MACRONUTRIENT COMPOSITION OF MILK FROM AN ASIAN RHINOCEROS (*RHINOCEROS UNICORNIS*) ACROSS LACTATION

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INTRODUCTION

The ability to produce milk is a trait unique to mammalian mothers. Milk is the first and often sole food over an extended time period. The macronutrient composition of milks from different species can vary widely. An understanding of this diversity is important for developing species-appropriate formulas for hand-rearing.

Here we present data on the macronutrient composition of milk from an Asian rhinoceros cow (*Rhinoceros unicornis*) collected between calf ages 4 and 21 months and compare our results to the composition of milks of other large terrestrial herbivores: 1) White rhinoceros (*Ceratotherium simum*); 2) Black rhinoceros (*Diceros bicornis*); and 3) Asian elephant (*Elephas maximus*).

METHODS

Milk samples were collected by manual expression from a single Asian rhino cow at the Fort Worth Zoo from day 123 through day 642 postpartum (N=26). Samples were assayed for dry matter (DM), fat, sugar, crude protein (CP), and ash (including calcium [Ca] and phosphorus [P] content) using methods validated at the Nutrition Laboratory of the Smithsonian National Zoological Park.

Gross energy content of the milk was calculated as: 9.11*fat+3.95*sugar+5.86*CP. Values are expressed on a wet weight basis, both as g/g (%) and on a per energy basis (mg/kcal). The mg of nutrient per kcal of milk was calculated by: 1000*(nutrient expressed in g/g)/GE.

RESULTS & DISCUSSION

Mean nutrient values for the Asian rhino across the sampled lactation period are given in Figure 1. Results indicate a milk high in water content (90.87 ± 0.2%) with correspondingly high sugar (6.74 ± 0.1%) and low fat content (0.38 ± 0.03%). Asian rhino milk has on average 0.25 ± 0.01% total ash, 0.06 ± 0.003% Ca, 0.04 ± 0.002% P, and a Ca:P ratio of 0.7 ± 0.02. There were no significant associations between any of the milk constituents calculated on an as-fed basis and calf age (Fig. 2); milk composition did not vary over the sampling period. Asian rhino milk is similar to the milks of both white and black rhinos (Table 1; Fig. 3); however, is higher in protein - on an absolute basis and on an energy basis - than the white rhino. Compared against all rhinos, Asian elephant milk for a calf at the same age is greater in protein; yet, milk protein on an energy basis is higher in the Asian rhinoceros (Table 1; Fig. 3).

The values for Asian rhino milk must be interpreted with caution; data represent the results from a single cow over a single lactation only. The value for milk protein on an energy basis has been suggested to be associated with relative growth rate. If this hypothesis is true for the rhino, then we predict that Asian rhino calves grow faster than white rhino calves, and even relatively faster than Asian elephant calves.

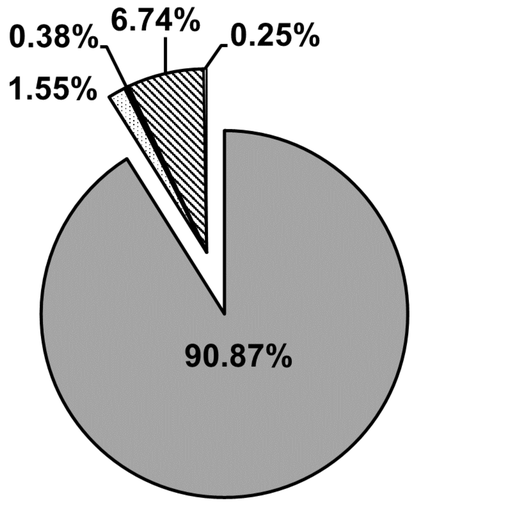

Figure 1. As-fed proportions of the water, crude protein (CP), fat, sugar, and ash contents of Asian rhino milk.

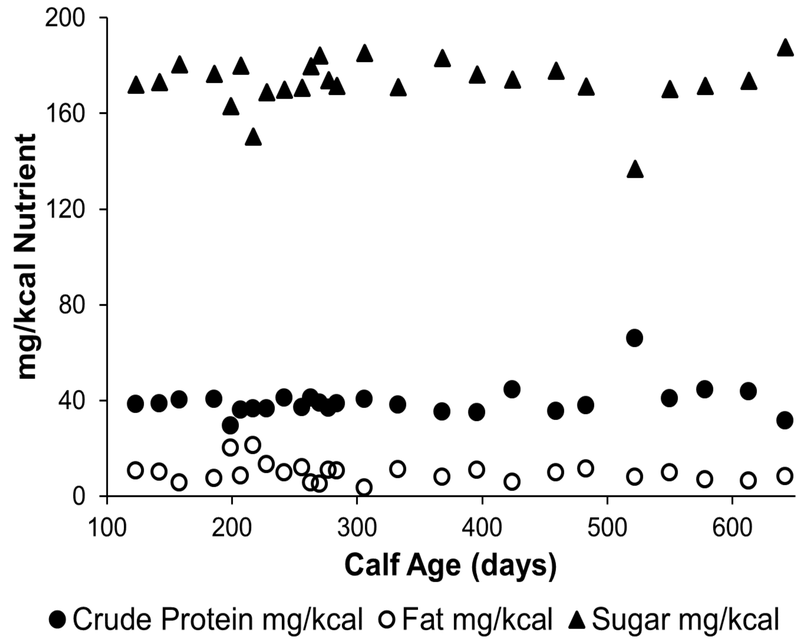

Figure 2. Changes in crude protein, fat, and sugar on a gross energy basis (g nutrient/ kcal) over days 123 through 642 of lactation in the Asian rhino.

Table 1. As-fed basis comparison between the maternal milk compositions of the Asian rhino (*Rhinoceros unicornis*), white rhino (*Ceratotherium simum*), black rhino (*Diceros bicornis*), and Asian elephant (*Elephas maximus*).

Nutrient	Asian Rhino	White Rhino[1]	Black Rhino[1]	Asian Elephant[2]
GE (kcal/g)	0.39	0.37	0.42	1.44
DM (%)	9.13	8.52	9.81	22.6
CP (%)	1.55	0.98	1.59	4.1
Fat (%)	0.38	0.42	0.55	11.1
Sugar (%)	6.74	6.86	7.05	5.0
Ash (%)	0.25	0.24	0.20	0.69[3]
Protein (mg/kcal)	39.26	26.7	37.96	30.0

[1]Data from Petzinger et al., 2012 for milk samples from 3 months to 1 year of calf age (white rhino) and 3 months to 4 months of calf age (black rhino).
[2]Data from Abbondanza et al., 2013 for milk samples from 6 months to 1 year of calf age.
[3]The sum of Ca, P, Mg, K, and Na.

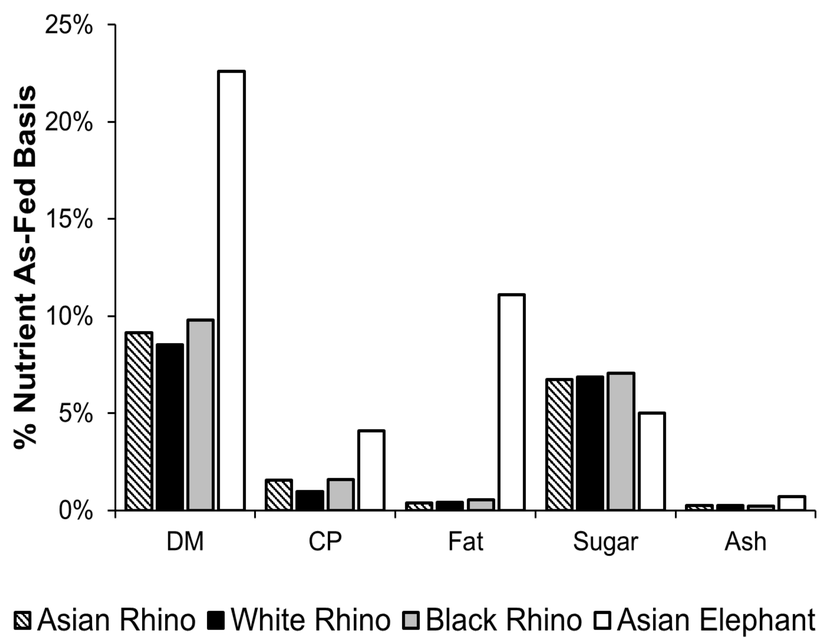

Figure 3. As-fed comparison of the dry matter (DM), crude protein (CP), fat, sugar, and ash contents of Asian rhino and other large terrestrial herbivores.