

Study on the Rumination Behaviour in Spotted Deer (*Cervus nippon*) Equipped with EMG Telemetry System

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EMG Telemetry System을 이용한 꽃사슴의 반추행동에 관한 연구

전병태 · 문상호

ABSTRACT

A behavioral investigation in deer equipped with EMG telemetry system was carried out to examine the chewing behavior pattern for efficient feeding management of Korean spotted deer (*Cervus nippon*). There was more frequent and irregular eating and rumination behavior pattern in deer than those in other ruminants. Time spent on eating and ruminating was 261 and 291 min., respectively. Total number of boli regurgitated was 647 times per a day and deer regurgitated an average bolus of 21.6 times per a rumination period. Total rumination time was 291 min. and deer have an average rumination time of 26.9 sec. per a boli. Deer had 245.3 min. for total chewing time, 20,405 times for number of chews, 31.5 times for number of chews per bolus, and 83.4 times for number of chews per minute during rumination period. An average regurgitation bolus an hour was lower with 15.3 numbers in the 09~15 hours subperiod and higher with 26 numbers in the 15~21 hours subperiod and it had been gradually trended to become to low after 15~21 hours subperiod. An average numbers of chews a bolus at every 6 hours subperiod increased gradually according to time. A deer spent 23.3 min. on eating and 26.2 min. on ruminating per 100g ingested dry matter.

Consequently, since deer have a different chewing behavioral pattern to other ruminants such as more frequent and irregular eating and ruminating patterns, small bolus and low number of chew, it is likely to needed to establishment and development efficient feeding system for deer.

(Key words : Deer, Chewing behavior, Eating, Ruminating, Telemetry system)

I. INTRODUCTION

Deer farming has been grew for velvet and venison production and game farming in over

the world, and deer have mainly been raised for velvet antler production in Korea. Because of severe condition of existing animal husbandry industry owing to opening of domestic agricul-

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tural market under the system of WTO, there is high concerns about the deer farming and it is considerably increased the deer numbers for about 220,000 heads at the present in Korea. (KADF, 1998). However, deer farming in Korea has several difficulties for improvement of productivity attributed to a little information about efficient feeding management which is due to deficiency of researches in relation to deer farming, and thus it is greatly needed to increase of basic and systematized researches on the deer farming.

All over the world, it has been mainly carried out researches on ecology and nutrition (Blaxter et al., 1976; Renecker et al., 1988; Reinken et al., 1990) of deer. However, because the results of those researches were mostly obtained at the wildlife condition, it is a difficult to direct application for intensive farming conditions.

In Korea, deer farming is newly acceptable to a part of livestock industry, and so it has vigorously been conducted the researches on farm survey for limited local areas(Kwak et al., 1991; Kwak et al., 1994; Jeon et al., 1995), feed intake and digestive physiology(Lee et al., 1990a; 1990b; Kim et al., 1995) and development of feed sources for deer(Jeon et al., 1994; Jeon et al., 1995; Kim et al., 1996) recently. But little information is still available on the establishment of a real feeding management for deer. Especially deer has a sensitive response on an external stimulation because of having a strong wild nature as ever. It has been known that a response on the stimulation was greatly different according to the movement or mixing of a herd(Pollard et al., 1993; Diverio et al., 1993) and the position and behavior of a

manager(Pollard and Littlejohn, 1995), and this was directly connected with the productivity of livestock. Therefore, it is highly demanded basic researches on the behavioral nature of deer for the improvement of productivity in deer farming industry.

In Korea, deer farming has been made of an intensive and a small scale farming pattern as a sideline in the limited land(Jeon and Kim, 1992), and so it is considered that the patterns of feeding behavior would be greatly restricted or changed in compared to the conditions of an extensive and a large scale farming condition. In this study, a behavioral investigation in deer equipped with EMG telemetry system was carried out to examine the chewing behavior pattern for efficient feeding management of spotted deer(*Cervus nippon*).

II. MATERIALS AND METHODS

This experiment carried out in HANA Deer Research Institute, Chungju, from April 25 to May 10 in 1993 targeting a female of three aged deer experienced to same management condition during a long period.

For application of electromyogram(EMG) telemetry system, a pair of electrode which can capture the fine electric signals occurring when jaw moves inserted into masseter muscle by surgical operation and a transmitter which can transmit to receiver the electric signal collected from inserted electrodes set up in neck of deer. The collected information about jaw movement when mainly eating and ruminating occurred was transmitted to receiver which is situated in the distance through the transmitter

and that was recorded in the recording chart (pen recorder: SANEI K.K. W-809, Ra-101). And watching record was also carried out for observation of eating and rumination behavior.

Behavioral observation was continuously recorded for three days from May 5 to 7 in 1993 and the second day's record was used for analysis of result. Feeding behavior of deer was continuously recorded during 24 hours by EMG telemetry system.

A female spotted deer of 60kg weight was offered for experimental animal and fed ad libitum. oak leaf hay, alfalfa hay cube and concentrate were fed by 4% DM level of body weight and they were fed twice a day at AM 9 and PM 6. Water was offered freely and mineral block was installed besides feeding device for free intake of mineral. Also a light of 60W was turned on during night for behavioral observation.

It is given in Table 1 the results on feeding amount and intake of deer.

Table 1. Feeding rate and dry matter intake for experimental deer

Feed	Feeding rate	Dry matter intake
Alfalfa hay cube	800g	291.5g
Oak browse	800g	316.8g
Concentrate	800g	513.0g
Total	2,400g	1,121.3g

III. RESULTS AND DISCUSSION

Diurnal distribution of feeding behavior of deer estimated using EMG telemetry system was

shown in Fig. 1 and 2. The pattern of diurnal eating and ruminating was comparatively short and shown continuously behavioral revelation. This was slightly different in compared to those of other ruminants such as cattle, sheep and goat (Jeon, 1983; Okamoto, 1979; Moon et al., 1994; 1995). This was agree with the report of Hofmann (1988) who divided the ruminants into three types as digestion and feeding pattern and concluded that deer have high frequency of eating and ruminating owing to a weak development of rumen. Consequently, this result suggests strongly that because deer are more frequently eats and ruminates than other ruminants, higher efficiency may be obtained with free choice feeding management in deer farming.

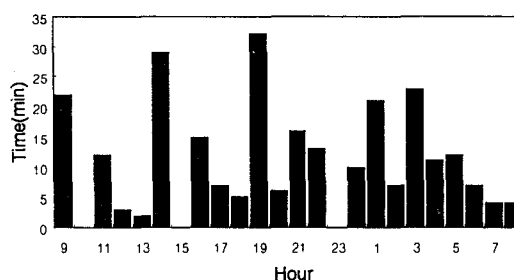


Fig. 1. Diurnal distribution of eating time in Korean spotted deer.

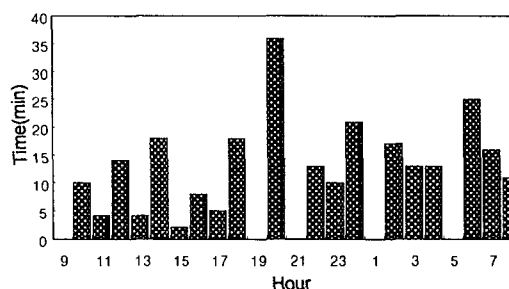
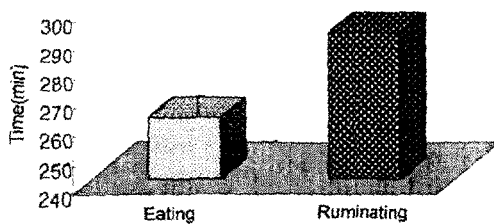


Fig. 2. Diurnal distribution of ruminating time in Korean spotted deer.

Time spent on eating, ruminating and resting during 24 hours in deer was 261 min., 291 min. and 888 min., respectively, as given in Fig. 3. Eating in deer was a similar level with other ruminants but ruminating was greatly low level in compare with sheep and goat (Moon et al., 1994; Okamoto, 1979). However, in researches by Jeon et al. (1993) and Kim et al. (1996), ruminating time of spotted deer under voluntary intake was 320 min. and 300 min., respectively. Therefore, it is considered that because deer have no intensive rumination period at specific time and have high frequency and short period of rumination (Fig. 1), ruminating time of about 290 to 330 min. was normal level in spotted deer. This difference for ruminating time in species was generally due to function of rumen and passage rate of feed particles through digestion tract changing by physical and chemical characters of feed (Gordon, 1958; Welch and Smith, 1978; Ehle, 1984). Therefore, it is thought that deer have comparatively undeveloped rumen and have rapid passage rate of feed particles owing to main intake of browse sources that have netlike structure of leaf vein(Wilson et al., 1989). But it is demanded more practical researches for the future.



3. Time spent on eating and ruminating in Korean spotted deer.

Chewing activity during rumination period in deer is given in Table 2. Total number of boli regurgitated was 647 times per a day and deer regurgitated an average boli of 21.6 times per a rumination period. Total rumination time was 291 min. and average rumination time of deer is 26.9 sec. per a boli. Total numbers of boli regurgitated in deer was a similar to those in sheep(Gordon, 1965; Okamoto, 1979), goat(Moon et al., 1995) and cattle(Teller et al., 1989), which were 686, 650 and 668 times per a day, respectively. But the numbers of boli regurgitated per a rumination period are 21.6 times and rumination time per a boli 26.9 sec., which were lower than those of cattle, sheep, and goat(Jeon et al., 1994; Gordon, 1958; Moon et al., 1995). These results indicate that at the similar rate of dry matter intake, no difference in species for the number of boli regurgitated and low total rumination time is attributed by

Table 2. Chewing behavior during rumination in Korean spotted deer

Item	Results
Total rumination period	30 No.
Total number of boli regurgitated per day	647 No.
Average number of boli regurgitated per rumination period	21.6 No.
Total rumination time	291 min.
Average rumination time per boli	26.9 sec.
Total pause time	45.7 min.
Total chewing time	245.3 min.
Total number of chews	20,405 No.
Number of chews per bolus	31.5 No.
Number of chews per minute	83.4 No.

smaller boli size regurgitated.

Deer had 245.3 min. for total chewing time, 20,405 times for number of chews, 31.5 times for number of chews per bolus, and 83.4 times for number of chews per minute during rumination period. This result was slightly low in compared with the results by other researches (Harumoto and Kato, 1979; Gordon, 1958) which carried out with sheep ingested similar level of dry matter. This was possibly due to faster rate of passage of digesta in contributing to the physical breakdown of particles within the rumen and thus reducing the total stimulus for rumination(Pearce, 1965).

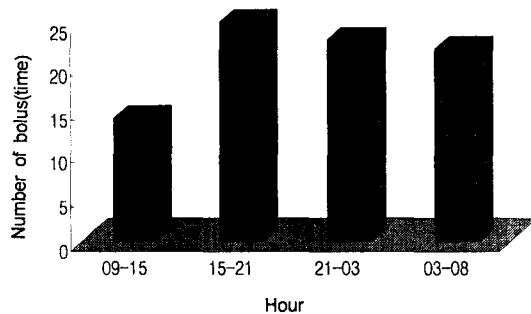


Fig. 4. Circadian distribution of number of regurgitated bolus an hour in 6 hours subperiod.

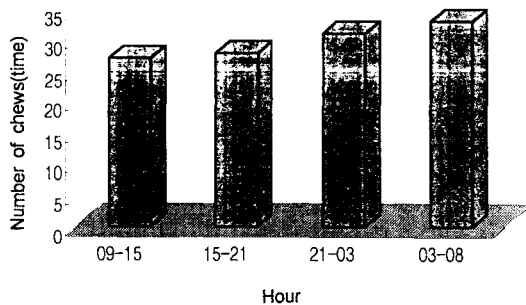


Fig. 5. Circadian distribution of number of chews per bolus an hour in 6 hours subperiod.

An average number of regurgitation bolus an hour was lower with 15.3 times in the 09~15 hours subperiod and higher with 26 times in the 15~21 hours subperiod and it had been gradually trended to become to decrease after 15~21 hours subperiod as given in Fig. 4. An average numbers of chews a bolus at every 6 hours subperiod increased gradually according to time as given in Fig. 5. An average regurgitation bolus and number of chews an hour were low in compare to cattle (Harumoto and Kato, 1974) and goat (Moon et al., 1994) and it is consider that this was due to revelation of short and frequent eating and ruminating speed. Also this result indicate that deer have actively rumination behavior during midnight period.

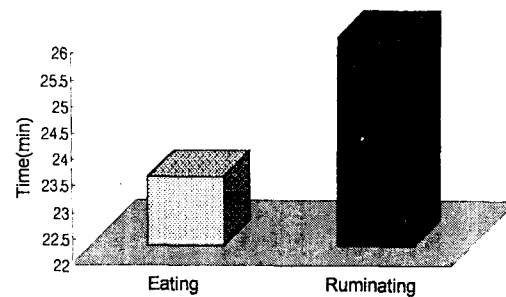


Fig. 6. Time spent on eating and ruminating per 100g ingested dry matter.

Time spent on eating and ruminating per 100g ingested dry matter is given in Fig. 6. Deer spent 23.3 min. on eating and 26.2 min. ruminating per 100g ingested dry matter. Time spent on eating per 100g ingested dry matter in deer was longer in sheep than cattle (Okamoto, 1979; Teller et al., 1989) which were 11.2 and 4.0 min., respectively. However, time on ruminating in deer was shorter than that in other

ruminants(Gordon, 1985; Welch and Smith, 1969; Okamoto, 1979). The conclusion to be drawn from this result is that deer spent comparatively long time on eating because of not intensive eating due to sensitivity on environmental factor and smaller bite size and spent short time on rumination because of rapid passage rate through digestion tract of feed particles and decrease in boli size.

Consequently, since deer have a different chewing behavioral pattern to other ruminants such as more frequent and irregular eating and ruminating patterns, small bolus, and low number of chew, it is likely to needed to establishment and development efficient feeding system for deer.

IV. 요 약

꽃사슴의 효율적인 사양관리를 위한 기초자료의 제시를 위해 근전도(EMG) Telemetry system을 이용한 사슴의 채식행동 조사가 실시되었다. 사슴은 다른 반추가축에 비해 빈번하고 불규칙한 채식행동 양식이 나타났다. 일중 채식과 반추에 소비한 시간은 각각 261분과 291분이었다. 사슴은 반추행동시에 일중 총 647회의 식피와 1반추기당 평균 21.6회의 식피를 토출했으며 1식피당 26.9초의 반추시간을 나타냈다. 반추기간중 총 저작시간은 245.3분이었다. 총 저작수는 20,405회였으며 식피당 31.5회, 분당 83.4회의 저작회수를 나타냈다. 시간대별 평균 식피토출수는 09~15시 사이에 15.3회로 가장 낮았고 15~21시 사이에 26회로 가장 높았으며 이후 점차 저하되었다. 매 6시간 간격의 1식피당 평균 저작회수는 시간이 경과함에 따라 증가되었다. 한편 섭취건물 100g당 채식시간과 반추시간은 각각 23.3분과 26.2분이었

다.

결과적으로 사슴은 다소 불규칙하고 빈번한 채식과 반추 그리고 적은 식피크기와 낮은 저작회수 등으로 인해 타 반추가축과는 다른 행동양식을 갖고 있기 때문에 이에 적합한 사양관리가 필요할 것으로 판단된다.

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