CHEMICAL CONSTITUENTS OF CAMEL'S URINE.

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In experiments upon water hunger of the camel, *Camelus bactrianus*, undertaken in these laboratories[1] numerous observations extending over a period of several months were made upon the urine of this animal. These findings appear to be of general interest as an example of the peculiarities of the excretion of herbivorous animals.

A full grown animal was placed upon a standard diet consisting of sorghum leaves, sweet potato vines, and salt. 130 pounds of this dry fodder given daily were found adequate both from a nutritional and reproductive standpoint. The urine collected daily was carefully measured and estimations were made upon it for the following constituents: total nitrogen, ammonia, urea, creatinine, creatine, hippuric acid, chlorides, and the purine bases, as shown in Table I.

The urine had a dark, smoky, yellow color and smelt like sweet hay. It had a specific gravity from 1.045 to 1.056. The volume varied according to the time of observation. During the month of November an average of about 4,000 cc. *per diem* were obtained. During the colder weather this volume increased to more than 6 liters. As already reported when the animal was deprived of water for 10 days the volume of urine secreted fell to 1,800 cc.

The nitrogenous constituents of the urine are of interest. The camel excretes no ammonia and only the very slightest trace of urea was found present in the urine. The large amount of hippuric acid is similar, relative to the weight of the animal, to that found in the urine of cows and horses. (In three deter-

[1] Hawk, P. B., Practical physiological chemistry, Philadelphia, 8th edition, 1923.

minations of the hippuric acid content of mules urine, an average of 1.08 per cent was obtained.)

A separate experiment was undertaken to identify the character of the organic acid considered to be hippuric acid. A specimen was prepared by Roaf's method which when decolorized and recrystallized five times from water, yielded a product giving the characteristic melting point, nitrogen content, and other properties of hippuric acid.

TABLE I.

Analysis of 24 Hour Camel's Urine.

Female, weight 1,129 lbs.

	gm.	*gm. N*	*per cent of total N*
Total N*	8.70		
Ammonia*	0	0.0	0
Urea*	Very slight trace.		0
Total creatinine*	9.24	3.43	39.4
Creatine†	3.97	1.27	
Hippuric acid‡	39.00	3.05	35.1
Purine bases§	4.70	1.73	19.9
Chlorides¶	7.99		
Total			94.4

Averages of 1 month's estimations conducted under standard dietary conditions, by standard methods (Read, B. E., *China Med. J.*, 1920, Anat. Suppl., xxxiv, 18).

* Folin.

† Folin-Benedict-Myers.

‡ Folin-Flanders.

§ Walker.

¶ Volhard-Harvey.

While hippuric acid is not considered a direct measure of protein metabolism it is readily seen that on such a limited diet, this acid is a fair measure of exogenous metabolism. On the other hand, the high values obtained for creatinine and creatine show an endogenous metabolism comparable to that of man. The total purine bases, while not examined in detail for their content of allantoin, uric acid, etc., are similar in relative amounts to those obtained from other animals. The same is true for chlorides and sulfates.

The animal was pregnant at the time of the above determinations. One month after parturition, during the lactation period, estimations were again made of the total nitrogen and hippuric acid in the urine. An average of 118.2 gm. of hippuric acid and 22.68 gm. of total nitrogen was found on 3 consecutive days.

Throughout North China on the many narrow roads which lead the traveller for hundreds of miles, there are to be found, about every quarter of a mile, straw beds for the collection of animals' urine. The camels, donkeys, and other beasts of burden, which pass along the highways, are induced by the odor to urinate at these places. Seeing that the urine when fresh contains no ammonia, it would be of particular interest to investigate the nature of the enzyme which sets up ammoniacal fermentation of the hippuric acid present. These straw beds, when considered sufficiently mature, are dug up and greatly prized as fertilizer. This procedure suggests other investigations associated with the oxidative processes involved.