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Comparative Evaluation on Performance of Copper and Stainless Steel Metal Freeze Branding in Sahiwal Cattle

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A B S T R A C T

The present investigation was conducted at the Bull Mother Experimental Farm, College of Veterinary Science & A.H., Anjora, Durg. Age group of Sahiwal cattle 0 to 6 and 6 to 12 months, the days required for appearance of white hairs was relatively lesser (43.33±1.20 and 42.8±4.93 days) at 7 and 8 seconds, respectively for copper metal during freeze branding. In 12 – 18 months of age group, minimum days (49.8±7.15) required for appearance of white hairs were seen at 18 seconds of exposure time using stainless steel metal. Age group of 0 to 6, 6 to 12 and 12 to 18 months, the 100 percent legibility of white hairs was seen mostly for stainless steel metal. The weak legibility of white hairs was seen in above 18 months of age group which can be attributed to the thickness of skin of animals which may have become thicker with advancement of age. Stainless steel metal was better than copper metal as 7.5 per cent animals scored 5. Hence, it was concluded that stainless steel metal is better for all age group over copper metal. The mean value of neutrophils, before and after freeze branding, was 20.28±1.62 and 22.62±2.47%, respectively within the normal range and could not be an indication of stress associated with freeze branding.

Introduction

Identification of animal in livestock enterprise is of immense importance to draw conclusion of their status in production as well as performance. In Indian subcontinent, a huge amount of money has been spent to improve the dairy breeds; however, the achievements are still meagre. One possible reason for the failure could be attributed to poor adoption of scientific/best identification procedure considering the conduciveness to monitor the breed improvement programme in field condition. In rural area each and every family rear small livestock enterprises to meet out their family requirements, may be able to distinguish his animals by sight, by markings on animals. The large livestock enterprises would however, assess the herdsman memory to impuissance point. Marking of cattle for identification should involve methods that are easy to read at a distance, easy to apply, permanent, durable and economic. Several methods can be used to identify the animals. Out of that ear notching, ear tags and tattoos cannot be read without catching the head of

animal (Hall *et al.,* 2004). Beside this hot branding is widely practiced in organized and unorganized herds of India. This method has been strictly condemned by the society for prevention of cruelty against animals. There are several methods in vogue to identify the animal though none of them is flawless and foolproof (Mishra *et al.,* 2005). Freeze branding offers a permanent form of identification i.e. easy to read at a greater distance, cause minimal damage to the hide and is less painful than hot branding (Lay *et al.,* 1992 and Schwartzkopf-Genswein *et al.,* 1997). This method resulted in destruction of pigment cells resulting in a white haired patch on the skin of Sahiwal. The Sahiwal is one of the best dairy breeds in India. The colour of Sahiwal is red. The white hair appearing on the skin will be permanent and remain easily readable. The present study was designed to observe the best exposure time of copper and stainless steel metal for effectiveness of freeze branding.

Materials and Methods

Present study was conducted on 80 Sahiwal cattle of different age groups at the Bull Mother Experimental Farm, College of Veterinary Science & A.H., Anjora, Durg. Each group comprised of 20 animals (Table 1). The age of animals ranged from 0 month to above 18 months (Hall *et al.,* 2004). The branding metal (copper and stainless steel) is an important instrument which acts as a medium to expose the required temperature to the skin of animals whereas, by various workers (Farrell *et al.,* 1966 and Whitter *et al.,*1993) assessed copper metal but present studies on freeze branding comparison with stainless steel metal. The shape of metal was moulded to "I" shape and the width and depth (face to back) of metal brand are same for all age group of animals whereas length and weight was different on the basis of age group of animals (Bath *et al.,* 1981). The liquid nitrogen was used as refrigerant. The temperature of it is nearly to -196^0C and remains as liquid in that temperature (Key *et al.,* 1977 and Wagner *et al.,* 2000). The frosted branding metal was quickly applied on the skin of the cattle with firm pressure by holding the metal on the area and do not let it slip.

Freeze branding experiment conducted mostly on exotic breed but there is no evidence for the indigenous breed i.e. Sahiwal, as well as no evidence of exposure time for freeze branding in Sahiwal, so we observe appearance of white hairs, legibility of white hairs, scoring system (Table 2) for selection of metal at different exposure times for different age groups (Farrell and Potter, 1966; Hall *et al.,* 2004; Hooven *et al.,* 1971 and McMahon *et al.,* 2006) and also observe the stress by haematological parameter. To see the effectiveness of branding by different exposure times in different age groups one way analysis of variance was applied (Snedecor and Cochran, 1994) and any significant difference exist in any group then DMRT was applied (Steel and Torrie, 1984).

Results and Discussion

Appearance of white hairs

In 0-6 months age group, the average time for appearance of white hairs on the skin was found to be 45.6±1.96 and 46.63±1.97 days for copper and stainless steel metals, respectively (Table 3). The minimum and maximum time being 43.33±1.20 and 50.5±2.10 days, respectively. Relatively, lesser time was seen for the appearance of white hairs at 7 to 9 seconds (43.33±1.20 and 43.4±4.26 days respectively) using copper metal. However all the values were non-significantly different with respect to both metals and exposure times. Similar results were found by Sherwin *et al.,* (2002).

In 6-12 months category an average time of 48.33±2.46 and 46.78±1.96 days, respectively for copper and stainless steel metal were observed for appearance of white hairs on skin following freezing (Table 3). The minimum and maximum days required for appearance of white hairs were 42.8±4.93 and 58±2.08 days, respectively. However, these results were in agreement with the findings of Bath *et al.,* (1981) and Bertram *et al.,* (2006), where they observe 6 weeks for the appearance of white hairs growth.

In Sahiwal, the average time for appearance of white hairs on skin were 58.09±1.34 and 54.9±3.87 days, respectively for copper and stainless steel metal with minimum and maximum days being 49.8±7.15 and 62±00 days, respectively in 12-18 months category (Table 3). In this age group, minimum of 49.8±7.15 days required for appearance of white hairs were seen at 18 seconds of exposure time using stainless steel metal. However, all the values did not differ significantly with respect to all exposure times and metals. Similar findings were observed by Bath *et al.,* (1981) and Bertram *et al.,* (2006).

Above 18 months of age group, the average time of appearance of white hairs on skin were 58±2.32 and 56.77±3.82 days, respectively for copper and stainless steel metal (Table 3). However, the minimum and maximum values for appearance of white hairs varied from 46.5±15.5 to 63.5±3.5days for both types of metal. The difference in the time required for appearance of white hairs in all exposure time of copper and stainless steel metals were non-significant.

These findings were in accordance with the findings of Sherwin *et al.,* (2002). Overall, a trend was noticed that relatively more days were required for appearance of white hairs with the advancement of age.

Legibility of white hairs

In 0-6 month's category, the legibility of white hairs for copper metal varies from 60 to 100 percent. For stainless steel metal the legibility varies from 40 to 100 percent in spite of non-significant difference (χ^2=5.064) among them (Table 4). However, the chi-square value indicated non-significant difference between the legibility of white hairs and various exposure times. Although 100 per cent legibility was observed in 9 and 7 seconds of exposure time using copper and stainless steel metal, respectively. The 80 per cent legibility was seen at 5 and 9 seconds of exposure time in stainless steel metal is also acceptable. In 6-12 months of age group, the legibility of white hairs for copper metal varied from 60 to 100 percent. In case of stainless steel, the legibility varied from 40 to 100 percent, in spite of this no significant difference (χ^2= 4.758) among them was noticed (Table 5). In copper metal, the chi-square value (χ^2=2.932) indicated non-significant difference between legibility of white hairs with respect to their exposure time. The copper metal has given 80 to 100 percent result at 11 to 8 seconds of exposure time. Similar results were observed in stainless steel metal where 80 to 100 per cent legible white hairs were observed at 11 to 8 seconds of exposure time.

The chi-square values were 0.601 and 8.8 for copper and stainless steel metal, respectively in 12-18 months category. Overall the minimum and maximum value of frequency (in percentage) of legible white hairs varied from 20 to 100 percent in both metal. In copper metal, the legible white hairs appeared less than 80 percent and were non-significant (χ^2=0.601). Whereas in stainless steel, the legibility varied from 20 to 100 percent in spite of having significant difference (χ^2=8.8) between for all the exposure time (Table 6).

Table.1 Different exposure time proposed for different age group

Age (months)	No. of Animal		Exposure time (seconds)
0-6	20	5	5
		5	7
		5	9
		5	11
6-12	20	5	8
		5	11
		5	14
		5	17
12-18	20	5	12
		5	15
		5	18
		5	21
Above 18	20	5	17
		5	20
		5	23
		5	26

Table.2 The scoring system

Score	Interpretation
1	No visible numbers
2	Visible numbers, but illegible.
3	Incomplete numbers, but able to understand.
4	Easily recognizable numbers, but with breaks or unbranded areas.
5	Instantly recognizable, complete unbroken numbers.

Table.3 Mean time for appearance of white hairs using various metals of same dimension in a given exposure time for Sahiwal cattle

Age Group (month)	**Exposure Time** (Seconds)	**Appearance of white hairs (days)**	
		Copper	**Stainless steel**
0 - 6	5	45±6.35	44.75±3.79
	7	43.33±1.20	47.6±3.33
	9	43.4±4.26	45.75±5.57
	11	50.5±2.10	49.50±2.50
6 - 12	8	42.8±4.93	45.6±5.03
	11	46.75±5.02	45.5±3.18
	14	50±1.15	48±2.08
	17	58±2.08	50.5±1.50
12 - 18	12	57.66±1.45	58±0.00
	15	60±2.00	60±3.06
	18	58±4.73	49.8±7.15
	21	57.33±2.33	62±00
Above 18	17	63.5±3.5	46.5±15.5
	20	52.33±2.03	53.5±1.5
	23	62±00	62.66±1.45
	26	60±00	61.5±2.50

Table.4 Mean value of frequency (in percentage) of legible white hairs on the animals in 0 to 6 months age group of Sahiwal cattle

Exposure Time (Seconds)	**Frequency of legible white hairs (percentage)**	
	Copper (%)	**Stainless steel (%)**
5	60	80
7	60	100
9	100	80
11	80	40
Chi square	2.932	5.064

Table.5 Mean value of frequency (in percentage) of legible white hairs on the animals in 6 to 12 months age group of Sahiwal cattle

Exposure Time (Seconds)	**Frequency of legible white hairs (percentage)**	
	Copper (%)	**Stainless steel (%)**
8	100	100
11	80	80
14	60	60
17	60	40
Chi square	2.932	4.758

Table.6 Mean value of frequency (in percentage) of legible white hairs on the animals in 12 to 18 months age group of Sahiwal cattle

Exposure Time (Seconds)	**Frequency of legible white hairs (percentage)**	
	Copper (%)	**Stainless steel (%)**
12	60	20
15	40	60
18	60	100
21	60	20
Chi square	0.601	8.8*

Values superscripted by different letters differed significantly from each other in a column *P<0.05

Table.7 Mean value of frequency (in percentage) of legible white hairs on the animals in above 18 months age group of Sahiwal cattle

Exposure Time (Seconds)	**Frequency of legible white hairs (percentage)**	
	Copper (%)	**Stainless steel (%)**
17	40	40
20	60	40
23	20	60
26	20	40
Chi square	2.414	0.601

Table.8 Scores and percentage of animals for both metals

Age Group (month)	Score point	Frequency (in percentage) of animals in different metals	
		Copper	Stainless steel
0 - 6	1	20	25
	2	15	10
	3	25	20
	4	25	15
	5	15	25
6 – 12	1	25	30
	2	15	10
	3	45	35
	4	15	20
	5	-	5
12 – 18	1	45	50
	2	20	10
	3	25	35
	4	10	5
	5	-	-
Above 18	1	65	55
	2	15	25
	3	15	15
	4	5	5
	5	-	-

Table.9 Overall classification of all the animals (in percentage) on the basis of score points for copper and stainless steel metal

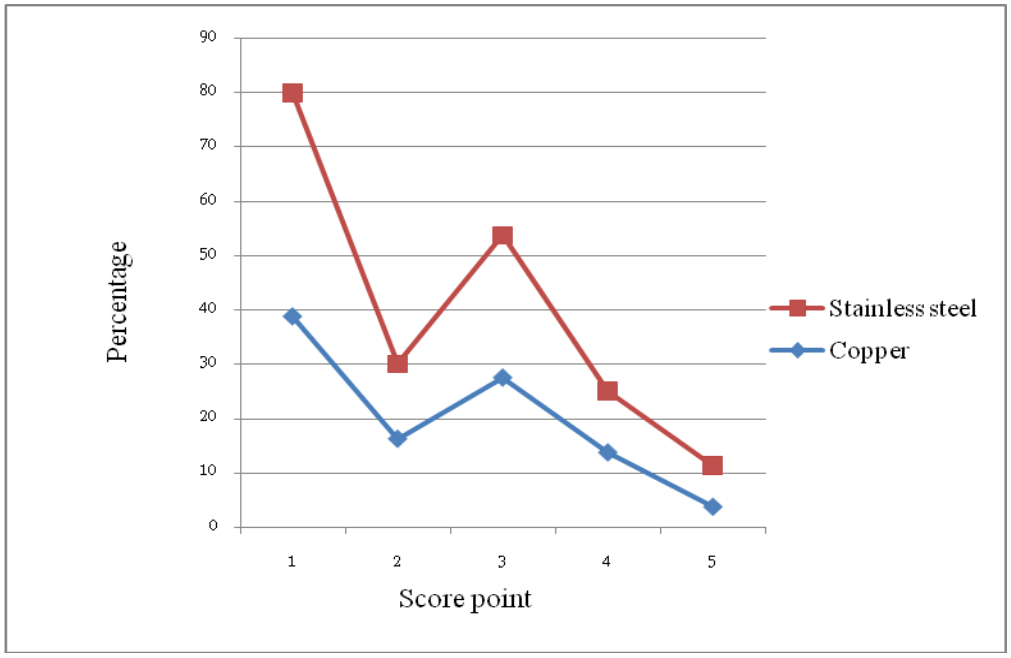
Score point	Metal	
	Copper	Stainless steel
1	38.75	41.25
2	16.25	13.75
3	27.50	26.25
4	13.75	11.25
5	3.75	7.5

Table.10 Mean ± SE change in Haematological parameters before and after freeze branding in Sahiwal

S.No.	Haematological Parameter	Before branding	After branding	Significans
1.	TEC (10^6/µl)	6.53±0.33	6.54±0.22	NS
2.	Hb (gm %)	8.62±0.53	8.40±0.44	NS
3.	PCV (%)	28.20±2.0	28.60±1.0	NS
4.	TLC (10^3/ µl)	5.71±0.45	8.25±0.6	NS
5.	Neutrophils	20.28±1.62	22.62±2.47	**
6.	Lymphocytes	57.42±2.83	59.54±2.40	*
7.	Monocytes	6.26±0.52	6.42±0.73	*
8.	Eosinophils	10.58±0.99	11.06±0.80	NS
9.	Basophils	0.12±0.10	0.22±0.13	**

Values superscripted by different letters differed significantly from each other in a column
*P<0.05**P<0.01NS=non-significant

Fig.1 Frequencies (in percentage) for scores of white hairs for copper and stainless metal



Above 18 months of age group, the chi square values were 2.414 and 0.601 respectively for copper and stainless steel metal. Overall minimum and maximum frequency (in percentage) of animals for white hairs varied from 20 to 60 percent in both metals (Table 7). The chi square values indicated non-significant difference with respect to all the exposure time. In spite of this, the appearance of white hairs was less than 80 percent; hence, legibility may be ambiguous after 18 months of age.

Selection of metal

In case of score 3, 4 and 5 the developed white brand was for copper (25, 25 and 15% animals, respectively) and for stainless steel (20, 15 and 25% animals, respectively) in 0-6 months category. At score 5 maximum percentage of instantly recognizable number was observed in stainless steel metal (25 percent) followed by copper metal (15 percent) (Table 8). These findings are in agreement with the results reported earlier by Thrift *et al.*, 1971.

In 6-12 months of age group 25, 15, 45 and 15 percent animals had scored 1, 2, 3 and 4, respectively for copper metal. However, maximum percentage (45 percent) of animals scored 3 (Table 8). In case of stainless steel metal 30, 10, 35, 20 and 5 percent animals, respectively scored 1, 2, 3, 4 and 5. Maximum percentage (35 percent) of animals scored 3 and after score 3 marked reduction in visible white hairs was observed in 4 and 5 scores, as these scores are known for better visibility of white hairs. Interestingly, stainless steel metal was the only metal which scored 5.

In 12-18 months category copper metal (45, 20, 25 and 10% animals) and stainless steel metal (50, 10, 35 and 5% animals) had score of 1, 2, 3 and 4, respectively (Table 8).

Overall, 10 percent animals contained visible hairs, when copper metal was used, which is higher that of stainless steel (5 percent) considering score 3 and 4 higher visibility was noticed in stainless steel metal than that of copper metals. However, differences among metals were non-significant.

The scores 1, 2, 3 and 4 were 65, 15, 15 and 5 percent, respectively for copper metal, whereas decline trend of improvement in visibility of white brand with increase in score points was noticed in above 18 month (Table 8). None of the animals branded with copper scored 5. Similar trend was noticed in stainless steel metal. However, differences among metals were non-significant.

Irrespective of exposure times and age groups, all the animals were classified according to the score points of 1, 2, 3, 4 and 5 for both metals studied in present investigation (Table 9 and Figure 1).

Further stainless steel metal, 25 and 5 percent animals scored 5 at 0 to 6 months and 6 to 12 months age group, respectively. However, overall efficiency of stainless steel metal was better than copper as 7.5 percent animals scored 5.

Haematological parameter

The mean value of neutrophils, before and after freeze branding, were 20.28±1.62 and 22.62±2.47 percent, respectively and the difference between them was highly significant ($P<0.01$) in response of body defence mechanism (Barragry, 1994). The mean value of lymphocytes (57.42±2.83 and 59.54±2.40 per cent), monocytes 6.26±0.52 and 6.42±0.73 percent) and basophils (0.12±0.10 and 0.22±0.13 percent) were before and after freeze branding, respectively (Table 10).

Overall, age group of 0 to 6 and 6 to 12 months, the number of days required for appearance of white hairs was relatively lesser (43.33±1.20 and 42.8±4.93 days) at 7 and 8 seconds, respectively for copper metal. In 12 to 18 months of age group, minimum days (49.8±7.15) required for appearance of white hairs were seen at 18 seconds of exposure time using stainless steel metal. The differences in the time required for appearance of white hairs in all exposure time of above 18 months age groups of copper and stainless steel metal were non-significant.

Overall, age group of 0 to 6, 6 to 12 and 12 to 18 months, the 100 percent legibility was seen in exposure time 7 (for stainless steel) and 9 (for copper), 8 (for both metals) and 18 (for stainless steel) seconds of exposure time, respectively. Therefore, stainless steel metal could be recommended. The weak legibility of white hairs was seen in above 18 months of age group which can be attributed to the thickness of skin of animals which may have become thicker with advancement of age (Hamid *et al.,* 2000). Perhaps increase in weight of metals could have given better legibility of white hairs.

Overall efficiency of stainless steel metal was better than copper metal as 7.5 per cent animals scored 5. Hence, it was concluded that stainless steel metal is better. Farrell (1967) and Torell *et al.,* (2001) who observed that copper to be more efficiently use with more success than brass, steel and aluminium. But in present investigation, stainless steel metal could give better results.

The lymphocytes and monocytes have showed significant rise ($P<0.05$) whereas, neutrophils and basophils were also increased significantly ($P<0.01$), but above results were within the normal range and could not be an indication of stress associated with freeze branding.

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