THE INFLUENCE OF CAECOTOMY ON COMPOSITION AND EXCRETION RATE OF SOFT AND HARD FECES, FEED AND WATER INTAKE IN RABBITS

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Abstract - The experiment was performed on 12 male adult New Zealand White rabbits . Six of them were caecotomized at about 5 months of age. The average body weight was 3.4 kg. After more than 4 months of the caecotomy, the rate of feed and water intake were detected throughout 24 hours for both groups. Excretion hourly rate of soft faeces (caecotrophy) and hard faeces in caecotomized and normal rabbits were carried out during 24 hours. The two types of focal material were subjected to chemical analysis. Daily dry matter intake and water intake in caecotomized group (132 g/day and 266 g/day) was significantly higher than that in control group (96 and 186 g/day respectively) Also, the total daily dry matter excreted in hard faeces was highly significant in caecotomized group than in control group (62.2 *vs* 42.8 g/day) No significant differences were detected in total dry matter excretion in soft faeces between caecotomized and control group. Excretion hourly rate of the two types of faeces throughout the day in both groups were not identical. Chemical composition of hard faeces differ significantly between groups in DM, ether extract, crude fibre, neutral detergent fibre (NDF) and acid detergent fibre (ADF), but not in organic matter and DM protein content. Chemical composition of soft faeces was statistically different between the 2 groups in all components except DM and OM.

INTRODUCTION

The complete removal of the caecum is not possible because the structure of the ileo-caeco-colic junction is such that some caecal tissue will always be left *in situ* (HERNDON and HOVE, 1955). After caecotomy, the rabbits continued to excrete two types of faecal material of similar composition, but the soft faeces had no mucus coat (PROTO, 1976; GALLOUIN *et al.*, 1979).

The excretion of hard and soft faeces is related to feeding, which turn shows a circadian rhythm (JILGE, 1974; RUCKEBUSCH and HÖRNIKE, 1977). A typical excretion pattern of hard and soft faeces in commercial and laboratory rabbit was observed (THACKER and BRANDT, 1955). About 80% of the hard faeces are excreted during the first hours after feeding followed by soft faeces over the next 8 hours (RUCKEBUSCH and FIORAMONTI, 1976). The composition of soft faeces was similar to caecal content (MADSEN, 1939; EDEN, 1940;, TALOR, 1940). Caecotrophes have much lower DM content (31%) than hard faeces (53%) (RUCKEBUSCH and HÖRNIKE, 1977). Net absorption of water take place in the caecum and dry matter content of the digesta rises shortly in this organ (WILLIAMS *et al.*, 1961).

The main objective of the present study was to determine the role of caecum in some function of rabbit metabolism and its influence on the composition and excretion rate of hard and soft faeces.

MATERIAL AND METHODS

The present study was realised on Faculty of Veterinary Medicine, University of Complutense of Madrid.
Twelve New Zealand White male rabbits about 5 months age were divided at random into two groups of 6 each. The mean initial body weight of the two groups was (3382 ± 84g and 3265 ± 73g). The rabbits in the first group were caecotomized with an electric scalpel in the operation rooms of Dept, of Animal Pathology II. The technique used for the caecum removal in this investigation was the same as described previously by EL-ADAWY (1993).

Throughout the experiment, all the animals were housed individually in wire mesh cages type flat-deck in ventilated block building. The animals were kept with a cycle of 16h light and 8h dark. Rabbits were offered

ad libitum pelleted complete diet "Biocun" produced by Bioter, S.A., consisting of cereals, dried forages, industrial by-product meals, oil seed cakes, molasses and sugar, supplemented with minerals, vitamins, dl-methionine, methyl-chlorpindol 25 ppm and copper (copper pentahydrated sulphate 15 ppm). Dietary composition is presented in table 1. Water was freely available throughout the trial.

Sampling period was beginning after 4.5 months of the caecotomy. Neck plastic rings described previously by LORENTE (1987) were used for the collection of animal excreta. Colars wer put for experimental animals at 14:00 h in the collection day. Feed and water intakes were controlled hourly throughout one day. Excreta were collected hourly (collection time was designed to be at 0,1,.24h), and separation between the two types of faeces (caecotrophes and hard faeces) were made immediately. Each of collected samples were weighted out, before and after drying at 80°C, using electric balance "Centorios" with sensibility 0.01g. Each type of faeces, over the sampling time, was pooled together in one sample. Chemical analyses of feed and faeces were made according to AOAC (1981) methods, while determination of NDF and ADF were made according to Van Soest (1969) methods.

Table 1 : Composition of complete feed

Item	Composition
- Dry Matter %	93.25
DM basis (%)	
- Organic matter	87.96
- Crude protein	17.85
- Ether extract	3.18
- Crude fibre	15.11
- NDF	52.46
- ADF	20.14
- Ash	12.04

The experiment conducted in the present study was repeated twice and the period between the collection times was one week. The data presented was the overall mean of the two collection times.
For statistical evaluation, one way analysis of variance was used and means were compared with the Tukey range test.

RESULTS AND DISCUSSION

Average daily dry matter intake (DMI) in the control group obtained in the present study was 96 ± 3 g. This value was lower than that reported by many other authors (LEBAS 1975; PARTRIDGE *et al.*, 1986) with rabbits about the same weight. This decrease in the DMI is possibly due to the neck plastic ring putted for the animals during the trial. Similar results were discussed by LORENTE (1987).

DMI was significantly higher ($P<0.01$) in the caecotomized group (132 ± 5 g) than that in the control group (96 ± 3 g), possibly a consequence of the high rate of outflow in the large intestinal because of the absence of the caecum of caecotomized rabbits. This results were in contrast with that obtained by GRALAK *et al.* (1992). This contrast can be due to the age of the experimental animals and, or the intervals time between caecotomy and trial starting which are different in the two studies.

Water intake (WI) was significantly higher ($P<0.01$) in caecotomized group than that in normal group (266 ± 19g *vs*, 186 ± 13 g). This indicate for the important role of the caecum in water absorption, which can't be corrected by the modification presented in the digestive tract after the caecotomy (EL-ADAWY, 1993) at the same time explain the high water content in the two types of faeces in the caecotomized rabbits. Net absorption of water in the caecum was reported by many authors (WILLIAMS *et al.*, 1961; PROTO, 1976; LANG, 1981).

The total dry matter excreted in soft faeces in a 24 h period was lower with 2.9 g in caecotomized group CC than in normal group CN (13.2 ± 1.1 g *vs* 16.1 ± 0.8 g) but this differences was not statistically significant. The excretion hourly rate of soft faeces in both groups was presented in figure 1. The period with the maximum excretion rate in CC was from 3:00 h to 7:00 h, where it was from 6:00 h to 14:00 h in CN. Similar results were obtained in normal rabbits by LAPLACE (1975- 1978); LAPLACE and LEBAS (1975). On the other hand, the total dry matter excreted in the hard faeces of caecotomized group HC was significantly higher than that in control group HN (62.2 ± 1.1 *vs.* 42.8 ± 1.2 g). This mean that the caecotomized rabbits excreted daily 19.4g DM in hard faeces more than the control group, which can be a consequence of the high DMI in caecotomized group. Changes in hourly excretion rate between the 2 groups were noted. This changes were more pronounced during the dark period and until 15:00 h. The period of maximum excretion rate of hard faeces was observed from 21:00 h., to 24:00 h in the control group, while it was from 17:00 h to 6:00 h in the morning for the

caecotomized rabbits (Figure 2). On the other hand, the excretion rate of soft faeces increased when the excretion rate of the hard faeces decreased in both groups.

The common source of both types of faeces is the caecum (BONNAFOUS and RAYNAUD, 1968; HENNING and HIRD, 1972; LENG and HÖRNICKE, 1976). Some studies of the physiology of the large intestine and the differential of fluid and particles in the digesta (BJÖRNHAG, 1972; PICKARD and STEVENS, 1972; RUCKEBUSCH and HÖRNICKE, 1977) have made it possible to suggest the following explanation for the production of hard and soft faeces : the movements of both caecum and proximal colon cause a constant flux and reflux of material between the proximal colon and the caecum; the net result is that the large particles and some fluid tend to move from the caecum into the colon and that much fluid and small particles tend to move into the caecum. Hard faeces are thus produced from the larger particles which are pushed into the posterior proximal colon. Soft faeces are produced after the caecal content have been subjected to several hours of microbial action, usually in response to more digesta present in the caecum. PROTO (1976) and GALLOUIN *et al.* (1979) in adult rabbits, GRALAK *et al.* (1992) in weaned rabbits, observed that few weeks after of the caecotomy, excretion of two types of faeces started again. This re-excretion is possibly dependent on the increase in the length and weight presented in the digestive tract (especially the part of ileo-caeco-colic junction) after the caecotomy (PROTO, 1976; GALLOUIN *et al.*,1979; EL-ADAWY, 1993). From the other side BONNAFOUS and RAYNAUD (1967); HÖRNICKE (1981), CONTERA (1985) reported that the proximal colon has great importance in the formation of two types of faeces.

Chemical composition of hard faeces and soft faeces in both groups are shown in table 2. No significant differences in dry matter and organic matter content of soft faeces were observed between the 2 groups. Crude protein content of soft faeces was significantly higher in control group than in caecotomized group while ether extract, crude fibre, NDF and ADF in control group was significantly lower. All the composition component of hard faeces in caecotomized rabbits were significantly higher except organic matter and crude protein. This results were in agreement with those obtained by OGUNDU *et al.* (1991) and GRALAK *et al.* (1992). The lower percentage of crude protein in soft faeces of caecotomized than in the control group and also the high percentage of fibre material in both hard and soft faeces in caecotomized rabbits, are possibly a consequence to a higher rate of passage of the digesta, and to a decrease in the microbial fermentation activity.

Table 2 : Excretion and composition of hard and soft faeces in normal and caecotomized rabbits.

	Hard faeces		Soft faeces	
Groups	Control	Caecotomized	Control	Caecotomized
Fresh faeces (g/day)	76.7 ± 3.3^{a}	169 ± 4.5^{b}	53.3 ± 7.7	46.8 ± 2.3
Faeces DM (g/day)	42.8 ± 2.2^{a}	62.2 ± 1.1^{b}	16.1 ± 0.8	13.2 ± 1.1
DM content (%)	55.8 ± 0.8^{a}	36.8 ± 1.0^{b}	30.2 ± 1.3	28.2 ± 0.5
DM basis (%)				
- organic matter	85.0 ± 1.0	85.7 ± 2.7	86.3 ± 1.8	85.9 ± 2.7
- crude protein	13.2 ± 0.2	12.1 ± 0.01	32.3 ± 0.5^{a}	26.1 ± 0.2
- ether extract	1.6 ± 0.05^{a}	2.5 ± 0.12^{b}	1.9 ± 0.09^{a}	2.8 ± 0.12^{b}
- crude fibre	38.1 ± 2.8^{a}	40.9 ± 3.3^{b}	23.6 ± 1.0^{a}	31.9 ± 2.3^{b}
- NDF	71.8 ± 1.8^{a}	77.1 ± 1.4^{b}	54.1 ± 0.6^{a}	66.6 ± 1.9^{b}
- ADF	44.7 ± 2.3^{a}	48.3 ± 0.4^{b}	29.7 ± 0.4^{a}	41.6 ± 1.2^{b}

^{ab} Means followed by diferent letters differ at $P < 0.05$

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Figure 1. Excretion rate of caecotrophy in normal (C.N.) and caecotomized (C.C.) rabbits during the day (g.DM/ h).

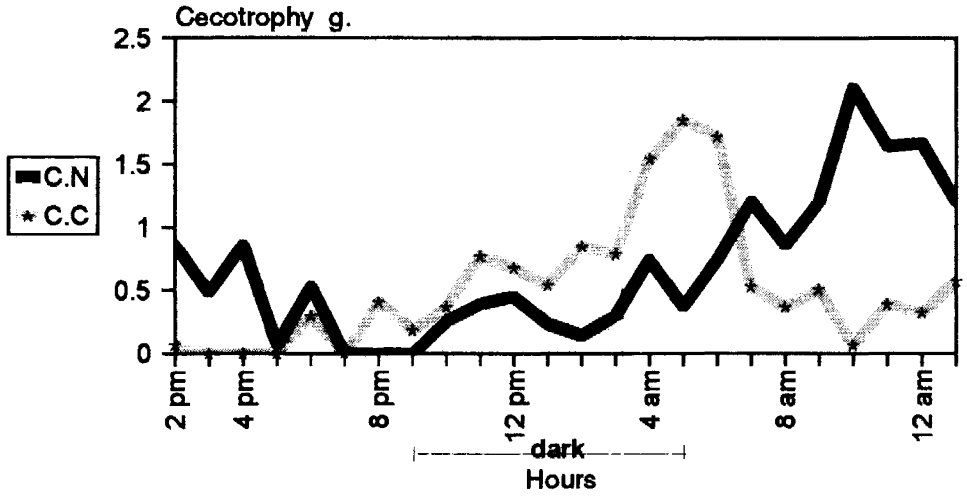
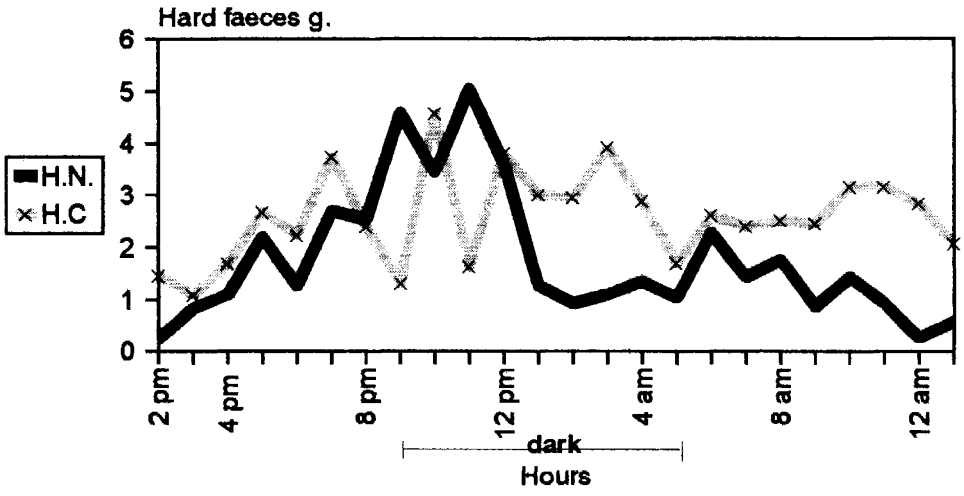


Figure 2. Excretion rate of hard faeces in normal (H.N.) and caecotomized (H.C.) rabbits during the day (g.DM/ h).



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