An Instrument for Collection and Transfer of Ruminal Fluid and for Administration of Water Soluble Drugs in Adult Cattle

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Collection of ruminal fluid serves both diagnostic and therapeutic purposes.[4,5,7] In Germany, collection of ruminal fluid is, however, rarely performed in veterinary practice. One of the reasons is that neither the naso-gastric tubes used in some practice areas nor specially designed equipment[1,3,7,13] fulfill the demands[9] made on such instruments. This is why we developed and tested a new device.*[8,9,10,11]

The Instrument

The device consists of an oro-ruminal probe (Table 1, Fig. 1), a suction pump (Fig. 2), and a funnel. The probe can be connected to the pump (collection of ruminal fluid) Fig. 3, to the funnel (administration of liquids or transfer of ruminal fluid) (Fig. 4) or to a water tap (cleaning) (Fig. 5) by means of a quick coupling connection. The pump consists of a pumping unit and a fluid container. Two fluid containers are available: one container with a capacity of 1l for collection of small samples, another with a capacity of 3l for therapeutic purposes.

A. Testing of the probe in cows with ruminal fistulas

Materials and methods

A precursor model of the actual probe was tested in 3 German Black Pied cows (Table 2) with ruminal fistulas.[8,10]

1. *The distance between the incisors and the ventral sac of the rumen* was measured to determine how far the probe must be introduced. The mean distance was calculated by using the distance from the incisivi to the caudodistal end of the ventral sac of the rumen and the distance between the incisors and the most caudal point of the left 9th rib (cranial part of the ventral sac of the rumen).

2. *For testing of the probe* (30 applications prior to morning feeding) the following criteria were used: time necessary for introduction of the probe, volume of "spontaneous efflux" within 2 minutes, number of obstructions of the suction tube and number of obstructed holes

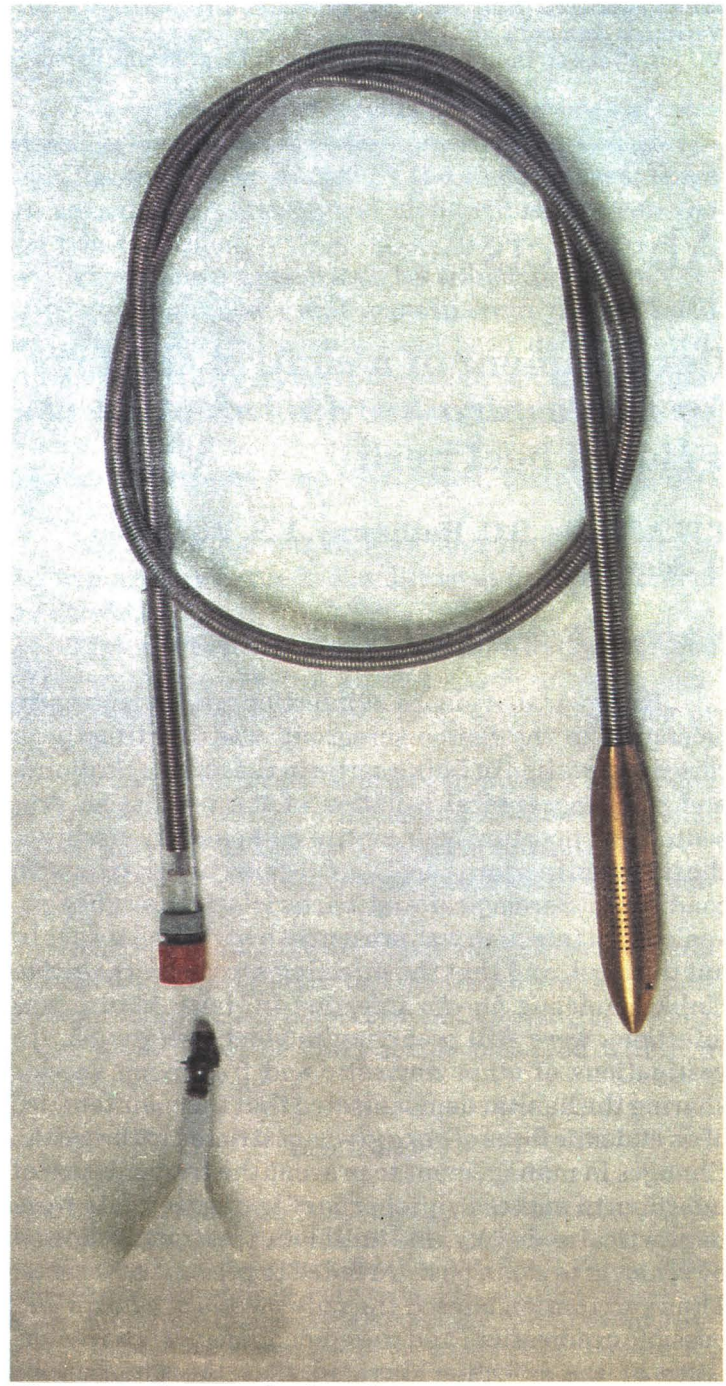

Figure 1. *Oro-ruminal probe*

**obtainable from:*
HEILAND, Albert-Schweitzer-Ring 5, 2 Hamburg 70, Germany
KRUUSE, 5290 Marslev, Denmark

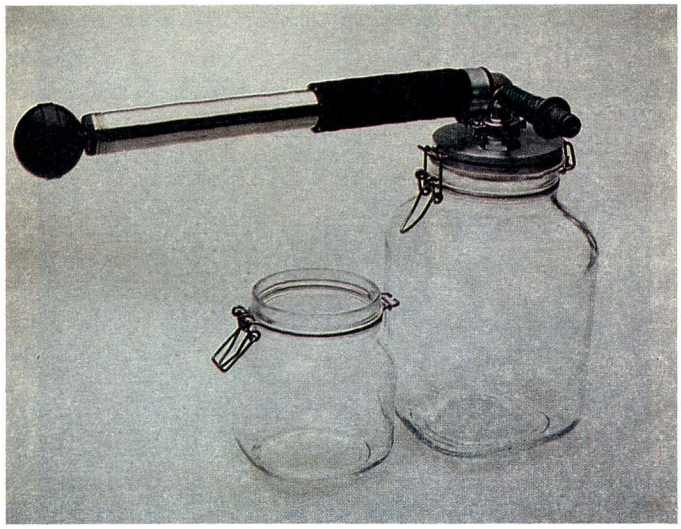

Figure 2. *Suction pump with the 3l fluid container connected. 1l container*

Figure 3. *Collection of ruminal fluid using the oro-ruminal probe and the suction pump*

in the probe's head during collection of 2l ruminal contents. The time required to administer 2l of ruminal fluid that had been collected by this probe, and for administration of 2l water via funnel and probe (15 administrations each) were also recorded.

3. Determination of the *position of the probe's head in the reticulorumen* by palpation via the fistula. This was performed prior to morning feeding and 3 to 4 hours after morning feeding (30 applications each).

4. Determination of the *saliva contamination in the sample*: Saliva contamination alters the pH- values and the sodium and potassium contents of ruminal fluid (increase of pH and sodium concentration, decrease of potassium concentration). Saliva contamination in a sample of ruminal fluid taken by an oro-ruminal probe may be detected by comparison of fluid collected by the probe and that collected via ruminal fistula by a rigid probe from the same location.[14] Collection by the oro-ruminal probe was performed after collection via the fistula in 15 cases, whereas in other 15 cases collection via the fistula was performed first.

Results

1. In adult German Black Pied cows, the probe had to be introduced at a length of 1.8 to 2.25m before its head reached the ventral sac of the rumen (Table 2). For further investigations, the probe was introduced at a length of 2.0m.

2. The introduction of the probe took an average time of 40 seconds. Within 2 minutes an average amount of 1.2l ruminal fluid was siphoned off ("spontaneous efflux"). In every case 2l of ruminal fluid were obtainable using the suction pump. The suction tube never got plugged. Few holes of the suction head obstructed (average number: 7) but this did not hamper the collection. The administration of 2l of ruminal fluid or water was performed in an average time of 50 or 52 sec. (Table 3).

3. Prior to morning feeding, the probe's head was found in the antrum in 2 cows (7%), in 29 cases it was found in the ventral sac of the rumen (93%). Three to 4 hours after morning feeding, the probe's head was detected in the antrum in 3 cows (10%), in the middle of the rumen in 2 cases (7%), and in the ventral sac of the rumen in 25 animals (83%).

4. No significant differences in pH-values and concentrations of sodium and potassium were detected between samples collected by the oro-ruminal probe and samples collected by a rigid probe via the ruminal fistula from the same location within the rumen. The sequence of sample collection (oro-ruminal probe - ruminal fistula, and vice versa) had no significant effect on the differences (t-test) (Table 4).

B. Testing of the instrument in healthy cows

Material and methods

The instrument used for trial A was slightly modified and tested in 106 healthy German Flecked cows.[11] Special emphasis was put on the question whether *collection of 2l of ruminal fluid* is possible and *which time is the ideal for collection.* The probe was introduced at a length of 2.0m either before morning feeding or 1 to 7 hours after morning feeding, respectively, and ruminal fluid was collected by using the pump. The time that was necessary to collect a volume of 2l of ruminal fluid was recorded and also the changes of the position of the probe necessary during collection. Time was taken from starting of the pump. The position of the probe was changed when no more ruminal fluid entered the fluid container. The probe was withdrawn at a length of 30cm to 1m and reintroduced to its original depth.

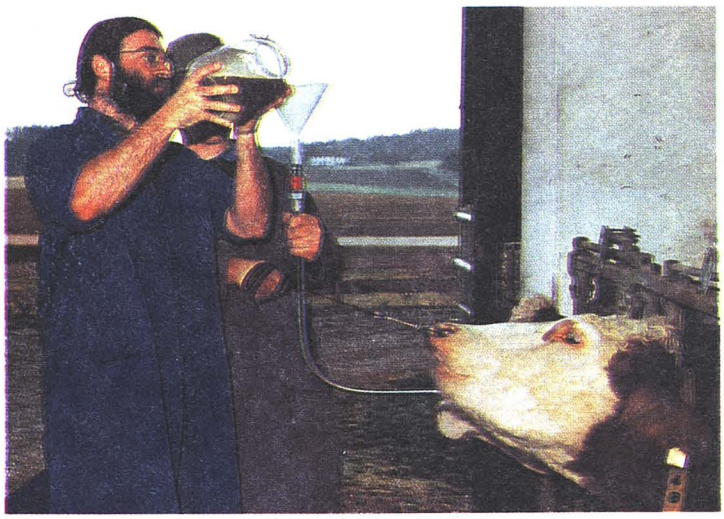

Figure 4. *Transfer of ruminal fluid using the oro-ruminal probe and the funnel*

Results

In every case 2l of ruminal fluid were collected. An average time of 2¼ min. and an average number of 1.8 changes were necessary. The values for both parameters decreased up to 3 hours after morning feeding and increased thereafter. The best time for collection of ruminal fluid was observed prior to morning feeding (Table 5 and Fig. 6).

Discussion

In order to avoid saliva contamination, forestomach fluid used for diagnostic purposes should be collected from the ventral sac of the rumen.[7] Nasogastric tubes do not enter the ventral sac of the rumen.[2] If the presented probe is introduced as described herein to a length of 2.0m, head reaches the ventral sac of the rumen in most cases. Thus the probe is also suitable for siphoning off ruminal fluid. Rumen contractions probably induce "spontaneous efflux".[12]

The instruments available in Germany up to now for rumen sampling often failed in the acquisition of ruminal content. The greatest problems were obstruction of the holes in the probe's head or the suction tube. This problem was resolved with our presented probe by drilling smaller holes in the probe's head and using a 1 to 4 ratio of the diameter of these holes to the diameter of the suction tube. Other problems in conventional rumen sampling devices arose from the aspiration apparatus. (The author started looking for an appropriate solution of this problem after sucking odiferous rumen content by mouth). Our suction pump produced sufficient vacuum to deliver rumen fluid in every case. A small amount of rumen fluid (500 ml) for diagnostic purposes is quickly obtainable (<0,5 min).

Saliva contamination due to introduction of the probe was not detected in the samples since no differences (pH, Na, K) were found between samples collected by the probe and samples collected via ruminal fistula from the same location within the reticulorumen. Samples taken with other rumen sampling devices offer a saliva contamination between 8,9 and 19,6%.[7,14]

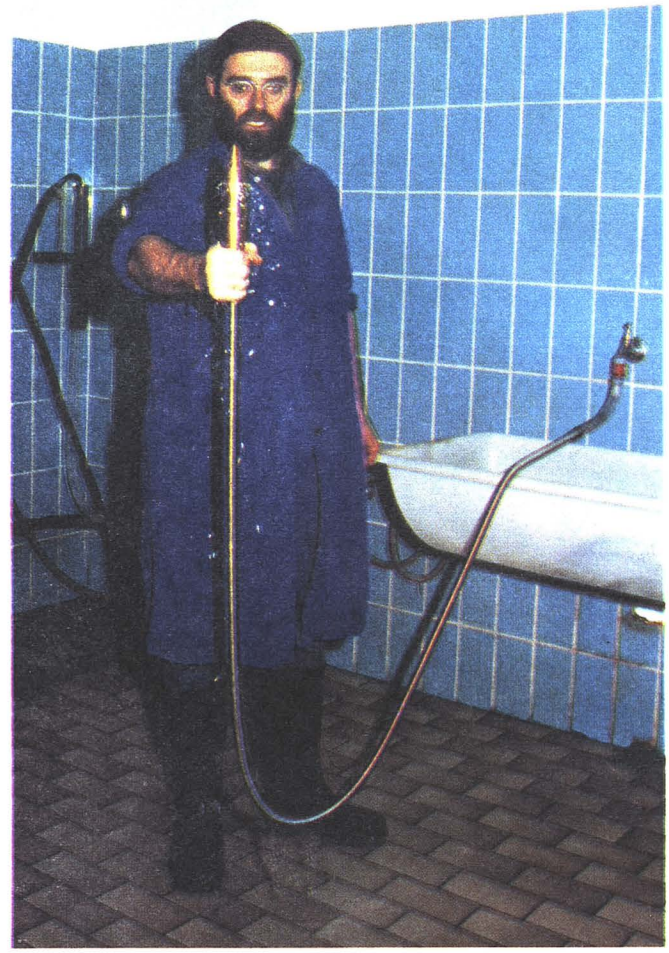

Figure 5. *Cleaning of the probe by connecting it to a water tap*

The volume of the sample is determined by the amount of filterable fluid around the probe's head. The proportion of fluid in the rumen contents is lowest immediately after feed consumption and increases after bacterial fermentation of the ingested foodstuffs. It is greatest in the morning before the first feeding of the day.[5,6,7] Early morning and 3-4 hours after food intake were the best times for obtaining 2l of ruminal fluid for therapeutic purposes.

Our device is also suitable for the transfer of rumen fluid and for administration of water soluble drugs, for example, following collection and evaluation of ruminal fluid.[5,6,7] After application the probe may easily be cleaned by connecting it to a water tap (Fig. 4).

Summary

An instrument for collection and transfer of rumi-

nal fluid that is also suitable for administration of water soluble drugs for use in adult bovines is described. The device consists of an oro-ruminal probe, a suction pump, and a funnel. According to the results obtained by testing the device in a group of cows with rumen fistulas and a group of healthy cows, the instrument is suitable for collection of representative samples of ruminal fluid for diagnostic purposes and also for collection of larger volumes of ruminal fluid for transfer. Before morning feeding and 3-4 hours after food intake are the best times for obtaining larger volumes of ruminal fluid.

Acknowledgement

I would like to thank Dr. Jon Naylor, Department of Veterinary Medicine, University of Saskatchewan, Canada for reviewing this article.

Table 1. Technical data of the probe

Length	2,85m
Distance between mark and top of the probe	2,0m
SPIRAL SPRING	
Material	V2A
Diameter	18mm
Wire guage	3mm
PROBE HEAD	
Material	Brass
Mass	1,1kg
Length	20cm
Diameter	4cm
Number of holes in the probe's head	312
Diameter of the holes	2mm
SUCTION TUBE	
Material	PVC
Inner diameter	8mm
QUICK COUPLING CONNECTION	Gardena, Ulm, Germany

Table 2. Age (years), body weight (kg), height (cm), distance from the incisors to the most caudo-distal point of the ventral sac of the rumen (a), distance from the incisors to the most distal point of the left 9th rib (b), mean values (x) of a and b in the animals M,K,F.

animal	age	wt.	ht.	a	b	x
M	6	630	135	227	182	204
K	4½	610	134	224	182	203
F	5	567	133	226	180	203

Table 3. Mean value, maximum value, and minimum value for time (tI, sec) necessary for introduction of the tube, of the volume (v,l) of "spontaneous efflux" of ruminal fluid within the first 2 minutes, of the number of obstructions of the suction tube (nT), and the number of obstructed holes in the probe's head (nH) during collection of 2l of ruminal fluid, and also of the time (tR, sec) necessary for administration of 2l of ruminal fluid, and of time (tW), sec) necessary for administration of 2l of water via funnel and probe.

	tI	v	nT	nH	tR	tW
Mean	41	1,2	0	7	50	52
Max	75	2,4	0	60	60	72
Min	25	0,4	0	0	45	40

Table 4. Mean and standard error for the differences in ruminal fluid in pH, sodium and Potassium concentration (mmol/l) collected either by oro-ruminal probe or by a rigid probe via the ruminal fistula fromthe same location within the rumen. The data are subdivided into groups according to sequence of sample collection: P1 (collection by oro-ruminal tube first), P2 (collection by rigid tube via the fistula first).

	Mean		Standard error	
Group	P1	P2	P1	P2
Parameter				
pH	0,03	-0,01	0,07	0,17
Na	1,97	-1,84	9,46	13,31
K	-0,69	-1,18	11,12	5,61

Table 5. Time necessary for collection of 2l of ruminal fluid (mean value t, maximum value tmax, minimum value tmin [sec]) and number of corrections of the position of the probe (mean value k, maximum value kmax, minimum value kmin) during n collections in relation to feeding (h: hours after morning feeding; h=0: prior to morning feeding).

h	*0*	*1*	*2*	*3*	*4*	*5*	*6*	*7*
n	5	15	15	14	14	15	15	13
t	69	144	111	97	101	129	136	158
tMax	105	210	165	165	180	180	210	255
tMin	30	90	60	60	60	90	60	90
k	0,8	2,6	1,6	1,2	1,2	1,7	2,0	3,0
kMax	1	4	4	3	2	4	4	5
kMin	0	0	0	0	0	0	0	1

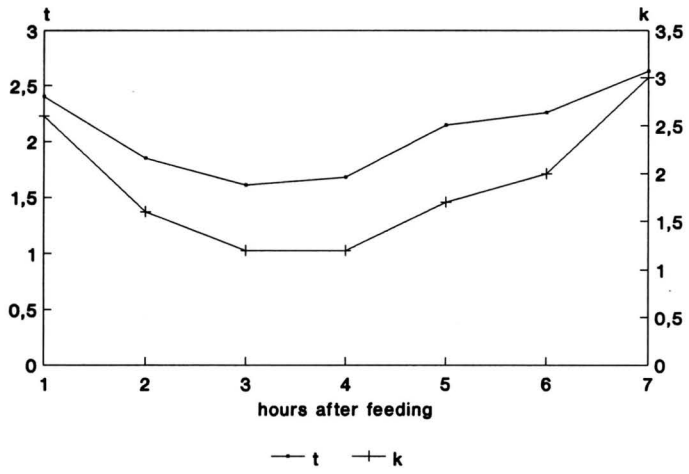

Figure 6. *Time t (min) necessary for the collection of 2l of ruminal fluid and number of changes of the probe position k in relation to feeding*

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Abstracts:

A subclinical infection of bulls with bovine herpesvirus type 1 at an artificial insemination center

J.T. van Oirschot, P.J. Straver, J.A.H. van Lieshout, J. Quak, F. Westenbrink, A.C.A. van Exsel

Veterinary Record (1993) **132,** 32-35

A subclinical bovine herpesvirus type 1 (BHV1) infection affected bulls at an artificial insemination center for at least six months. The virus was detected in semen samples from 43 out of 116 bulls examined; 27 of them shed virus during one consecutive period of up to 10 days and 16 shed the virus intermittently. The virus titres ranged between 10 and 100,000 TCID50/ml. Vaccinated bulls tended to excrete the virus less frequently than unvaccinated bulls. Approximately 50 per cent of the bulls that had an increase in neutralizing antibody titre to BHV1 shed the virus in their semen.

BSE fibrils in autolysed central nervous system

A.C. Scott, G.A.H. Wells, M.J. Chaplin and M. Dawson

Research in Veterinary Science (1992) **52,** 332

The characteristic abnormal fibrils, originally called 'scrapie-associated fibrils', were found in four different areas of the central nervous system of nine cattle with bovine spongiform encephalopathy (BSE) even after the tissues had been subjected to controlled incubations for up to seven days at 37°C, to simulate autolysis. No fibrils were found in one suspect case which was proved histopathologically not to have BSE. The detection of fibrils is therefore of diagnostic value in cases of BSE when post mortem changes render the tissues from the central nervous system unsatisfactory for a histopathological examination.