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HAEMATOLOGICAL AND ACID BASE BALANCE CHANGES IN NEWLY BORN CALVES FED ON MILK SUBSTITUTES

(With 5 Tables)

By

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(Received at 28/11/1990)

صورة الدم والتوازن الحامضى والقاعدى لدم العجول الرضيعة المغذاه على بدائل الألبان

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أجرى هذا البحث على عدد ١٢٢ من العجول الجاموسى والفريزيان الرضيعة تراوحت اعمارها مابين اسبوع الى ١٢ إسبوع والتابعة لمزرعة الالبان بالحواتكة وبنى مر بمحافظة اسيوط وشمل البحث دراسة مكونات الدم وهى العد الكلى لكريات الدم الحمراء والبيضاء ونسبة كلاً من الهيموجلوبين والكريات المصته بالإضافة إلى مكونات الدم من ناحية التوازن الحامضى والقاعدى وذلك بعد تغذية العجول باللبن الطبيعى لمدة ثلاثة أيام ثم خليط من اللبن الطبيعى واللبن البديل لمدة إسبوعين ثم أستخدم اللبن البديل بمفرده حتى الفطام . وشملت الدراسة مدى تأثير إستخدام بدائل اللبن على مكونات صورة الدم والتوازن الحامضى والقاعدى في تلك العجول الرضيعة وتم تصميم المقارنات الإحصائية

SUMMARY

A total number of 122 newly born buffaloe and fresiain calves with average age (1-12 weeks) were selected for this investiagation. Aimal were classified into four groups; group I and group II were proved to be clinically healthy by both clinical and laboratory methods of examination and considered as control group for both Buffaloe and Freissian calves. Meanwhile animals in group III and group IV were fed on natural milk for 3 days then were given a mixture of natural milk and milk substitutes till the second week then they fed on milk substitutes alone till the weaning period.

Haemogram picture was performed including total erythrocytic & total leucocytic count, haemoglobin concentration and packed cell volume.

Also, blood gases were estimated including blood pH, carbon-dioxide tension, oxygen tension, partial oxygen tension, bicarbonate; total carbon dioxide and Base-excess.

INTRODUCTION

Milk replacers or substitutes are used extensively to raise calves for replacements in dairy hards and to fatten calves in vealing operations (RADOSTITS AND BLOOD, 1985). These milk replacers are cheaper than cow's whole milk because they consist of skin milk powder and other milk by-products and added fats of animal or vegetable origin, added carbohydrates of Vegetable origin and more recently added non-milk proteins (SIOBO AND ROY, 1978). The details of nutrient requirements of the pre-ruminant calf in the first few weeks of the life were extensively discussed (JACOBSON, 1969; RADOSTITS & BELL, 1970 and NATIONAL RESEARCH COUNCIL, 1978).

Metabolic alkalosis partially compensatory by respiratory acidosis had been evident in calves (1-4 weeks age) fed on whole milk replacers (REECE AND WAHLSTROM, 1972).

Variations in acid base balance values either due to feeding milk replacers or conventional feeding was studied by REECE (1984).

Haemogram picture in healthy buffaloe calves from birth until weaning were widely discussed by many authors (GREATOROX, 1957; EBERHERT & PATT, 1971; KARRAM, 1978; SCHALM, 1979 and COLES, 1986).

The aim of the present work was to throw light upon the possibility of using milk replacers and its influence on newlyborn calves and estimating the variations in both haemogram picture and acid base balance in naturally sucking calves and those fed on milk replacers.

MATERIAL and METHODS

A total number of 122 newlyborn calves (buffaloe and fressian breed 1-12 week old) were included in this investigation. The calves were belonged to El-Hawatka and Beni-Morr Governmental dairy farms. The animals were classified into four goups. Age, number, regeim of feeding were illustrated in table (1).

Newly born calves were fed on natural milk for 3 days then from the fourth day until the second week were fed on a mixture of natural milk with milk substitute. From the second week up to weaning (45-70 days) animals were fed on milk substitute as a a liquid replaced starter. Milk* replacer powder was dissolved in warm water. The adviced concentration was 125 gm/L. All equipment and utensils must be cleared before and after using milk replacement to avoid the infection.

Blood samples were collected from each animal anaerobically from jugular vien into disposable plastic syring whose dead space had previousely filled with 1:1000 I.U.

* : Holand milk replacer contains vit. AD_3, E_1, B_1, B_2, B_6, B_{12}, K, Ca panthonate and trace elements. Antibiotic and furazilidone are also added to prevent outbreaks of diseases particularly enteritis.

Table (1)

Animals, groups, numbers, ages and regiem of feeding.

Group	Number and age, type	Regiem of feeding
I	25 buffaloe calves (1-12) week old.	Fed on natural milk.
II	25 freissian calves (1-12) week old	Fed on natural milk.
III	9 from 1-2 week 9 from 2-4 week 10 from 4-6 week 10 from 8-12 week Total 38 Buffaloe calve	Animal were fed on natural milk from calving till 3 days then a mixture of natural milk and milk replacer from the fourth day of life till the second week. From the second week till the weaning time they were fed milk replacer in concentration of 125 gm/L.
IV	7 from 1-2 week 7 from 2-4 week 10 from 4-6 week 10 from 8-12 week Total 34 Fressian calves	

sodium heparin. The samples immediately placed in ice bath to avoid metabolic changes in the blood and analysed using blood gas analyzer model (168). The rest of samples were used for haemogram picture (T.R.B.Cs/T/L); (TWB.Cs/G/L) and (Hb Conc/gm/L) using electronic cell-counter (Cell Dyne 300 sequoia Turnar). Packed cell volume (P.C.V. %) was estimated according to routine methods of haematology (COLES, 1986).

Statistical analysis of the data was performed according to the method described by KALTON (1967).

RESULTS

Mean values of haemogram picture and acid base balance in both buffaloe and fressian calves are illustrated in tables (2,3,4 & 5).

Table (2)

Values of acid-base balance of Fressian calves feeding substitute milk.

Age of calves	item	pH	pCO_2 mm/Hg	pO_2 mm/Hg	HCO_3^- mmol/L	TCO_2 mmol/L	B.E mmol/L
1-2 weeks	X±S.E	7.322 ± 0.018	46.3 ± 2.06	26.91 ± 1.59	23.91 ± 1.108	25.47 ± 1.16	-3.24 ± 0.58
	Range	(7.287 - 7.393)	(37.7 - 53.3)	(22.0 -26.9)	(21.0 -29.3)	(22.2 -30.8)	(-0.7- (-5.1))
	Control	7.414 ± 0.01	43.85 ± 0.21	28.0 ± 0.212	30.95 ± 4.065	29.35 ± 0.601	3.55 ± 0.106
2-4 weeks	X±S.E	7.180 ± 0.018	49.57 ± 1.55	19.8 ± 5.22	18.57 ± 0.667	20.0 ± 0.671	-10.15 ± 0.94
	Range	(7.131 - 7.254)	(56.6 - 46.7)	(16.8 -24.8)	(18.5 -21.6)	(16.9 -23.0)	(-14-(-5.8))
	Control	7.365 ± 0.01	46.6 ± 2.2	31.81 ± 1.34	26.0 ± 4.282	27.95 ± 2.68	0.38 ± 1.64
4-6 weeks	X±S.E	7.337 ± 0.06	49.39 ± 3.59	25.36 ± 1.05	28.22 ± 3.162	28.22 ± 1.36	2.42 ± 0.56
	Range	(7.271 - 7.396)	(68.3 - 27.5)	(31.5 -21.3)	(35.5 -22.4)	(37.8 -23.9)	(-0.5 - (-5.6)
	Control	7.346 ± 0.036	46.89 ± 0.36	33.81 ± 0.08	26.27 ± 0.07	27.95 ± 0.04	0.42 ± 1.64
8-12 weeks	X±S.E	7.295 ± 0.041	50.71 ± 2.8	32.14 ± 0.85	24.74 ± 0.96	26.35 ± 0.32	-1.68 ± 2.21
	Range	(7.253 - 7.346)	(47.7 - 57.2)	(29.5 -37.5)	(23.0 -25.9)	(24.0 -27.5)	(-0.5-(-2.6)
	Control	7.337 ± 0.05	47.7 ± 1.94	31.2 ± 0.86	25.5 ± 2.44	27.0 ± 1.45	3.10 ± 0.04
	Overmean	7.284 ± 0.07	48.99 ± 1.88	26.05 ±5.1	23.9 ± 3.9	25.01 ±3.53	-4.37 ± 3.9

Table (3)

Values of blood gases and acid-base balance of bufaloe calves rearing on replaced milk.

Age of calves	Item	pH	pCO_2 mm/Hg	pO_2 mm/Hg	HCO_3^- mmol/L	TCO_2 mmol/L	B.E mmol/L
2 week	X±S.E	7.165 ± 0.6	51.91 ± 2.13	30.75 ± 1.2	19.96 ± 1.57	21.53 ± 4.589	-8.2 ± 2.38
	Exp.R	(6.839 - 7.305)	(56.6 - 44.4)	(22.4 - 36.1)	(25.1 - 11.2)	(26.6 - 13.3)	(12.1 - 2.6)
	Control	7.342 ± 0.07	40.3 ± 5.12	33.37 ± 4.3	22.37 ± 4.58	23.37 ± 4.58	-2.4 ± 5.38
4 week	X±S.E	7.357 ± 0.03	51.59 ± 1.9	38.68 ± 3.9	30.44 ± 1.12	31.66 ± 1.106	3.918 ± 1.54
	Exp. R	(7.395 - 7.305)	(37.8 - 56.7)	(65.8 - 27.1)	(23.7 - 30.8)	(35.6 - 27.3)	(5.8 - 1.1)
	Control	7.338 ± 0.02	41.38 ± 4.31	36.11 ± 3.7	25.17 ± 1.98	27.3 ± 2.19	0.62 ± 1.54
6 week	X±S.E	7.346 ± 2.1	52.4 ± 5.02	30.9 ± 2.36	30.9 ± 3.2	32.08 ± 3.3	+3.98 ± 1.97
	Exp. R	(7.384 - 7.35)	(57.6 - 51.9)	(33.7 - 27.1)	(37.9 - 25.9)	(27.3 ± 3.4)	(7.8 - 1.1)
	Control	7.334 ± 0.2	47.3 ± 1.3	29.5 ± 0.3	23.3 ± 0.5	32.08 ± 2.3	3.6 ± 1.75
8 week	X±S.E	7.302 ± 0.28	50.6 ± 0.816	38.11 ± 2.11	24.91 ± 0.391	26.41 ± 0.384	1.92 ± 0.46
	Exp. R	(7.339 - 7.24)	(47.0 - 53)	(46.6 - 28.6)	(23.2 - 28.8)	(27.7 - 24.7)	(3.6 - 0.1)
	Control	7.368 ± 0.044	47.38 ± 3.28	31.52 ± 3.9	28.55 ± 2.2	28.55 ± 2.2	1.83 ± 2.79
	Overmean	7.29 ± 0.08	51.6 ± 0.7	34.61 ± 4.4	26.55 ± 5.17	27.92 ± 4.98	-4.51 ± 2.6

Table (4)

Calves reared on milk replacer, hoemtological mean values of cattle (Fressian calves).

Age of calves	item	T.R.Bcs. T/L	T.W.Bcs G/L	Hoemoglobin gm/L	P.C.V %
1-2 weeks	X±S.E	9.62 ± 0.56	8.3 ± 1.1	106.71 ± 2.7	38.7 ± 1.09
	Range	(8.3 - 12.0)	(8.0 - 15.0)	(98.0 ±112.0)	(33.0 - 42.0)
	Control	8.3 ± 1.57	10.0 ± 1.03	110.00 ± 3.5	34.7 ± 0.2
2-4 weeks	X±S.E	6.57 ± 3.51	9.17 ± 0.63	113.14 ± 1.68	43.9 ± 1.07**
	Range	(5.25 - 7.70)	(8.0 - 12.0)	(111.00 -117.00)	(40.0 -47.5)
	Control	8.12 ± 1.6	8.7 ± 1.3	118.00 ± 2.1	33.5 ± 2.5
4-6 weeks	X±S.E	5.8 ± 1.0**	9.03 ± 0.83	103.2 ± 6.8*	40.8 ± 2.3
	Range	(3.6 - 7.6)	(4.0 -12.0)	(71.0 -120.00)	(36.0 -44.0)
	Control	12.03 ± 1.5	9.9 ± 2.3	86.0 ± 0.9	39.3 ± 2.4
8-10 weekd	X±S.E	9.22 ± 0.69	9.3 ± 0.991	125.0 ± 1.2*	39.4 ± 2.01
	Range	(6.8 - 15.0)	(7.2 -13.0)	150.0 -110.0)	(34.0 -53.0)
	Control	8.9 ± 1.1	9.3 ± 2.7	118.0 ± 2.6	35.0 ± 2.8
	Overmean	7.8 ± 1.9	8.95 ± 0.45	112.01± 9.6	40.7 ± 2.3

Table (5)

Hoematological means values of buffaloe calves rearing on replaced milk.

Age of calves	item	T.R.BCs T/L	T.W.BCs G/L	Haemoglobin gm/L	P.C.V. %
2 weeks	X±S E	9.45 ± 1.3	8.9 ± 1.4	121 ± 0.59	31.0 ± 4.3
	Exp.R.	(7.0 - 11.8)	(6.8 - 12.2)	(108 - 136.4)	(20 - 37)
	Control	8.38 ± 1.1	12.5 ± 0.7	12.0 ± 2.9	31.3 ± 5.7
4 weeks	X±S E	7.5 ± 0.7	9.7 ± 1.9	101.2 ± 1.0	33.5 ± 2.9
	Exp.R.	(6.25 - 8.8)	(6.4 - 13.8)	(76 - 140)	(26 - 37)
	Control	10.1 ± 1.8	9.23 ± 0.4	139.9 ± 3.9	39.0 ± 3.2
6 weeks	X±S E	7.4 ± 1.9	10.3 ± 1.6	105.2 ± 1.6	32.3 ± 2.5
	Exp.R.	(5.3 - 9.4)	(6.4 - 12.9)	(98 - 120)	(26 - 36)
	Control	10.2 ± 0.3	9.23 ± 0.0	141.0 ± 0.6	39.3 ± 3.6
8 weeks	X±S E	13.6 ± 0.6	21.0 ± 0.5	128.0 ± 1.3	48.0 ± 2.9
	Exp.R.	(12.3 - 14.4)	(20.3 - 22.4)	(108 - 159)	(43 - 54)
	Control	9.3 ± 0.8	12.4 ± 0.6	86.0 ± 0.4	32.0 ± 0.7
	Overmean	9.5 ± 2.9	12.5 ± 5.71	113.8 ± 12.7	36.2 ± 7.9

DISCUSSION

In this investigation, the mean values of acid base balance in buffaloe and fressian calves including pH; PCO_2-mmHg; PO_2-mmHg; HCO_3-mmHg; TCO_2-mmHg and B.E. mmol/L which mentioned in table (2,3) are in agreement with data previously mentioned by GATES et al. (1971); SCHOTMAN (1971); EL-SEBAIE & HASSAN (1984); KHAMIS (1984) and EL-SEBAIE et al. (1984). Slight variations for mean values of acid base balance here and data reported by REECE & WAHLSTROM (1972); ROSENBERGER (1969); RANDHAWA et al. (1980); SINGH & KOHLI (1985) and HABASY (1985). Explanation of such variations could be due to animal races and species in additional to possible methodological variations.

Moreover, there was a non-significant variations between blood pH is both buffaloe and fressian newlyborn calves while a significant variations in (PO_2) between bufaloe and fressian calves which can be attributed to species variations (KHAMIS, 1984).

Slight variations have been obtained in acid base parameters at different periods of experiment that could be attributed to handling of animal during blood sampling which may lead to respiratory acidosis (KHAMIS, 1984).

Regarding results of total erythrocytic count (T.R.B.Cs. T/L) in both clinically healthy buffaloe and fressian calves Tables (4, 5) it appeas that are in agreement with those previously obtained by KARRAM (1978) and SCHALM (1979) which recorded $5\text{-}10^6$/mm in buffaloe calves.

This variation can be attributed to age of animal which recorded a highest value at birth (SCHALM, 1979).

Fluctuations in haemoglobin concentration in both buffaloe and freissian calves were in agreement with those previously obtained by KARRAM (1978) and TOMAS et al. (1951) which showed a decline of haemoglobin until 30-70 days of life followed gradual increase the authors pointed out that the decrease at the begining of life was due to lack of iron (Fe) in milk which suggests the fall in haemoglobin concentration.

Regarding total leucocytic count (T.W.B.Cs-G/L) and packed cell volume (P.C.V. %) values in both buffaloe and Fressian calves, obtained in our study, data appear to be coincided with those previously obtained by SCHALM (1979) and SOLIMAN & ZAKI (1960).

Finally the study declared the influence of milk replacers on general health condition of both buffaloe and Fressian newly born calves and their effect upon haemogram picture and acid base balance. Also, the confirmation of using milk replacer instead of natural milk in feeding newly born calves without any risk upon healthy condition of calves.

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