— Note —

Coprophagy in Rabbits : Autoingestion of Hard Feces

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(Received 26 January 1993/Accepted 7 May 1993)

The rabbit is a representative animal species that conducts coprophagy, i. e. the production and reingestion of soft feces. We, however, encountered a maternal rabbit eating its own hard feces. A detailed investigation was performed on coprophagy in the rabbit to elucidate whether rabbits actually reingest their own hard feces. It was found that young adult Japanese White rabbits reingested their hard, as well as soft, feces directly from the anus. It has been reported that rabbits reingest only soft feces because of their high nutritive content, but the present study demonstrates that rabbits also reingest their hard feces despite their low nutritive content. It seems possible that coprophagy may be initiated by the colonic or rectal wall expanding effects of the fecal material itself. —KEY WORDS : coprophagy, rabbit

We encountered a maternal rabbit eating its own hard feces lying on the floor of its nursing cage. This behavior conflicts with the previously reported coprophagous behavior of the rabbit in two respects. First, the rabbit has been reported to reingest only its soft feces, and secondly, to take its soft feces directly from the anus at the time of excretion [8,9].

Soft feces, produced and excreted during certain times of the day [1,2], have been revealed to be rich in crude proteins and B vitamins, whereas hard feces are poor in such nutrients but rich crude fiber [7,11]. From a nutritional perspective, it seems reasonable that the rabbit reingests only its own soft feces to utilize as nutrients. Then, we made a further detailed observation of the coprophagy to elucidate whether or not the rabbit reingests its own hard feces.

Four male and four female Japanese White rabbits purchased at 10 weeks of age (Kitayama Labes, Nagano) were individually housed in aluminum cages (350W×500D×400Hmm) with transparent polycarbonate fronts and ceilings. Each cage was placed on a table and the tray was pulled out so as to see the feces fall through the floor screen of the cage at defecation and

accumulate on the table. After a one week acclimatization period, 2 animals of the same sex were observed for their coprophagous behavior for 24 hours using a video tape recorder. This behavior was recorded in the remaining 2 males and 2 females at 16 or 26 weeks old. During the dark period, the animals were illuminated with infrared light [3]. The recorded tapes were reproduced on another day to observe the coprophagy. During the experiment, animals were kept in a barrier-sustained animal room with a controlled environment : temperature, $22 \pm 2^\circ\text{C}$; humidity, $55 \pm 15\%$; ventilation, 15 times per hour (all-fresh-air system) ; and illumination, 14 hours per day (light on at 5 : 00 a.m. and off at 7 : 00 p.m.). Pellet diet RC-4 (Oriental Yeast Co., Ltd.) and sterilized well water were supplied *ad libitum* to the animals.

Coprophagy was observed throughout a 24 hour period in each animal, i. e., during the time of hard feces excretion as well as soft feces excretion. Total frequency of coprophagy in individual animals ranged from 25 to 100 times a day. The frequency of coprophagy for hard feces and the ratio to the total frequency were from 15 to 87 and 41 to 87%,

Fig. 1. Individual diurnal pattern of coprophagy ● : Coprophagy for hard feces ○ : Coprophagy for soft feces a : Frequency of coprophagy for hard feces b : Frequency of coprophagy for both soft and hard feces c : $a/b \times 100$

Fig. 2. Coprophagy at hard feces defecation. Just defecated but unrecovered fecal pellets are seen under the cage.

respectively (Fig. 1). The weight of hard feces reingested was estimated to be 3 to 17 g per rabbit and to correspond to approximately 1/20 to 1/4 of soft feces on a wet weight basis. The postures of animals during coprophagy for hard feces were entirely the same as those for soft feces (Fig. 2). However, coprophagy for hard feces was distinguished from that for soft feces by the following two characteristics. The most outstanding characteristic was the low recovery rate of hard feces at each episode of coprophagy. Soft feces were almost entirely recovered by rabbits at each defecation, whereas hard feces were taken partially because they were numerous, separated from each other, and defecated quickly. Consequently, the greater part of hard feces could be seen to fall through the floor screen of the cage and accumulate on the table at the time of coprophagy (Fig. 2). The second characteristic was the short interval between each instance of coprophagy. During the time of soft feces excretion, coprophagy was repeatedly observed at intervals of approximately 10 to 60 minutes. On the

other hand, during the time of hard feces excretion, the intervals of coprophagy shortened to approximately 1 to 3 minutes or less. But, coprophagy did not necessarily accompany all excretions of hard feces. When rabbits were devoted to another type of behavior, especially feeding, they barely reacted to hard feces.

It has been reported that the rabbit reingests only its own soft feces at coprophagy [8,9]. Soft feces have been revealed to be produced through a mechanism separating small particles from the digesta at the proximal colon and excreted during certain times of the day [1,2]. Actually, coprophagy in the rabbit has been reported to be observed during certain periods of the day; during the active daytime [10], the night [11] or 24 hours [12]. These discrepancies are now accepted as being attributable to different environmental conditions such as feeding schedule or light-dark cycle [6]. In our observation, it was shown that rabbits reingested both their soft and hard feces and therefore coprophagy was observed at almost any time of the day. The rabbit's reingestion of its hard, as well as soft, feces is speculated to occur for the following reasons: According to an established theory [5], the signals transmitted to the animal's nervous system which indicates the presence of feces and induce the defecation reflex is the fecal matter itself located within and expanding the colonic or rectal wall. It is likely that copro-

phagy in the rabbit is initiated in the first place by fecal signals transmitted from the colonic or rectal wall to the central nervous system. It can be speculated that the signal for hard feces is identical with that for soft feces. Differences in nutritional or physical aspects of soft and hard feces would have little to do with the initiation of coprophagy. However, there were exceptional cases in a day in which the rabbits barely reacted to hard feces; this is an open question which remains to be solved.

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ウサギの食糞行動

—— ウサギは硬糞も摂取する ——

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ウサギは食糞行動を示す代表的動物種である。従来よりウサギは軟糞・硬糞の2種類の糞を排泄し、その内軟糞だけを摂取すると報告されてきた。しかし、ウサギの食糞行動を詳細に観察したところ、ウサギは軟糞同様に硬糞も摂取していた。従来、ウサギはその栄養価値が高いゆえ軟糞のみを摂取すると

言われていたが、栄養価値の低い硬糞も食べていることが本実験で明らかになった。得られた成績から、ウサギの食糞行動は結腸もしくは直腸内にあってそれらの壁を内側より伸展する糞そのものの刺激によって誘起される可能性があると考えられた。