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ORIGINAL

Micronutrients supplementation and the outcome in preterm neonates in a tertiary health centre

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Abstract: Approximately 15 million babies are born preterm each year.[1] Preterm infants commonly experience postnatal growth failure due to insufficient intake of micronutrients. We aim to determine the outcome of preterm neonates that received micronutrients.

Methods: The study subjects comprised of 210 preterm neonates admitted to (SCBU) of Federal Medical Centre, Brinin kebbi, Kebbi State from 1st June 2020 to 30st May, 2022.

The subjects were randomized into two groups; 100 preterm neonates (Study group) received micronutrients (Reload; Reload Brands, LLC, Salt Lake City, Utah, USA) while, 110 preterm neonates (Control group) did not receive micronutrients. Biodata and other important information were obtained. All the babies (210) received the usual treatment protocol of preterm admitted to our SCBU. Ethical approval was obtained from the Research and Ethics Committee.

Results: Birth weights of the 210 neonates ranged from 800grams to the highest 2500grams with mean birth weight of 1.54kg ±0.95. Average daily weight gains in 71% of the study subjects ranged from 25grams to a maximum of 29 grams per day while, in the non-micronutrients group, 54% had daily weight gain range of 10-14grams per day (p = 0.001). Twelve (12%) of the Micronutrient group (MG) and 30% 0f the Non-Micronutrient group (NMG) had need for blood transfusion respectively (p = 0.002). The average hospital stay was 22.95±9.68; hospital stay for the MG was 8 to 21 days while that of the NMG was 22 to 42 days (p = 0.001).

Conclusions: Micronutrients intake were in consistent with optimal weight gain, shorter hospital stay and lower need for blood transfusion in preterm newborns.

Recommendations: We recommend early commencement of micronutrient supplement (Reloads) in preterm babies.

Key Words: Micronutrients, outcome, neonates

Introduction

Survival of preterm babies is very critical; Preterm birth is a persistent health challenge with its attendant high morbidity and mortality.[1] Approximately 15 million babies are born preterm each year; Sixty percent of them are born in sub-Saharan Africa and South Asia.[1] Approximately 1 million children die each year from complications of preterm birth.[1] Many survivors face a lifetime of disability, including learning disabilities, visual and hearing problems.[1-4]

In low-income settings, preterm babies die due to a lack of feasible, cost-effective care[1]. Extremely preterm infants have high nutrient requirements and they commonly experience postnatal growth failure.[5-8] The required micronutrients for the optimal growth of these preterm population include vitamins and minerals.

Objective: Determination of the outcome of preterm neonates that received micronutrient supplementation (Reload drops and Reload Kids LLC, Salt Lake City, Utah, USA) that we used in this study

Material and Methods

Study Area

Federal Medical Centre (FMC) Kebbi is located in Brinin Kebbi, the capital of Kebbi State, north western Nigeria. Kebbi State has anestimated population of 4.7

million. Kebbi State has the worst newborn death rates of 55 per 1000 births which is higher than the national average of 37 per 1000 births.[9] The Federal Medical Centre Kebbi serves as a referral centre in north western Nigeria. The hospital provides secondary and tertiary care to the population of Brinin Kebbi and the neighbouring states. The Special Care Baby Unit (SCBU) is run by consultants, residents, medical officers and nurses who provide expert health care for both inborn and out-born pre-term and term neonates. The unit is equipped with radiant warmers, incubators, improvised CPAP, mechanical ventilators, cribs, suctioning machines, and oxygen delivery system among others. It is the only newborn unit in the entire state

Study Population: Preterm neonates (28/52 weeks to less than 37 completed weeks of gestation) admitted and managed in the Special Baby Care Unit of the Federal Medical Centre, Brinin Kebbi for a period of two years from 1st June 2020 to 30st May, 2022.

(a) Inclusion criteria

i. All preterm babies admitted to SCBU who survived greater than 24 hours
ii. Preterm babies with obtained verbal and/or written consent of parents or the care-giver to participate in the study (Group A).

(b) Exclusion criteria

i. Preterm babies that the parents or care-giver refused consent
ii. Preterm babies with major congenital malformations
iii. All preterm babies with perinatal asphyxia

A two-group study (A and B)

Group A: A descriptive longitudinal study:112 preterm babies were admitted during the study period between 1stJune, 2021 and 31st May, 2022to our Special Baby Care Unit (SCBU) but, 100 met the inclusion criteria and were recruited for the study (Study group). Babies in this group received enteral Reload drops (Multivitamin and Minerals) 1ml once a day. The intervention was started 48 hours after introduction of feeds and continued until 38 weeks' post-menstrual age. The dosage was then changed to Reload for kids at 2.5mls twice daily and continued after discharge until 12 weeks of chronological age. Their daily and weekly weight gain while on admission and after discharge was monitored respectively until 12 weeks of chronological age. In addition to the Reload therapy, these babies also had the units' routine protocol of care for preterm newborns. Birth weight and packed cell volume (PCV) were obtained and documented at the point of contact for admission. The need, if any for blood transfusion was also documented. Thereafter, daily weight gains and weekly PCV were obtained and documented. Only babies that received micronutrients and survived to the point of discharge were included in the analysis (group A).

Group B: (Control group):118 preterm babies were admitted during the study period between 1st June, 2020 and 31st May, 2021 to our Special Baby Care Unit (SCBU) but, 110 met the inclusion criteria and were recruited in the study (Control group). Birth weight, packed cell volume (PCV) and random blood sugar (RBS), daily weight and weekly PCV were obtained and documented from their case files. Biodata and other important information were also obtained from the case files for all the groups using a preformed questionnaire.

The outcome of the babies in group A (Study group; micronutrients group, MG) was then compared to babies in group B (controls, none micronutrients group, NMG) that had no contact with Reload Vis-à-vis; daily weight gain, PCV pattern and duration of hospital stay.

The study subjects were not matched for gender.

Ethical Approval

Ethical approval was obtained from the Research and Ethics Committee of the Federal Medical Centre, Brinin Kebbi, Kebbi State.

Data analysis

A unique number was allocated to every baby in this study and it was used in the storage and management of all data. The data was manually sorted out for completeness and cleaned using standardized queries to conduct range and logic check. Data were analysed using SPSS Statistical software (Version 25.0 for Windows, SPSS Inc. Chicago, IL). version 25. Where there are discrepancies in records, they were rectified by the records of the babies concerned. The program was used to compute frequencies, proportions and means of study variables using tabular and graphical presentation of the data. Chi square test or where figures were small, Fisher's exact test was used for comparison of proportions, while means were compared using student t-test. An independent sample t-test was used to compare the performance of the micronutrient (Reload) amongst the two preterm groups. Statistical significance was accepted at a 5%(p-value of less than 0.05).

Results

A total of 324 preterm babies were admitted to the SCBU during the study period; 210 met the criteria for the present study: 100 newborns were recruited in the group A, 110 where recruited into the control group. Forty-four Percent (44%) of the study group (MG) were males compared to 40% males in the NMG group. Concerning Birth weight; 51% of the study group had low birth weight as against 59% in the NMG group. Sixty-four percent of the study group were inborn via SVD being the highest (64%) mode of delivery while, in the NMG group 58% were in-born and 59% were delivered vaginally. Seventy-two percent of the study group (MG) were of low socio-economic status as compared to 59%

in the NMG group (p = 0.131). Thirty-three percent (33%) of mothers in the study group had morbidity (Table 1).

Table 1: Neonatal and maternal baseline socio-demographic characteristics

Variables	Reload		
	NM (n = 100)	NMG (n = 110)	*P*-value
Socio-economic status			
Low	72	84	
Mid	11	14	0.131
High	17	12	
Weight at discharge			
1.40	0	76	
1.42	1	2	
1.5	16	25	0.000
1.52	0	3	
1.53	0	4	
1.55	3	0	
1.6	72	0	
1.7	8	0	
Transfusion			
Yes	12	34	0.002
No	88	76	
Average daily weight gain			
10-14	0	61	
15-19	0	49	
20-24	25	0	
25-29	71	0	
>30	4	0	0.000
EGA Category			
Extremely preterm	1	0	
Very preterm	44	45	
Moderate preterm	30	31	
Late preterm	25	34	0.593
Hospital stay (days)			
<7	0	0	
8-14	58	1	
15-21	42	0	
22-28	0	24	
29-35	0	60	0.000
36-42	0	25	

Pattern of Weight Amongst study groups

The birth weights of the 210 preterm neonates ranged from the lowest 800grams to the highest of 2500grams.Forty-six (46%) of the study group were early preterm and eighty-five percent were appropriate-for-gestational age while, forty-one percent of the NMG were early preterm and 79% were appropriate-for-gestational age. Concerning average daily weight gain amongst the study subjects; 71% of the Micronutrient group gained a range of 25grams to a maximum of 29 grams per day while, in the non-micronutrient group, 54% had daily weight gain range of 10-14grams per day (p = 0.001). Seventy-two percent (majority) of the MG were discharged with high weight of 1600grams while majority (76%) of the NMG were discharged with weight of 1400grams(p = 0.001) (Table 2)

Table 2: Relationship between Micronutrients (Reload) and other variables

Variable	Reload		
	MG (n=100)	NMG (n=110)	Total
Gender			
Male	44(48%)	48(52%)	92(100%)
Female	56(47%)	62(53%)	118(100%)
Birth weight			
ELBW	2	4	6
VLBW	46	43	89
LBW	51	63	114
NORM	1	0	1
Place of delivery			
Inborn	64	64	128
Outborn	36	46	82
Mode of delivery			
SVD	64	66	130
EMCS	29	44	73
ELCS	7	0	7
Weight-for-age			
AGA	85	86	171
SGA	15	24	39
Birth attendant			
Skilled	85	98	183
Unskilled	15	12	27
Maternal morbidity			
Yes	33	38	71
No	67	72	139
Socioeconomic status			
Low	72	84	156
Mid	11	14	25
High	17	12	29
Neonatal Morbidity			
Yes	70	86	156
No	30	24	54

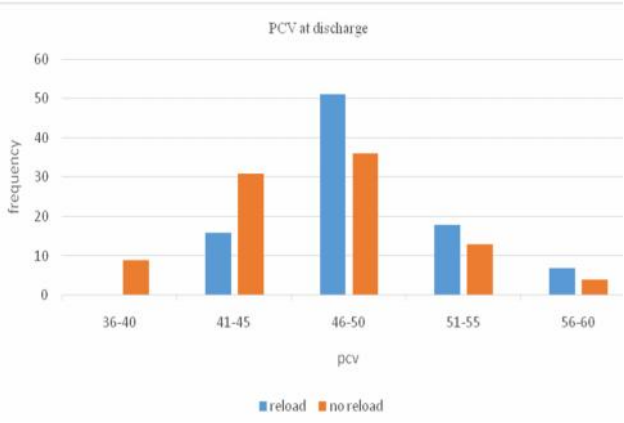
Average Hospital Stay Amongst Study Groups

The average hospital stay for the study subjects was 22.95±9.68; Fifty-eight (58%) of the MG had a hospital stay of 8 to 14 days while 54% of the NMG had a hospital stay of 29 to 35 days (p = 0.001)(Table 2).

Pattern of PCV amongst Study Groups

The Packed Cell Volume (PCV) of the 210 preterm neonates at presentation ranged from the lowest 32% to the highest 71% with a mean of 44.97% ±7.5 The mean PCV amongst the study group showed a significant rise from 42.7% at presentation to 48.62% at discharge (p = 0.001) while, the mean PCV for the NMG showed a decrease from 47.24% at presentation to 46.3% at discharge (Figure 1). Twelve (12%) of the MG had blood transfusion while a higher number 30% of the NMG had blood transfusion. The difference in the proportion was statistically significant (p = 0.002) (Fig. I).

Fig 1: Packed cell volume in the MG and in the NMG



Discussion

Aggregate of previous studies have confirmed the significant positive role of micronutrients in the growth of both extreme low-birth weight and preterm new-borns however, the routine use of micronutrients is yet to bead opted in third world countries.[2,8]In most cases, the reason is the not only the cost of payment which is usually out-of-pocket but, dearth of knowledge on the clinical need for micronutrients for growth and development in preterm neonates amongst health care providers. Our study was carried out to evaluate the clinical outcome with the use of micronutrients for rapid growth and development in preterm babies. The present study showed significant association between the use of micronutrients (Reload) and average weight gain, need for blood transfusion, average packed cell volume and length of hospital stay.

The study group (MG) a showed a significant optimal weight gain with the use of the micronutrient (Reload); 71% of them had daily weight gain ranging from 25-29grams as against only 54% of the NMG having daily weight gain in the range of only 10-14 grams. This finding is in agreement with previous studies including the Sweden study.[2,5,8]where they observed that the extreme preterm neonates that received micronutrients supplementation had optimal weight gain. The result further highlights the fact that achieving weight gain in preterm neonates still remains a major management problem in neonatal practice. The optimal weight gain amongst the MG has led to their shorter hospital stay.

The Micronutrient group had lesser need for blood transfusion compared to the NMG; Over 30% of the NMG had blood transfusion for various reasons with exclusion of probable anaemia of prematurity when compared to less than 12% of the MG where there is the use of micronutrients. Similar studies where there was no use of micronutrients amongst neonates reported similar high rates of blood transfusion.[10-14] However, there is the need for a larger study for results that will adequately power an acceptable generalization on positive use of micronutrients to improve PCV in neonates. Blood transfusion procedure is cumbersome with increasing financial implication in addition to the associated risks of infection transmission and immunologic reactions. Therefore, reduced frequency for blood transfusion amongst neonates is apt.

Another documented finding from this study was the shorter duration of hospitalization associated with the use of micronutrient supplementation. The average hospital stay for the study subjects was 22.95±9.68. More than half(58%) of the MG had hospital stay of 8 to 14 days compared to 54% of the NMG with a hospital stay of 29 to 35 days. This observation of longer hospital stay amongst the NMG is similar to finding in previous studies.[15,16] The shorter hospital stay might have led to reduced cost of care, and less of both mental and physical stress for the parents/caregivers as most of the cost are out-of-pocket payments. This is particularly important as majority of the patients in both groups are of low socio-economic extract; 72% and 59% of the MG and the NMG respectively.
There was no significant association between the MG and the NMG when the socio-economic status of their parents was compared.

Conclusions

i. Intakes of Reload (micronutrients and minerals) were in consistent with the expected optimal weight gain of between 20 to 30grams per day.
ii. Lesser need for blood transfusion and
iii. There was shorter hospital stay in preterm newborns

Recommendations

Early commencement of micronutrients is therefore, recommended in preterm neonates to achieve optimal postnatal growth. However, there is the need for multicentre intervention studies using single or multiple micronutrients in preterm infants including absorption studies to increase nation-wide acceptance and usage.

Limitation

We were not able to analyse the absorption and utilization of individual micronutrient's contribution to the growth of the neonates. The study subjects and the NMG used for the study were not matched for gender.

Authors Contributions
Onankpa Ben: Concept, design and intellectual content.
Lawal Taslim: Literature Searches
Aliyu Mamman Na'uzo: Experimental studies and data acquisition
Usman Sanni Abiola: Clinical and experimental studies
Musa Lilly**:** Manuscript editing and review
Opeyemi Ojomu: Data and statistical analysis
Pharm Gidado Yusuf: Editing and review of Reload use
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