Effects of Kerosene on Ruminal Characteristics, Total Number of Rumen Protozoa and Appetite in Sheep

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Bloat is still a common and costly disorder in ruminants. Most cases of feedlot bloat result from an excessive foaming of the contents of the rumen¹⁻³⁾. Therefore, it is effective to control stable foam formation for the prevention and treatment of feedlot bloat. Animal, vegetable and mineral oils, and several surfactants have been used as anti-foaming agents⁴⁻⁹⁾.

We found out that kerosene had a remarkable anti-foaming effect in a previous *in vitro* study¹⁰⁾.

This study was conducted in order to determine the quantitative effects of kerosene as an anti-foaming agent by observing changes in ruminal characteristics, and to determine the influences of kerosene addition on the appetite and the number of rumen protozoa in sheep.

Materials and Methods

The anti-foaming effect of kerosene was investigated by adding it to the rumen fluid *in vitro* at the level of 0.1%, 0.25%, 0.5%, and 1.0%. Sheep were fed a bloat-producing diet¹¹⁾ (BPD : 61% barley, 22% alfalfa meal, 16% soybean oil meal and 1% salt) twice daily at the rate of 2.5% of body weight (air dry matter) per day. The feed was changed to BPD from the normal diet after the transition period. 400ml of rumen fluid per head was collected 2 hrs after the morning feeding from four rumen-fistulated sheep on ten occasions between the 4th and 15th days of BPD feeding. It was mixed well, and was used for each treatment.

めん羊の第一胃内容液性状, 第一胃内プロトゾア数, 食欲に及ぼす灯油の影響: 宇佐川智也・吉田正
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The ingesta volume increase (IVI) and the stable ingesta volume increase (stable IVI) were measured by the method of JACOBSON *et al*¹²⁾. Gas production values were measured by incubation for 2 hrs at 39°C using a 50 ml syringe¹³⁾. The pH values were measured with a glass electrode pH meter. The viscosity of rumen fluid was measured with the Falling-Ball viscometer after filtration through one layer of gauze in a 39°C water bath¹⁴⁾.

Influences of kerosene addition on the appetite and on the number of rumen protozoa were investigated by injecting kerosene into the rumen via the rumen fistula at the level of 0.25% of the volume of rumen contents. Sheep were fed a diet (75% beef cattle ration and 25% hay) twice daily at the rate of 2.5% of body weight (air dry matter) per day. The volume of rumen contents was estimated by anatomy of a sheep weighing 72.5 kg. The residues of the diet were weighed at the next feeding. Rumen fluid was collected from four sheep just before kerosene injection and 2 hrs after the morning feeding on the 1st, 2nd, 3rd, 5th, 7th, 10th and 14th days after kerosene injection. The number of rumen protozoa was counted via the method of KURIHARA and TAKECHI¹⁵⁾.

Results and Discussion

Effects of kerosene on ruminal characteristics are shown in Fig. 1.

The IVI value for each kerosene treatment (5.70% ~ 9.70%) was significantly smaller than the control value (42.95%); the stable IVI value for each kerosene treatment (3.55% ~ 5.45%) was also significantly smaller than the control value (23.75%). The IVI values and the stable IVI values gradually decreased as kerosene administration increased. No significant difference was observed in gas production values between the 1.0% kerosene treatment (130.7 ml/100 ml rumen fluid) and the control (129.5 ml/100 ml rumen fluid). The pH value was 5.73 for pre-culture, 5.35 for the control which was measured after 2 hrs of fermentation, and the value for 1.0% kerosene treatment was slightly lower than the control (5.33 : $P < 0.05$).

It has been suggested by other researchers that bacterial capsular material increases the viscosity of rumen fluid^{16,17)}. Our previous studies indicated that the viscosity of cell-inclusive rumen fluid was closely related to the stable IVI value¹⁴⁾. The viscosity in this study was measured using cell-inclusive rumen fluid, the values being 14.68 cSt for pre-culture, 16.80 cSt for the control, 16.25 cSt for 0.1% treatment, 14.94 cSt for 0.25% treatment, 14.27 cSt for 0.5% treatment and 15.44 cSt for the 1.0% treatment. The viscosity values for kerosene treatments, except for 0.1% treatment, were significantly smaller than for the control.

REID¹⁸⁾ reported that odourless kerosene administration caused the depression of appetite in cows. However, in this study, the appetite in sheep was not influenced by kerosene injection judging from the fact that no residue of the diet was found at the next feeding. The number of rumen protozoa was $116.1 \times 10^4/\text{ml}$ just before kerosene injection, which tended to decrease on the 1st and 2nd days after kerosene injection ($75.8 \times 10^4/\text{ml}$ and $104.1 \times 10^4/\text{ml}$ respectively), recovered thereafter, and increased to

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Fig. 1. The ingesta volume increase (IVI) and the stable IVI of rumen fluid, and viscosity of gauze-filtrated rumen fluid in sheep. Vertical lines indicate S.E. (n = 10).

* (P < 0.05), ** (P < 0.01), *** (P < 0.001): Significantly different from control.

123.1 ~ 134.4 × 10⁴/ml exceeding the pre-injection value. Genus *Entodinium* constituted the largest part of rumen protozoa before kerosene injection, which was not changed after kerosene injection.

The *in vitro* data on ruminal characteristics indicated that kerosene has a clear anti-foaming effect. The data of the pH and of the gas production suggested that kerosene addition did not affect rumen fermentation. Besides, 0.25% of kerosene injection into the rumen caused no influence on appetite, and its influence on rumen protozoa was slight.

In a serious case of frothy bloat, excess ruminal gas cannot be removed even by trocar. In an acute case, administration of kerosene through a trocar ensuring exclusion of freed gas appears to be an effective remedy. However, further investigations are needed concerning quantitative limitation of kerosene administration, and the influence on both VFA fermentation and on meat and milk production.

References

- 1) CLARKE, R.T.J. and C.S.W. REID, *J. Dairy Sci.*, **57**: 753-785. 1974.
- 2) USUI, K. and S. MOTOYOSHI, *Rinsho-Juigaku* (BLOOD, D.C., J.A. HENDERSON and O.M. RADOSTITS, *Veterinary Medicine*), 199-209. Bun-eido. Tokyo. 1982.
- 3) HOSHINO, S., *Jpn. J. Zootech. Sci.*, **54**: 153-164. 1983.
- 4) REID, C.S.W. and A.T. JOHNS, *N.Z.J. Sci. Tech.*, **A 38**: 908-927. 1957.
- 5) BROWN, L.R., R.H. JOHNSON, N.L. JACOBSON and P.G. HOMEYER, *J. Anim. Sci.*, **17**: 374-385. 1958.
- 6) JOHNSON, R.H., L.R. BROWN, N.L. JACOBSON and P.G. HOMEYER, *J. Anim. Sci.*, **17**: 893-902. 1958.
- 7) ELAM, C.J. and R.E. DAVIS, *J. Anim. Sci.*, **21**: 568-574. 1962.
- 8) SHINOZAKI, K., I. CHIBA, T. KASHIWAZAKI, S. IWASAKI, K. SUHARA and T. SEMBA, *J. Jpn. Vet. Med. Assoc.*, **15**: 366-372. 1962.
- 9) VAN HORN, H.H. Jr., S.M. KASSIR, N.L. JACOBSON, P.R. SHELLENBERGER, D.K. HOTCHKISS and R.S. ALLEN, *J. Anim. Sci.*, **22**: 86-92. 1963.
- 10) USAGAWA, T. and R. KAWASHIMA, *Jpn. J. Zootech. Sci.*, **58**: 170-173. 1987.
- 11) LINDAHL, I.L., R.E. DAVIS, D.R. JACOBSON and J.C. SHAW, *J. Anim. Sci.*, **16**: 165-178. 1957.
- 12) JACOBSON, D.R., I.L. LINDAHL, J.J. MCNEILL, J.C. SHAW, R.N. DOETSCH and R.E. DAVIS, *J. Anim. Sci.*, **16**: 515-524. 1957.
- 13) USAGAWA, T. and T. NISHINO, *Jpn. J. Zootech. Sci.*, **53**: 535-540. 1982.
- 14) USAGAWA, T. and R. KAWASHIMA, *Jpn. J. Zootech. Sci.*, **55**: 389-393. 1984.
- 15) KURIHARA, Y. and T. TAKECHI, *Ushi no Rinsho Kensa Ho* ed. by R. NAKAMURA, T. YONEMURA and T. SUTO., chap. 6, 14-42. Nosan Gyoson Bunka Kyokai. Tokyo. 1973.
- 16) MEYER, R.M. and E.E. BARTLEY, *J. Anim. Sci.*, **33**: 1018-1021. 1971.
- 17) CHENG, K.-J., R. HIRONAKA G.A. JONES, T. NICAS and J.W. COSTERTON, *Can. J. Microbiol.*, **22**: 450-459. 1976.
- 18) REID, C.S.W., *N.Z.J. Sci. Tech.*, **A 38**: 825-838. 1957.