Flehmen Induction with Goats by the Urine of Twenty Animal Species*

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Summary

Flehmen is well-known response which often occurs during the process of courtship in most mammals. Recent studies with domestic ruminants suggest that the flehmen may be involved in the mechanism of transferring some pheromonal substances to vomeronasal organ. Thus, variety of its significance has been supposed, besides that male animals may use it for estrus detection.

In this experiment, 8 male, 3 female and 3 castrated goats of Saanen and its hybrid were used to ascertain whether urine from alien species can induce flehmen as that from same species. Urine was collected from twenty species consisting of 15 mammals, 3 birds and 2 reptiles and frozen until use. Mostly urine was sprayed to the nose of goats, but some coagulated ones were sniffed. Duration of flehmen was scored to four ranks as 0, 1-19, 20-39 and > 40 sec.

Each urine sample induced the response in any goats. However, much difference in the intensity was found between the samples and according to the reproductive state of the receptor goats. Although individual difference was manifest, male goats generally showed more intense response than did female. Castrated goats showed the intermediate pattern. Administration of antiandrogen to the male goat tended to reduce the response.

The results indicate that flehmen in the goat could occur for the urine of alien species as that of same species and the androgen may be one of the factors regulating the response.

Introduction

Odors are used as one of the communication stumuli in animals (1). Most of them are passed through the nasal cavity, bound with olfactory neurons and transporting signals into the main olfactory bulb. In addition, roles of vomeronasal organ (VNO) have been discussed in the recent years (2); e.g. in the laboratory animals such as hamster the male detects the estrous female with the help of this organ (3). In the ungulates (4), occurrence of flehmen response during the process of courtship has been noted in association with VNO. According to data newly presented (5,6,7), it is highly probable that animals including goat and cattle transfer some pheromonal substances to VNO through the flehmen. Neverthless, information so far obtained is still controversial and the inducing factors as well as biological significance of flehmen are not fully understood.

The aim of this study was to examine whether urine of alien species can induce the flehmen in goat and whether this response varies between sexes of goats and between urine samples from different species.

Materials and Methods

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A total of 14 goats of Saanen and its hybrid were used as test animal for 7 trials. The test group consisted of 8 bucks (1 to 5 years), 3 does (2 to 5 years) and 3 castrated goats (2 to 3 years). During a period of this experiment 4 bucks were administered an antiandrogen drug (Oxendolone, Takeda) subcutaneously at a dose of 125 mg/kg body weight/week × 2. Urine was collected from 20 animal species (15 mammals, 2 reptiles and 3 birds) in a zoo and a farm at natural urination, and stored at −20°C until use. For induction of flehmen, goats were sprayed with the frozen-thawed urine samples to their nose directly or sniffed if coagulated. Distilled water was used as control sample. The intensity of the response was scored to four ranks according to the duration: − for 0 sec., + for 1-19 sec., ++ for 20-39 sec., and +++ for ≥ 40 sec.

Results and Discussion

Immediately after spraying, flehmen occurred in some goats by any urine samples, although there was a difference in the intensity among goats or urine samples tested (Table 1). In general, bucks responded more intensely than did does, regardless of samples from native and alien species. Castrated goats showed the intermeiate pattern. Flehmen-inducing activity was not apparently affected by the frozen-thawed treatment of urine. Sex and age of urine-donated animals did not apparently relate to the induction. However, urine from farm animals tended to induce more intense response than that of zoo animals. No response occurred by the control water. Antiandrogen-treated bucks reduced the response as well as sexual activity. By repeated spraying, the flehmen was able to be induced continuously for several minutes. When the animals ceased to respond, urine from another species was effective to induce it again.

Table 1. Summary of four trials for flehmen induction with goats by the urine of 4 farm and 6 zoo animals

Urine tested	Goats																	
	♂1		♂2		♂3		♀1		♀2		♀3		♀4		♀5		♂4	
	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B	A	B
Buck	−	++		−		−	−	+			+	−						
Doe	−−−	+++	+	−−	+	−	−−	+	−									
Ram		−−		+				−				+		−		−		
Cow		−−−		+		−		−−								−		
Sow		−		−		+		+				−		−		−		−
Japanese serow(♀)	++	+++	−	+		−	+	+	−		−	−	+	−	−	−		−
Cape buffalo(♂)		+++		+		+++		+				−		−		−		−
Tiger(♀)		−		−		−		+						−		+		−
Orang-utan(♀)		++		−		++		+				+		+		−		−
Indian elephant(♂)		++		++		++		+				+++		−		−		−
African elephant(♂)		+++		+++	−	+++		++				−		−		−		−
Distilled water	−	−	−	−	−	−	−	−	−		−	−	−	−	−	−	−	−

*The intensity of the response was scored to four ranks according to the duration; − for 0 sec., + for 1-19 sec., ++ for 20-39 sec. and +++ for ≥40 sec.

**The trials were done in the following months of year; A: August, B: September, October and November in 1986.

Although the mechanism and inducing factors of flehmen are not yet fully understood, the results showed that this response could be induced widely by the urine from alien species as well as natives. This suggests that irrespective of species origin the urine samples contain some common substance(s) stimulating flehmen in goats. The data also suggest that the flehmen may not occur for any particular object such as estrus detection, even if the response acts for searching reproductive state of other individuals. It appears that androgen in the testing animal is a factor associating with this response, since there was a definite difference in the intensity between buck and doe, and between antiandrogen-treated and non-treated goats.

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