

Passage of Ingesta through the Digestive Tract in Sheep by Using Chromic Oxide as a Marker

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COMPARATIVE study was undertaken between Merino and native sheep breeds (Ossimi and Rahmani) at the Faculty of Agriculture, Cairo University, with the aim of studying the rate of passage of ingesta through the digestive tract, using chromic oxide as a marker.

Four rams of each breed were slaughtered successively after 6, 12, 24 and 48 hr from feeding the marker to measure the weight of the contents and the concentration of Cr_2O_3 in each compartment of the digestive tract. The main results were:

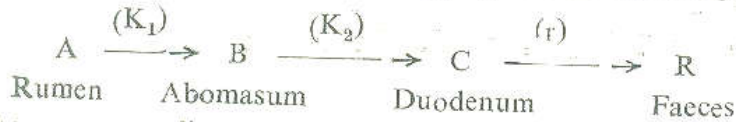
1. 6 hr after dosing, 90% of the feed consumed was still retained in the rumen. The Merino showed the greatest retention.
2. After 12 hr the rumen contained only 20% of the feed. The Merino showed the highest retention. The same trend for breed differences was observed in the colon.
3. After 24 hr the Merino retained 15% of the feed in the ruminoreticulum while the native breeds retained only 10%.
4. After 48 hr the forestomach (ruminoreticulum and omasum) of the native breeds were completely free of Cr_2O_3 while the Merino still showed the presence of the marker in the forestomach (omasum).

The rate of passage of digesta is one of the important factors in determining the efficiency with which the animal utilizes a given amount of feed, another important factor is the rate of breakdown of the feed to provide the requirements of the animal (Blaxter *et al.*, 1956).

Various terms are used to describe the flow of ingesta through the digestive tract including transit time, retention time, rate of passage, and rate of flow or rate of transport. Any of these terms implies the time taken by undigested residues from a given meal to reach the faeces or any point in the gut (Kotb and Luckey, 1972).

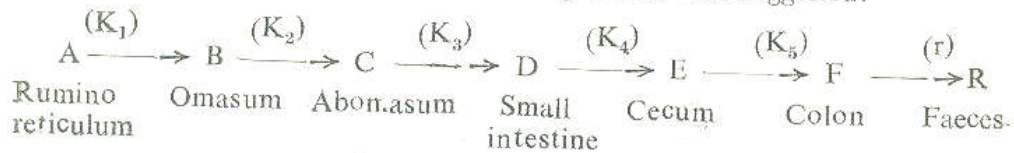
The problem of measuring this time has been approached using chromic oxide (Cr_2O_3) techniques (Lambourne, 1957), to show the time taken by clover or berseem to pass completely through the digestive tract.

Balch (1950), Blaxter *et al.* (1956) and Phillipson and Ash (1965) suggested that the passage of ingesta through the digestive tract of ruminants could be regarded as a kinetic process. They proposed the following model.



There was no direct experiment to show that those three constants actually represent events in the specific parts of the tract.

In the present experiment the following model was suggested:



Where K_1, K_2, K_3, K_4 and K_5 are constants of passage and (r) is a time delay between F and R.

Little information is available for Egyptian clover (*Trifolium Alexandrinum*), the main animal feed in Egypt, concerning its rate of passage and the quantity of digesta that passes a point along the digestive tract in a given time period.

Another objective of this study was to find out any difference that may exist between imported Merino and the native sheep breeds, Ossimi and Rahmani, in this respect.

Material and Methods

The rate of passage of the ingesta through the digestive tract was recorded using chromic oxide as a marker. Four rams, aged 15 months, from each of the Ossimi, Rahmani and Merino breeds were used. Each ram was given 5g of Cr_2O_3 in a capsule. Each animal was given 10 kg of berseem *ad libitum*.

Rams of each breed were slaughtered successively after 6, 12, 24 and 48 hr. to find out the concentration of Cr_2O_3 in each compartment of the digestive tract after the lapse of the specified period of time denoting the rate of passage through the digestive tract within that fixed period.

The mean concentration of Cr_2O_3 was determined according to the following equation after Lambourne (1957).

The percentage of marker in each compartment =

$$\frac{\text{weight of markers in any compartment}}{\text{Total weight of the marking dosing}} \times 100$$

The procedures used were those described by Smith (1955), Analytical Methods Committee (1960), Carter *et al.* (1960), Whitby and Daphne Lang (1960) and Ali and Evane (1967).

The concentration of Cr_2O_3 was estimated by colorimetric technique at 425 W.L.

Results and Discussion

After 6 hr from dosing, the rumen retained more than 90% of the feed consumed (Table 1). The Merino showed the greatest feed retention (Fig. 1).

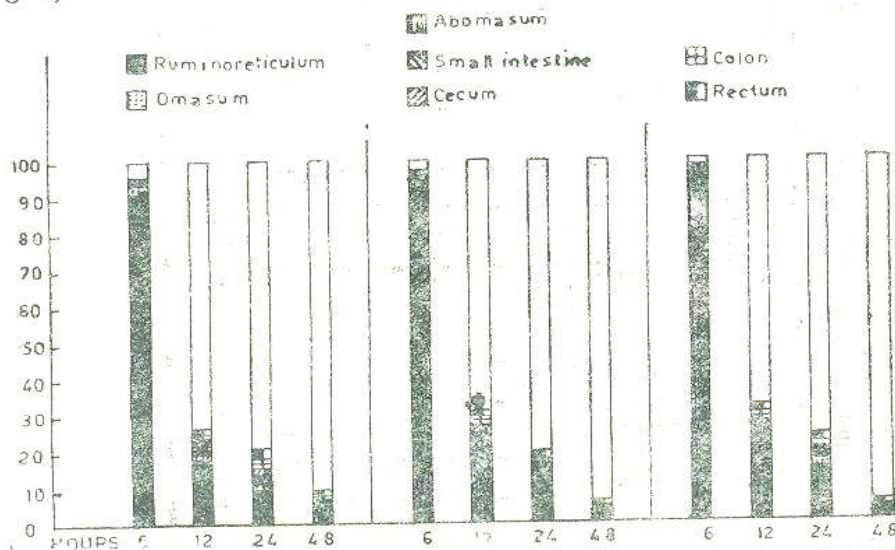


Fig. 1 The percentage value of Cr_2O_3 in compartments of the digestive tract of Ossimi, Rahmani and Merino sheep at 6, 12, 24 and 48 hr from dosing.

After 12 hr the rumen contained about 20% of the feed, the Merino showed also the highest retention after 24 hr, the Merino retained 15% of the feed while the native breeds retained only 10%. Whether this greater retention of feed can be a criterion explaining the better rumen digestion in Merino is a question of concern in this work.

The ruminoreticulum and omasum of the native breeds were completely free of Cr_2O_3 at 48 hr after dosing (Fig. 1). On the other hand the Merino, however, still showed the presence of the marker in the omasum which denotes slowest evacuation of the ruminoreticulum.

It was reported that the marker of Cr_2O_3 had passed from the rumen through the omasum the abomasum in $1/2$ hr (Lambourne, 1957). This rumen evacuation is greatly related to feeding habits (Campling *et al.*, 1961; Balch, 1961 and Balch and Campling, 1965).

TABLE 1. The percentage value of $C_{12}O_3$ in the compartments of the digestive tract of Ossimi, Rahmani and Merino sheep at 6, 12, 24 and 48 hr from dosing.

Breed	Ossimi				Rahmani				Merino			
	6	12	24	48	6	12	24	48	6	12	24	48
Compartment	91.80	18.40	10.81	—	94.82	21.23	9.80	—	96.89	21.99	15.22	—
Rumenoreticulum	2.41	0.20	0.52	—	2.01	0.97	0.48	—	1.03	0.64	1.06	0.40
Omasum	1.50	0.52	0.91	0.92	0.98	0.82	0.26	0.38	0.49	1.98	0.22	0.26
Abomasum	—	1.63	2.88	2.20	—	2.24	1.88	1.03	—	1.84	0.54	0.88
Small intestine	—	2.14	1.04	2.80	—	1.15	2.04	2.01	—	0.96	0.38	0.56
Cecum	—	2.37	2.07	1.40	—	2.02	2.80	1.95	—	2.98	0.80	0.86
Colon	—	1.68	2.99	1.80	—	1.69	2.40	0.62	—	2.13	2.15	0.83
Rectum	—	—	—	—	—	—	—	—	—	—	—	—
Total	95.71	26.94	21.22	9.12	99.81	30.12	19.66	5.99	98.41	32.52	20.37	3.79

The intestinal tract showed no breed difference in feed retention at 12 hr (around 8%), while at 24 hr, it showed less retention in Merino (4, 9 and 9% in Merino, Ossimi and Rahmani, respectively) and the same was also noticed at 48 hr (3,9 and 9% in Merino, Ossimi and Rahmani respectively).

Another characteristic breed difference was the very low retention of feed in the cecum of Merino compared to the native breeds at any time after Cr_2O_3 dosing (Table 1). The colon also showed the same breed difference but after 12 hr from dosing.

The results may indicate the good adaptation of the local breeds of sheep to the coarse roughages usually available for sheep feeding in Egypt.

The native breeds have adopted feeding habits which make contribute to their efficiency utilizing such feeds (Sharafeldin and Shafie, 1962).

This breed difference however needs more confirmation. Ruminal and caecal fistulae offer greater accuracy and better testing at shorter time intervals. Feed type and management for both local sheep and imported Merino must have particular consideration.

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سرعة مرور الغذاء خلال الجهاز الهضمي للأغنام

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أجرى هذا البحث في كلية الزراعة جامعة القاهرة بهدف دراسة سرعة مرور الغذاء في الجهاز الهضمي للأغنام المحلية (الأوسيمي والرحماني) والأغنام المستوردة (مرينو) واستعمل البرسيم (الغذاء الرئيسي للحيوانات في مصر) في تغذية هذه الأغنام وشملت تجربته ٤ ذكور من كل نوع وأعطيت جميعها الرقم (أكسيد الكروميك) ثم ذبحت على فترات بعد ٦ ساعات، ١٢ ساعة، ٢٤ ساعة، ٤٨ ساعة ووزنت محتويات الكرش والسبكية والورقية والأنفحة والأمعاء الدقيقة والأعور والأمعاء الغليظة والمستقيم (الروت) وأخذت عينه من كل جزء لتقدير المادة الجافة ونسبة أكسيد الكروميك *

وكانت أهم النتائج:

- (١) لم يتجاوز مرور البرسيم في الجهاز الهضمي للأغنام بعد ٦ ساعات من إعطائها الرقم الكرش الذي كانت به نسبة ٩٠٪ من الغذاء المعطى كما كان المرينو أعلاها في حفظ الغذاء.
- (٢) لم يحتو الكرش بعد ١٢ ساعة الا على ٢٠٪ من البرسيم، وكان المرينو كذلك أعلاها في حفظ الغذاء، ووضع ذلك أيضا في الأعور.
- (٣) وبعد ٢٤ ساعة احتفظ المرينو بمقدار ١٥٪ من الغذاء في الكرش، بينما لم يتجاوز ما احتفظت به الأغنام المصرية ١٠٪ من الغذاء المعطى.
- (٤) وبعد ٤٨ ساعة كان المرينو لا يزال يحتفظ بالغذاء في أجزاء من المعدة المركبة (الورقية) بينما كانت الورقية خالية تماما في الأنواع المحلية. وبوجه عام فإن دراسة هذا الموضوع يجب أن تستمر ومن الطبيعي أن تستخدم الحيوانات ذات الفستيو لا الثابتة في الكرش والأعور سوف يعطى نتائج أكثر دقة وإمكانات أكبر للدراسة *