as compared to control group though this difference was not found to be statistically significant.⁹ In Subedi K et al, average duration of hospital stay was 8.99 days.¹⁰ In Udani Rekha et al, when current cohort was compared with historical control of pre-KMC period (1999, when KMC was not practiced) there was clinically meaningful statistically significant decrease in the duration of hospital stay by 6.2 days.¹¹ Gupta M, Jora R et al, observed mean duration of hospital stay was 15.5 days.¹² Similarly, KMC in infants in Evereklian M et al, had discharged at 13.4 days after enrolment.¹³ In Sharma D et al average day of hospital stay was 27.2 ± 7 days.¹⁴

In this study, out of 50 newborns in Term IUGR group, majority (74%) children had gained weight of 51 to 150 grams with mean weight gain was 113.3 ± 57.5 grams with mean weight gain per day was 26.6 ± 14.2 grams while in Preterm AGA group, out of 50 newborns, majority (82%) children had gained weight of 51 to 150 grams with mean weight gain was 87.4 ± 39.7 grams with mean weight gain per day was 20.4 ± 8.9 grams.

Various other studies had shown that KMC babies had better average weight gain per day. A study done by In Rao et al, from Mumbai India showed average weight gain of 23.99 grams in KMC groups.⁸ In Subedi K et al, average weight gain in Preterm SGA group was 26.50 grams/day, in Preterm AGA group was 34.60 grams/day and in Term SGA was 29.96 grams/day.¹⁰ Similarly, experience of K. Ramanathan, V. K. Paul et al, from Delhi found average weight gain in KMC babies after first week of life were 15.9 gm/day and Gupta M. et al,

from Rajasthan India, showed average weight gain of 21.3 grams/day.^{15,12}

Narang et al, from Chandigarh and Srivastava et al, from Allahabad, reported much lower mean birth weight of IUGR babies i.e. 1657±354 gms and 1645±390 gms respectively, compared to present study.^{16,17} Mean birth weight of preterm babies 2038.00 gm is more or less similar as documented by Prasad et al, (2087.5±353.0 g).¹⁸ Similar to present study, Das et al, also found higher mean birth weight of IUGR babies compared to preterm babies.¹⁹ Present study revealed faster rates of growth increment of Term IUGR compared to Preterm AGA infants in all the parameters. Das et al also noticed faster weight gain for both IUGR and preterm, but increment seems to be faster in IUGR babies.¹⁹

In Rao et al, demonstrated a significantly higher daily weight gain in infants who received the KMC intervention.⁸

In their clinical trial study among LBW neonates, Mohammadkazem et al, found that KMC had better effect on daily weight gaining (18.31±7.57 vs. 4.89±16.57; $p<0.001$).²⁰ Jafari et al, reported that the mean weight change in neonates that received KMC and control group were 15 and 4 g, respectively ($p=0.015$).²¹ Basiri et al, showed that KMC for more than four hours a day for five days had better effect on daily weight gaining in LBW neonates (37.5±42.8 vs 14.5±25.3 g; $p<0.007$).²²

In this study, out of 50 newborns in Term IUGR group, 32 children had no weight loss and 14 (28%) children had lost their weight between 1-2 days with mean days of weight loss was 0.90±1.05 days and these children had lost their weight of 1 to 100 grams with mean weight loss was 17.94±28.8 grams with mean weight loss per day was 13.81±25.5 grams. Out of 50 newborns in Term IUGR group, 32 (64%) children had no weight loss and 34% children had lost their weight of 0.1 to 4.9% followed by 1 child with weight loss of 5 to 9.9% with average weight loss was 0.9%

Term IUGR babies if adequately fed, they do not lose weight and start gaining weight after 2 to 3 days of age. Their initial weight gain rapid which subsequently slows down after three months of age.⁷

In Preterm AGA group, out of 50 newborns, 6 children had no weight loss, 33 (66%) children had lost their weight between 3-5 days with mean days of weight loss was 3.54±1.5 days. The difference of days of loss in both groups was extremely statistically significant. ($p<0.0001$) In Preterm AGA group, out of 50 newborns, 6 (12%) children had no weight loss and 76% children had lost their weight of 1 to 150 grams with mean weight loss was 98.06±80.83 grams with mean weight loss per day was 26.6±20.14 grams. The difference of weight gain in both groups was statistically significant ($p<0.05$).

In Preterm AGA group, out of 50 newborns, 6 (12%) children had no weight loss 78% children had lost their weight of 0.1 to 9.9% with average weight gain was 5.4%.

Postnatal growth varies from intrauterine growth in that it begins with a period of weight loss, primarily through the loss of extracellular fluid. The typical prenatal weight loss in the term infant is 5% to 10% of the birth weight. In preterm infants, this postnatal weight loss can be as much as 15% of the birth weight. Most preterm babies lose their weight during the first 3 to 4 days of the life and loss is up to maximum of 10 to 15% of the birth weight. The weight remains stationary for the next 4 to 5 days and then the babies start gaining at a rate of 1.0 to 1.5% of the bodyweight. (10-15 g/kg/day). This postnatal weight loss pattern, however, can be attenuated in most preterm infant with optimized, early nutrition.²³ In this study due to KMC the average weight loss reduced to 5.4% with mean days of weight loss was 3.54±1.5 days in preterm AGA group.

CONCLUSION

IUGR term new-borns had mean weight loss for 0.90±1.05 days with mean weight loss of 17.94±28.8 grams of weight with average weight loss of 0.9% followed by mean weight gain of 26.6±14.2 grams of weight per day with average weight gain of 5.53% for mean 4.36±0.74 days. Preterm AGA shows weight loss for 3.54±1.5 days with mean weight loss of 98.06±80.83 grams of weight and average 5.4% followed by mean weight gain of 20.4±8.9 grams of weight 4.22±0.97 per day with average gain of 4.74% for mean 4.36±0.74 days. With average hospital stay of 5.26±1.2 and 7.76±1.51 days respectively for Term IUGR and Preterm AGA.

IUGR term babies start gaining weight earlier than preterm AGA babies with mean weight gain is also higher than Preterm AGA with less hospital stay and early discharge which correlate with physiological pattern of the weight gain of low birth weight IUGR and preterm AGA.

From above statistical analysis, authors can conclude that KMC helps in decreasing the morbidity like hypothermia, infection and apnoea which in turn helps in achieving physiological weight gain and early discharge in both IUGR term and preterm AGA new-borns but maintain their physiological pattern of weight gain.

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