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Research Article

ENTERAL HYDRATION OF ADULT CATTLE USING ISOTONIC SOLUTION OF SODIUM CHLORIDE, POTASSIUM CHLORIDE AND DEXTROSE

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ABSTRACT

The study was carried out on 10 clinically dehydrated adult animals. These animals were treated with oral electrolyte solution prepared by dissolving electrolytes in water after evaluating clinical parameters and fluid requirement. The oral electrolyte solution was drenched using Oral Rehydration Unit. The body temperature changes remained statistically non-significant in all cases. The heart rate and pulse rate decreased after rehydration however, respiration rate was elevated during treatment and decreased after completion of therapy. The packed cell volume, total erythrocyte count and hemoglobin reduced significantly after therapy. Protein concentration is increased during dehydration, which significantly reduced after rehydration therapy. The serum sodium values improved to normal levels, which was lower before oral rehydration. Similarly, there was improvement in chloride levels, which was observed towards lower side of the normal range in dehydrated animals indicating effectiveness of therapy.

Key words: Adult Cattle, Enteral hydration, Isotonic solution

Dehydration is commonly seen in various diseases like acute mastitis, acute metritis, milk fever, ketosis etc. Fluid therapy in adult ruminants is often difficult because large volumes are needed, which is very expensive. Furthermore, animals must be restrained properly before therapy, which is time consuming. Therefore, fluid therapy is often avoided in adult ruminants. However, there are clinical situations where either oral or intravenous fluids are necessary and cannot be avoided. There are two things required for dehydrated cows, one is water and other is electrolytes (Smith, 2005). A healthy cow just drinks what she needs and gets electrolytes from her feed. But a sick or weak animal will not drink and eat properly. Dehydration can then become an emergency. The rumen serves as a reservoir which releases consumed water to the body fluid compartments through an osmotic pressure gradient. As cells require fluid for metabolism, electrolytes and other nutrients exert osmotic pressure to continuously supply the cells with fluid for normal functions. A body fluid deficit results in reduced perfusion of fluid which subsequently, affects the cells metabolism. Management of the water content of the rumen should be done to maintain both normal rumen fluid volume as well as other body fluid reserves to help cattle to combat the dehydrating effects of disease, environmental stress or transportation water restriction. The present study shows the effectiveness of enteral hydration in adult cattle with dehydration.

MATERIALS AND METHODS

The study was carried out on 10 clinically dehydrated cattle of either sex to evaluate the effect of oral rehydration therapy in correcting dehydration and electrolyte imbalance.

For this purpose, animals suffering from diarrhea with dehydration were selected from Gorakshan Sabha, Dhantoli, Nagpur. Animals' dehydration was evaluated on the basis of skin tent test, eye position and characteristics of eye mucus membrane at 0^{th}, 24^{th} and 48^{th} hour as described by Kopcha (2008).

Parameters like body temperature, pulse, respiration, heart rate, gait, appetite hematological (PCV, TEC, Hb) and biochemical (Serum total protein, sodium, calcium and chloride) at 0^{th}, 24^{th} and 48^{th} hour were estimated as per the standard procedures. Electrolyte solution was prepared by dissolving dextrose (100 g), NaCl (140g) and KCl (25g) in 20 L of water. The weight of the animal was calculated on the basis of formula described in official gazette of Prevention of cruelty to draught and pack animal rules, Government of India, 1965.

$$\text{B. weight of animal (Kg)} = \frac{\text{Length (cm)} \times \text{Girth}^2\text{ (cm)}}{10838}$$

B. weight (Kg) x Estimated dehydration % = Fluid deficit in liters (Kopcha, 2008)

Lubricated orogastric tube, attached to rehydration unit was held gently over the base of the tongue and passed into the oesophagus and rumen. The utmost care was taken while passing this tube. The expulsion of gases was indicative of proper placement of orogastric tube in the rumen. With the help of motor pump, electrolyte solution from hydration unit was deposited in the rumen. During this therapy, orogastric tube was moved in forward and backward direction to facilitate eructation of ruminal gases. After drenching of required electrolyte solution at the orogastric tube was removed slowly from the rumen. The enteral rehydration was carried out at 0 hour of assessing dehydration and monitoring all necessary parameters in the dehydrated animals.

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RESULTS AND DISCUSSION

In the present study, dehydrated adult animals were found lethargic, dull and depressed. Some of them had sunken eyes, congested and tacky mucous membrane along with prolonged skin tenting indicating dehydration state of the animals. These findings are supported by Watt (1965) who noticed typical signs of diarrheic dehydration as lassitude, sunken eyes, sluggish capillary refill time, tight hide bound skin, which when pinched remain in a ridge, cold extremities and pale mucus membrane overlaid by a dirty brownish coloration. Constable *et al.* (1998) suggested that altered hydration status can be estimated by observing eye position within orbit, extent of skin elasticity and degree of mucous membrane moistness. The eye ball recession was also observed in studied animal along with stiff, stumbling gait and recumbent state. The appetite was reduced in three animals and seven animals were totally anorectic. Bywater (1980) correlated degree of dehydration with clinical signs and reported weight loss, sunken eyes, tight skin, severe depression and recumbent state in 8 to 10% dehydration.

Skin tent test was performed by pinching the skin at neck region of dehydrated animals and time required for the skin fold to disappear was noted. The values of skin tent test and per cent dehydration are closely related to each other as the skin elasticity is lost due to loss of fluid from the body. From Table 1, skin tent test readings shows that skin returned to normal position after 5.70 seconds before hydration therapy in moderately dehydrated animals which was further improved and skin came to normal position after 3.40 and 1.70 seconds at 24th and 48th hours of study period, respectively. This indicated that the rehydration therapy was very effective in dehydrated animals.

The body temperature in all dehydrated animals remained normal and ranged between 100.53 to 101.67°F. These findings corroborate with findings of Constable *et al.* (2001) who reported unaltered rectal temperature in dehydrated animals. Average pulse rate of these animals was 60.60 per minute at 0th hour, which declined to 54.90 and 53.10 per minute at 24th and 48th hours of study period, respectively. Bhalerao *et al*. (2000) also reported normal pulse rate in dehydrated cattle. However, Kumar *et al.* (1981) reported increased temperature and pulse rate for up to 5 days in dehydrated buffalo calves. This may be due to variation in the species and age of the animals. The average heart rate in dehydrated animal was 60.60 per minute before initiation of therapy, which declined to 54.90 and 53.10 per minute at 24th and 48th hours after therapy, respectively. The average respiration rate of animals was 23.80 per minute at 0th hour which reduced to 21.00 and 20.20 per minute at 24th and 48th hours after oral rehydration therapy, respectively. Similar observations were also reported by Boyd *et al*. (1974) who reported normal heart rates and respiration rates in dehydrated animals.

Table 1
Skin tent test, percent dehydration and fluid given

Animal	Body Weight (kg)	Skin tent test			Dehydration %	Fluid given (L)
		0h	24h	48h		
1	154.1	4	2	2	8	12.33
2	196.1	3	1	0	7	13.73
3	194.5	5	2	0	8	15.56
4	172.0	4	1	0	8	13.76
5	151.0	5	2	0	8	12.08
6	136.0	4	2	0	8	10.88
7	215.0	4	2	0	8	17.20
8	224.0	10	9	6	10	22.40
9	184.0	11	9	7	10	18.40
10	194.0	7	4	2	10	19.40
	Average	5.7	3.4	1.7		

Table 2
Hematological parameters of animals before and after rehydration therapy

Animal	PCV			TEC			Hb		
	0h	24h	48h	0h	24h	48h	0h	24h	48h
1	22.0	20.0	24.6	4.5	4.4	5.2	7.0	6.6	7.9
2	32.8	28.7	31.0	6.9	6.0	6.6	11.4	9.1	9.8
3	20.0	18.0	22.0	4.1	3.4	4.8	7.2	6.8	7.6
4	25.4	22.1	28.8	5.8	5.0	6.5	9.6	7.4	9.3
5	16.0	14.0	19.0	3.4	3.1	4.1	6.6	4.9	6.5
6	22.0	18.0	22.0	4.8	3.9	5.2	8.0	6.0	7.3
7	26.3	26.2	25.4	5.2	5.1	5.1	9.0	8.7	8.5
8	39.6	37.3	36.8	7.9	7.5	7.1	12.9	12.5	11.7
9	19.6	18.9	16.7	3.5	3.4	4.1	8.2	8.4	8.6
10	37.8	36.7	30.5	7.7	7.5	7.1	12.8	13.1	11.9
Avg	26.15	23.99	25.68	5.41	4.95	5.61	9.27	8.35	8.91

The average packed cell volume was 26.15% at 0th hour, which decreased to 23.99% at 24th hour of study which further increased to 25.68% at 48th hour (Table 2). Similar trend was also observed for total erythrocyte count at 0th (5.41), 24th (4.95) and 48th (5.61) hours. The average hemoglobin level was 9.27, 8.35 and 8.91 gm% at 0th, 24th and 48th hours, respectively. The reduction in the values of PCV, Hb and TEC at 24th hour of therapy indicated that the oral rehydration is required to be continued at 48th hour also. Similar trend was also reported by Benjamin (1981). The average serum protein level for dehydrated animals was 6.15 gm/dl at 0th hour which was reduced to 4.96 gm/dl at 24th hour and increased to 6.40 gm/dl at 48th hour. An increased level of serum protein before therapy was due to dehydration. The reduced serum protein value at 24th hour after therapy indicated that the oral rehydration is required to be repeated. Similar findings were also recorded by Constable *et al*. (2001), Avanza (2004) and Benjamin (1981) who reported decreased total protein level during oral rehydration due to expansion of plasma volume.

The average value of serum sodium at 0th hour was 135.84 mmol/L, which elevated to 139.44 mmol/L at 24th hour after initiation of therapy (Table 3). This level slightly reduced to 138.62 mmol/L at 48th hours which indicated that the therapy should be continued at 24th and 48th hours also. The increase in the values of serum Sodium is indicative of rehydration in the animals. These findings are similar to that of Dalton *et al*. (1965) who reported

Table 3
Serum biochemical parameters of animals before and after rehydration therapy

Animal	Total Protein			Serum Sodium			Serum Chloride			Serum Calcium		
	0h	24h	48h	0h	24h	48h	0h	24h	48h	0h	24h	48h
1	5.6	4.4	6.2	135.9	138.0	138.2	95.1	88.0	117.7	8.9	6.4	8.5
2	4.6	4.0	6.9	138.4	145.3	139.2	91.0	82.0	106.4	7.7	5.9	8.0
3	4.9	3.2	6.6	136.6	138.1	137.9	101.0	68.0	127.0	8.2	5.1	8.7
4	8.1	2.3	6.4	132.1	137.1	137.0	124.0	65.0	101.1	8.8	5.7	8.4
5	5.1	4.4	5.8	132.8	135.5	139.0	89.1	91.4	108.4	9.4	7.2	8.0
6	5.8	3.4	5.9	134.8	140.3	140.6	101.0	83.0	125.5	9.6	7.4	8.6
7	7.0	6.8	6.4	135.7	140.4	139.3	111.0	101.0	106.0	9.9	9.5	9.3
8	6.7	6.7	6.1	134.0	137.3	136.5	109.0	97.9	103.0	10.6	10.6	9.4
9	6.9	6.9	6.7	141.0	142.3	140.0	104.0	106.0	109.0	8.7	9.2	9.1
10	6.7	7.5	6.9	137.1	140.1	138.5	99.9	105.0	115.0	10.2	10.0	9.7
Avg	6.15	4.96	6.4	135.84	139.44	138.62	102.51	88.73	101.91	9.20	7.70	8.77

increased serum sodium values after rehydration.

The average serum chloride value was 102.51, 88.73 and 111.91 mEq/L at 0th, 24th and 48th hour of study period, respectively (Table 3). However, these values are within normal physiological range. Similar findings were also recorded by Constable *et al.* (2001). The average value of serum calcium was 9.20, 7.70 and 8.77 mg/dl at 0th, 24th and 48th hours, respectively which was within reference range. The decreased levels of serum calcium after oral rehydration were also recorded by Riberio *et al.* (2013) who performed oral hydration in experimentally dehydrated cattle at a dose of 10L for 12 hours in continuous flow system. The slight increment in the level of calcium at 48th hour shows that the oral rehydration needs to be repeated at 24th and 48th hours for speedy recovery. Thus, enteral hydration was safe, economic and very effective in mild and moderately dehydrated animals, which was demonstrated by improvement in the skin elasticity and hematological as well as biochemical parameters.

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