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## **RATE OF PASSAGE OF INGESTED MATERIAL THROUGH THE DIGESTIVE TRACT OF NILI-RAVI BUFFALO, SAHIWAL AND CROSSBRED CATTLE**

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The project was designed to study the rate of passage of ingesta from the alimentary tract of buffalo, Sahiwal and crossbred (Holstein Friesian x Sahiwal) cattle at College of Veterinary Sciences Lahore (Pakistan). The trial was conducted on 15 animals of each species. Measurement of rate of passage of ingesta was carried out during 10 days after feeding of experimental ration containing stained wheat straw. Each animal was fed with 4% of stained wheat straw of their daily dry matter intake. The faeces collection was initiated after 14 hours post feeding, then 6 hourly interval during next 3 days, at 12 hourly interval during 7th and 8th days, and 18 hourly interval during last 2 days. Stained particles were counted in each 2.5 g of faeces. The number of stained particles per sampling period was calculated and expressed as a percentage of total number of particles excreted during 242 hours of experimental period. The excretion of stained particles was 79, 325 and 239 with mean values of  $17.75 \pm 3.4$ ,  $81.25 \pm 3.42$ ,  $59.75 \pm 5.12$  in buffalo, Sahiwal and crossbred animals, respectively. The excretion rate increased ( $P < 0.01$ ) significantly up to 38 hours in buffalo (18.14%), 20 hours ( $P < 0.01$ ) in Sahiwal (20.08%), and 32 hours ( $P < 0.01$ ) in crossbreds (16.81%) and gradually decreased to 0.00% at 242 hours in all species. The rate of passage of ingesta through the alimentary tract of all species were highly significant ( $P < 0.01$ ) up to 56 hours post feeding and was non significant ( $P > 0.05$ ) thereafter. Retention time of ingesta was more in buffalo than in Sahiwal and crossbred cattle. However, crossbreds had more retention time of ingesta than Sahiwal cattle.

passage rate; ingesta; buffalo; Sahiwal; crossbred cattle



## INTRODUCTION

Livestock plays an important role in agricultural economy of every country of the world by producing milk, meat, hides, manure, etc. In developing country like Pakistan livestock contributes by about 30% of total gross production value of agriculture (PARC, 1991). The rate of growth of livestock sector has not kept pace with the requirements of the country. Since the rate of growth of human population is comparatively high, the deficiency in the protein particularly of animal origin is likely to increase.

Increasing the supply of animal protein is primarily a matter of increasing the production of the livestock through scientific and economic feeding. This should involve proper and efficient utilization of all the available animal feed resources. The information regarding the comparative passage rate of nutrients of feedstuffs through the alimentary canal (tract) of the animal is negligible. The rate of ingesta through digestive tract of the animal usually determines the rate of utilization of the feed (Goetsch, Owns, 1985). The feed which takes more time to pass through the gut is open to enzymatic action for longer duration and hence more digested (Ganouski, Ivanov, 1982). The nature and the level of feed as well as the animal species may also effect the rate of passage of the ingesta (Campher et al., 1983). Recently considerable interest has developed in the studies on the rate of passage of ingesta from rumen and rest of the digestive tract in order to establish the nutritional values of indigenous feedstuffs for different livestock.

The present investigation was an attempt to compare the rate of passage of ingesta in buffalo, Sahiwal and cross-bred (Holstein Friesian x Sahiwal) cattle to determine the retention time in various species in accordance with digestibility of individual nutrient. The work was carried out in Animal Nutrition Centre Rakh Dera Chahl, under the guidance of College of Veterinary Sciences Lahore, University of Agriculture, Faisalabad, Pakistan.

## MATERIAL AND METHODS

Rate of flow of ingesta through the digestive tract of the animal usually determines the rate of digestion of the feed. The trial was conducted on 15 yearling buffalo, 15 Sahiwal and 15 crossbred calves (Holstein Friesian x Sahiwal). Total daily feed allowance was given in two identical proportions according to their nutritional requirements. The animals were initially fed on the experimental ration for a transitional period of 5 days. Measurement of rate of passage was made during the next 10 days after transitional feeding. Each animal was fed with a specific amount of stained wheat straw once

a time at the rate of 4% of their daily dry matter intake. The percentage elimination rate of stained particles in the experimental animals at different post feeding periods was recorded.

### Preparation of stained particles

22.5 kgs chaffed wheat straw was washed and dried in hot air oven at 105 °C for 24 hours and then passed through 1 mm screen. The straw was kept for 6 hours in hot solution of 1% crystal violet followed by rinsing thoroughly with tap water and finally dried to its original weight at 105 °C.

### Selection and preparation of animals

15 yearling Nili-Ravi buffalo, pure Sahiwal and crossbred (Holstein Friesian x Sahiwal) cattle of about the same age, weight and size were selected and weighed. Before the start of the experiment, proper deworming of the experimental animals was done. An experimental ration was computed for all the three groups of animals to meet their maintenance requirement. Composition of the ration is shown in Tab. I and its analysis in Tab. II. Only once 200 g of stained wheat straw was mixed with 1 kg of prepared ration and offered to each animal in a similar fashion within half an hour. Mid point of this half an hour (15 minutes after the start of feeding the stained straw) was noted as initial time of feeding. Later the rest of ration was offered to each of the experimental animal. The daily allowance was given in two feeding intervals, i.e at 9 a.m. and 7 p.m. The feeding schedule was continued for the next ten days of experimental period. A transitional period of five days was provided to the start of the experiment to accustom the animals to the experimental ration. Water was supplied *ad-libitum* to each animal throughout the experimental period.

### Collection of faeces for count of stained particles

All the animals were properly managed, kept under strict observation during the conduction of the experiment. Faeces collection was commissioned 14 hours after the feeding, then after 6 hourly interval during next three days. 8 hourly interval for the following 3 days, 12 hourly interval during 7th and 8th day and 18 hourly interval during the last two days of the experiment. The faeces collected were weighed and representative samples weighing 15 g were collected and marked with necessary information in triplicate and stored for stereoscopic count.



### I. Composition of experimental ration

Feedstuffs	Quantity (kg)	DM (kg)	DP (kg)	TDN (kg)
Berseem green 1st cut	13.76	2.04	0.30	1.36
Cotton seed cake	2.30	2.14	0.36	1.57
Wheat straw	1.36	1.23	—	0.60

### II. Chemical composition of experimental ration

Components	Percentage
Original dry matter (ODM)	28.84
* Crude protein (CP)	15.66
* Ether extract (EE)	5.85
* Crude fibre (CF)	28.03
* Mineral matter (MM)	11.08
* Nitrogen free extract (NFE)	39.38

\* = on dry matter basis

### Counting of stained particles

Stained particles were counted in each 2.5 g of faeces obtained at each sampling period. These samples were washed out with water to remove unnecessary material. The samples thus obtained were filtered and dried for counting of stained particles using the stereoscope SEL 3, and counter (manual). The number of stained particles of samples collected at different intervals were counted and expressed as percentage of number of particles excreted during 242 hours of experimental period.

The complete data thus collected from the experiment were statistically analysed by the methods of one and two way analysis of variance (Steel, Torrie, 1981). The difference between the species was tested for significance by Least significant difference test (L.S.D).

### RESULTS AND DISCUSSION

The data collected from excretion of stained particles 14 hours post feeding for buffalo, Sahiwal and crossbred animals are reported in Tab. III. It was

### III. Excretion of stained particles 14 hours post feeding in buffalo, Sahiwal and crossbred calves

Buffalo	Sahiwal	Crossbreds
13	89	78
20	73	58
29	79	60
17	84	73
19.75 ± 3.4	81.25 ± 3.42	59.75 ± 5.12

### IV. Analysis of variance of the data of stained particles excretion 14 hours post feeding in various species

Source of variation	Degree of freedom	Sum of squares	Mean squares	F ratio
Species	2	7 792.67	3 896.33	58.818 **
Error	9	595.25	66.25	—
Total	11	—	—	—

For Tabs. IV, V, VII, VIII, X, XI, XIII, XIV:

\* = significant

\*\* = highly significant

NS = non-significant

### V. The mean comparison of stained particles among buffalo, Sahiwal and crossbred calves by L.S.D (Least significant difference) test

Species	Mean	Difference of mean
Buffalo	19.75	B-S = 61.59 **
Sahiwal	81.25	B-C = 40.00 *
Crossbreds	59.75	S-C = 21.5 NS

observed that 79, 325, and 239 with mean values of 19.75 ± 3.4, 81.25 ± 3.42 and 59.75 ± 5.13 stained particles were excreted in the faeces of buffalo, Sahiwal and crossbred calves, respectively. Highest number of stained particles (81.25 ± 3.42) were excreted in Sahiwal calves, whereas, lowest in buffalo calves (19.75 ± 3.9). During statistical analysis was a highly significant difference ( $P < 0.01$ ) in stained particle excretion among species (Tabs. IV and V).



VI. Excretion of stained particles 20 hours post feeding in buffalo, Sahiwal and crossbred calves

Buffalo	Sahiwal	Crossbreds
96	817	508
102	739	569
87	902	503
93	835	498
94.5 ± 3.12	823.25 ± 33.5	519.5 ± 16.6

VII. Analysis of variance of the data of stained particles excretion 20 hours post feeding in various species

Source of variation	Degree of freedom	Sum of squares	Mean squares	F ratio
Species	2	1 066 205.17	533 102.58	283.72 **
Error	9	16 910.75	1 878.97	—
Total	11	—	—	—

VIII. The mean comparison of stained particles among buffalo, Sahiwal and crossbred calves by L.S.D (Least significant difference) test

Buffalo	94.56	B-S = 728.70 **
Sahiwal	823.25	B-C = 425.00 **
Crossbreds	519.50	S-C = 303.70 **

A maximum excretion (3 293 with mean values of 823.25 ± 33.5) was found in Sahiwal calves on 20th hour of post feeding (Tabs. VI, VII and VIII). On 32nd hour post feeding the crossbreds had the maximum excretion (3 178, with mean values of 794.5 ± 7.87) of stained particles which declined during later hours (Tab. IX). Statistically the difference was highly significant ( $P < 0.01$ ) among species (Tabs. X and XI). When faeces were collected 38 hours post feeding, buffalo was on its peak excretion of stained particles (1 931, with mean value 482.7 ± 17.6), which declined thereafter (Tabs. XII, XIII and XIV).

The cumulative percentage of stained particles were calculated (Tab. XV) and it was observed that 0.75, 1.98, and 1.26% of stained particles were excreted through faeces at 14th hours post feeding, i.e 1st collection time in

IX. Excretion of stained particles 32 hours post feeding in buffalo, Sahiwal and crossbred calves

Buffalo	Sahiwal	Crossbreds
360	509	806
297	470	783
609	493	810
329	525	779
323.7 ± 13.76	499.2 ± 11.73	794.5 ± 7.87

X. Analysis of variance of the data of stained particles excretion 32 hours post feeding in various species

Source of variation	Degree of freedom	Sum of squares	Mean squares	F ratio
Species	2	452 771.17	226 385.58	436.06 **
Error	9	4 672.5	519.16	—
Total	11	—	—	—

XI. The mean comparison of stained particles among buffalo, Sahiwal and crossbred calves by L.S.D (Least significant difference) test

Species	Mean	Difference of mean
Buffalo	323.7	B-S = 175.5 **
Sahiwal	499.2	B-C = 470.8 **
Crossbreds	794.5	S-C = 295.3 **

buffalo, Sahiwal and crossbred calves, respectively. For the next 3 days faeces were collected at 6 hourly intervals. 20, 26, 32 and 38 hours post feeding, the excretion rate of stained particles was 3.6, 7.51, 12.38, and 18.40% in buffalo, 20.08, 12.49, 12.17, and 11.53% in Sahiwal and 10.99, 13.3, 16.81, and 16.14% in crossbred animals, respectively. The excretions among species were significant ( $P < 0.05$ ) up to 56 hours of collection period and non-significant ( $P > 0.05$ ) thereafter.

The general trend of excretion of stained particles in the faeces of different animals indicated that the retention time of the ingesta was more in buffalo than Sahiwal and crossbred cattle. The longer retention of digesta in buffalo



XII. Excretion of stained particles 38 hours post feeding in buffalo, Sahiwal and crossbred calves

Buffalo	Sahiwal	Crossbreds
430	467	825
502	488	697
498	466	838
501	471	692
482.7 ± 17.6	473.0 ± 5.11	763.0 ± 39.6

XIII. Analysis of variance of the data of stained particles excretion 38 hours post feeding in various species

Source of variation	Degree of freedom	Sum of squares	Mean squares	F ratio
Species	2	216 980.17	108 490.08	42.64 **
Error	9	22 898.75	2 544.3	—
Total	11	—	—	—

XIV. The mean comparison of stained particles among buffalo, Sahiwal and crossbred calves by L.S.D (Least significant difference) test

Species	Mean	Difference of mean
Buffalo	482.7	B-S = 290.0 **
Sahiwal	473.0	B-C = 280.0 **
Crossbreds	763.0	S-C = 9.7 NS

In the table each value indicate average data of 5 animals of individual species

might be responsible for the better digestion of various nutrients of the ingested feed in buffalo. The retention time of ingesta was more in crossbred than Sahiwal cattle. The present findings were similar to that of the observations of Campher et al. (1983), who stated more retention time in buffalo than cattle, but the results vary with the findings of Ponnappa et al. (1971) who compared the rate of passage of feed in Murrah buffalo and cattle. This may be because of different buffalo species. The results of present study were supported by Lundri et al. (1982), who demonstrated the results on Hariana cattle and Murrah buffalo.

XV. Excretion of stained particles (percentage)

Hourly intervals	Buffalo	Sahiwal	Crossbreds
14	0.75	1.98	1.26
20	3.60	20.08	10.99
26	7.51	12.49	13.30
32	12.34	12.17	16.81
38	18.40	11.53	16.14
44	15.42	9.92	10.66
50	10.41	8.48	10.33
56	7.04	6.77	6.25
62	6.65	3.76	3.61
68	4.63	2.89	2.61
74	2.81	1.89	2.24
80	2.08	1.84	1.49
86	1.98	1.84	1.11
94	1.87	1.54	0.86
102	1.17	0.81	0.69
110	0.91	0.72	0.51
118	0.87	0.51	0.28
126	0.41	0.29	0.14
134	0.34	0.28	0.14
142	0.18	0.14	0.12
150	0.11	0.11	0.08
158	0.08	0.10	0.07
170	0.08	0.05	0.05
182	0.06	0.05	0.05
194	0.06	0.04	0.04
206	0.06	0.03	0.03
224	0.06	0.02	0.02
242	0.00	0.00	0.00



However, the results of the present study do not agree with the findings of Sukhija et al. (1985) who reported that the rate of passage of ingesta increased almost equally in both the species, i.e. cattle and buffalo. This may be possibly because of incorporation of urea in the experimental ration.

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#### Doba průchodu zažitiny zaživacím traktem buvolů Nili Rawi, skotu plemene sahiwal a kříženců.

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Na Vysoké škole veterinární v Lahore (Pákistán) byl stanoven projekt pro studium doby průchodu zažitiny zaživacím traktem buvolů, skotu plemene sahiwal a kříženců (holštýnsko-fríské x sahiwal).

Pokus byl proveden na 15 zvířatech z každé skupiny. Měření doby průchodu zažitiny bylo prováděno během 10 dnů po zkrmení pokusné dávky obsahující obarvenou pšeničnou slámu. Každé zvíře obdrželo 4 % obarvené pšeničné slámy z celkového denního příjmu sušiny. Sběr trusu byl započat 14 hodin po krmení, další tři dny byl prováděn v 6hodinových intervalech, sedmý a osmý den ve 12hodinových inter-

valech a poslední dva dny v 18hodinových intervalech. Obarvené částice byly spočítány a vyjádřeny v procentech z celkového počtu částic vyloučených během 242 hodin pokusného období. Vylučování zbarvených částic bylo 79, 325 a 239 s průměrnými hodnotami  $17,75 \pm 3,4$  u buvolů,  $81,25 \pm 3,42$  u skotu sahiwal a  $59,75 \pm 5,12$  u kříženců. Doba vylučování se významně zvýšila ( $P < 0,01$ ) až na 38 hodin u buvolů (18,14 %), na 20 hodin ( $P < 0,01$ ) u skotu plemene sahiwal (20,08 %) a na 32 hodin ( $P < 0,01$ ) u kříženců (16,81 %) a postupně poklesla na 0,00 % za 242 hodin u všech skupin. Doba průchodu zažitiny zaživacím traktem byla u všech skupin vysoce významná ( $P < 0,01$ ) až do 56 hodin po krmení, poté však byla nevýznamná ( $P < 0,05$ ). Doba retence zažitiny byla vyšší u buvolů než u zbývajících dvou skupin skotu. Kříženci měli delší dobu retence zažitiny než skot plemene sahiwal.

doba průchodu; zažitina; buvol; plemeno skotu sahiwal; kříženci

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