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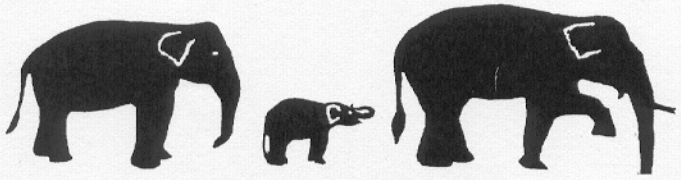
SALVANA Milk für Baby Elephants



COMPOSITION

Coco-fat
Lactose
Isolated soyprotein
Palm-oil
Casein
Rapeseed oil
Dicalcium-phosphate
Lecithin
Disodium phosphate
Magneseium-sulphate
Calciumformiate
Vitamins
Trace-elements

CONTENTS (d.m.):

Dry substance :	20,00		
Protein	18,00 %	Vitamin A	50.000 IU/kg
Fat	50,00 %		
Ash	5,00 %	Vitamin D	4.000 IU/kg
Lactose:	20,00 %	Vitamin E	100 mg/kg
Lysine	1,20 %		
Methionine	0,70 %	Vitamin B-complex	
Calcium	0,80 %		
Phosphorus	0,60 %	Trace-elements	
Sodium	0,15 %		

Gesunde Nahrung für alle Tiere

SALVANA TIERNAHRUNG GmbH

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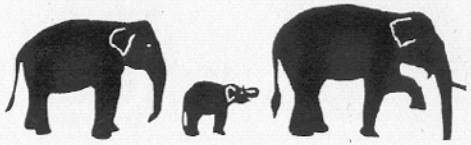
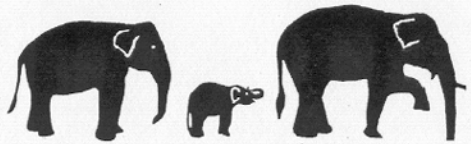


SALVANA Elefantenmineral ES

vitaminiertes Mineralfutter für Elefanten



entw. in Zusammenarbeit mit der TA Gemeinsch.Praxis Hinke + Wipplinger, Erfurt

Inhaltsstoffe:

4,5 % Calcium	
1,1 % Phosphor	
3,4 % Natrium	

Zusatzstoffe je kg:

571.420	I.E.	Vitamin A	2.171	mg	Cholinchlorid
57.142	I.E.	Vitamin D_3	114.280	mg	Vitamin C
28.571	mg	Vitamin E	8.000	mcg	Biotin
85,7	mg	Vitamin K_3	11.428	mg	Eisen
68,5	mg	Vitamin B_1	4.285	mg	Zink
114,3	mg	Vitamin B_2	2.285	mg	Mangan
360	mg	Nicotinsäure	857	mg	Kupfer
142,8	mg	Calciumpantothenat	8,5	mg	Jod
51,4	mg	Vitamin B_6	7,4	mg	Kobalt
57,1	mg	Folsäure	28,5	mg	Selen
360	mcg	Vitamin B_{12}			

Verhältnis Ca : P = 4 : 1

Art.-Nr.: 52099

Mit jedem Biskuit SALVANA ES erhält ein Elefant:

8,0 g	Calcium	100.000	I.E. Vitamin A
2,0 g	Phosphor	10.000	I.E. Vitamin D_3
6,0 g	Natrium	5.000	mg Vitamin E
2.000 mg	Eisen	15	mg Vitamin K_3
750 mg	Zink	12	mg Vitamin B_1
400 mg	Mangan	20	mg Vitamin B_2
150 mg	Kupfer	63	mg Nicotinsäure
1,5 mg	Jod	25	mg Ca-Pantothenat
1,3 mg	Kobalt	9	mg Vitamin B_6
5,0 mg	Selen	10	mg Folsäure
		63	mcg Vitamin B_{12}
		380	mg Cholinchlorid
		20.000	mg Vitamin C
		1.400	mcg Biotin

Verhältnis Ca : P = 4 : 1

Fütterungshinweis:

Dieses Ergänzungsfuttermittel darf wegen der gegenüber Alleinfuttermitteln höheren Gehalte an Vitamin D3 und Spurenelementen nur an Elefanten bis 1 v. H. der Tagesration (= max. 2 Biskuits) verfüttert werden.

Einschließlich Zusatzstoffe mindestens

haltbar bis: (Monat/Jahr Partie-Nr.)

Zusammensetzung:

Zitrustrester, Zusatzstoffvormischung, Weizenkleie, Calciumcarbonat, Zuckerrübenmelasse, Natriumchlorid, Monocalciumphosphat, Weizennachmehl, Palmfett, Lecithin.

Nettomasse: 25 kg

SALVANA

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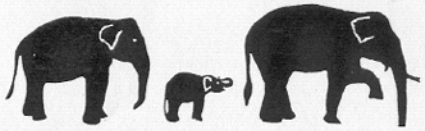
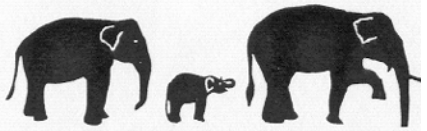


SALVANA Elefantenmineral *Pulver*

vitaminiertes Mineralfutter für Elefanten

entw. in Zusammenarbeit mit der TA Gemeinsch.Praxis Hinke + Wipplinger, Erfurt



Inhaltsstoffe:	Zusatzstoffe je kg:				Art.-Nr.: 52070
4,0 % Calcium	500.000 I.E.	Vitamin A	1.900 mg	Cholinchlorid	
1,0 % Phosphor	50.000 I.E.	Vitamin D_3	100.000 mg	Vitamin C	
3,0 % Natrium	25.000 mg	Vitamin E	7.000 mcg	Biotin	
	75 mg	Vitamin K_3	10.000 mg	Eisen	
	60 mg	Vitamin B_1	3.750 mg	Zink	
	100 mg	Vitamin B_2	2.000 mg	Mangan	
	315 mg	Nicotinsäure	750 mg	Kupfer	
	125 mg	Calciumpantothenat	7,5 mg	Jod	
	45 mg	Vitamin B_6	6,5 mg	Kobalt	
	50 mg	Folsäure	25 mg	Selen	
	315 mcg	Vitamin B_{12}			

Verhältnis Ca : P = 4 : 1

Mit dem Verfüttern von 200 g SALVANA ES *Pulver* erhält ein Elefant:

8,0 g Calcium	100.000 I.E. Vitamin A
2,0 g Phosphor	10.000 I.E. Vitamin D_3
6,0 g Natrium	5.000 mg Vitamin E
2.000 mg Eisen	15 mg Vitamin K_3
750 mg Zink	12 mg Vitamin B_1
400 mg Mangan	20 mg Vitamin B_2
150 mg Kupfer	63 mg Nicotinsäure
1,5 mg Jod	25 mg Ca-Pantothenat
1,3 mg Kobalt	9 mg Vitamin B_6
5,0 mg Selen	10 mg Folsäure
	63 mcg Vitamin B_{12}
	380 mg Cholinchlorid
	20.000 mg Vitamin C
	1.400 mcg Biotin

Verhältnis Ca : P = 4 : 1

Fütterungshinweis:

Dieses Ergänzungsfuttermittel darf wegen der gegenüber Alleinfuttermitteln höheren Gehalte an Vitamin D3 und Spurenelementen nur an Elefanten bis 1 v. H. der Tagesration (= max. 300 g) verfüttert werden.

Einschließlich Zusatzstoffe mindestens

haltbar bis: (Monat/Jahr Partie-Nr.)

Zusammensetzung:

Glucose, Zusatzstoffvormischung, Calciumcarbonat, Natriumchlorid, Monocalciumphosphat.

Nettomasse: 25 kg

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kartonaufk es-pulver/kn

Analysis of major components in Asian Elephant (*Elephas maximus*) milk during different stages of lactation

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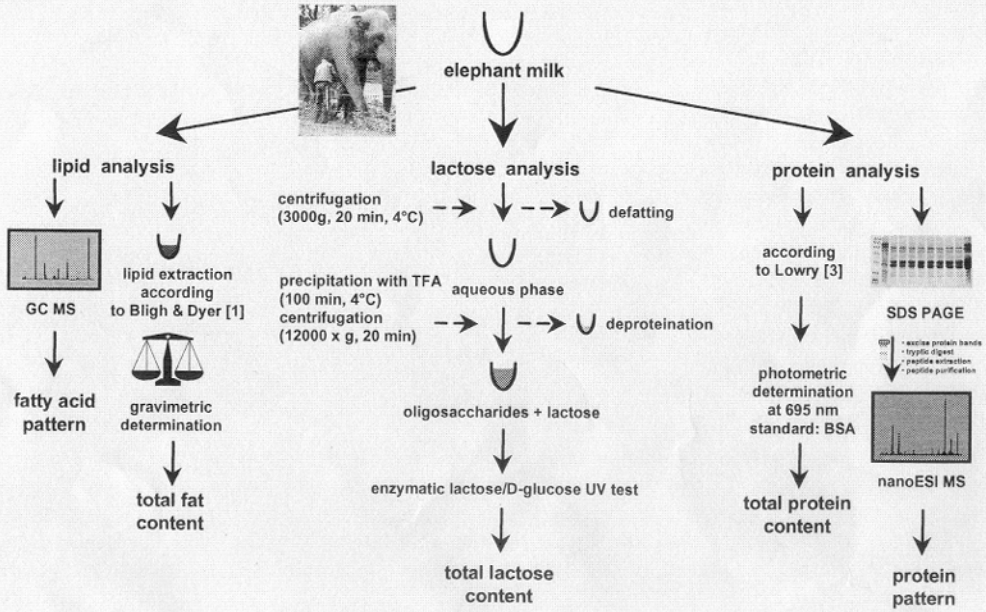
Introduction

Experiences made in different zoos showed considerable difficulties with respect to artificial rearing of elephant calves born in captivity. Besides loose stools or diarrhea also skin dryness and umbilical infection seem to be more likely in hand-raised calves [2,5,7]. Therefore - and to prevent other nutrition-dependent stressors – it is necessary to provide a milk substitute which closely resembles the nutrient makeup of the dam's natural breast milk.

Milk is the sole food for infants during the first six month [8]. It is well known that calves are milk-dependent for the first two years and will often suckle to the age of four or five. At the age of two the volume of the consumed milk begins to decrease gradually [2,8,9].

The makeup of natural milk is extremely complex and in most species, the milk composition changes during lactation. In order to achieve a successful hand-rearing it is necessary to optimise the formula over the whole period of lactation. Therefore as much information as possible is required about the milk composition during different stages of lactation.

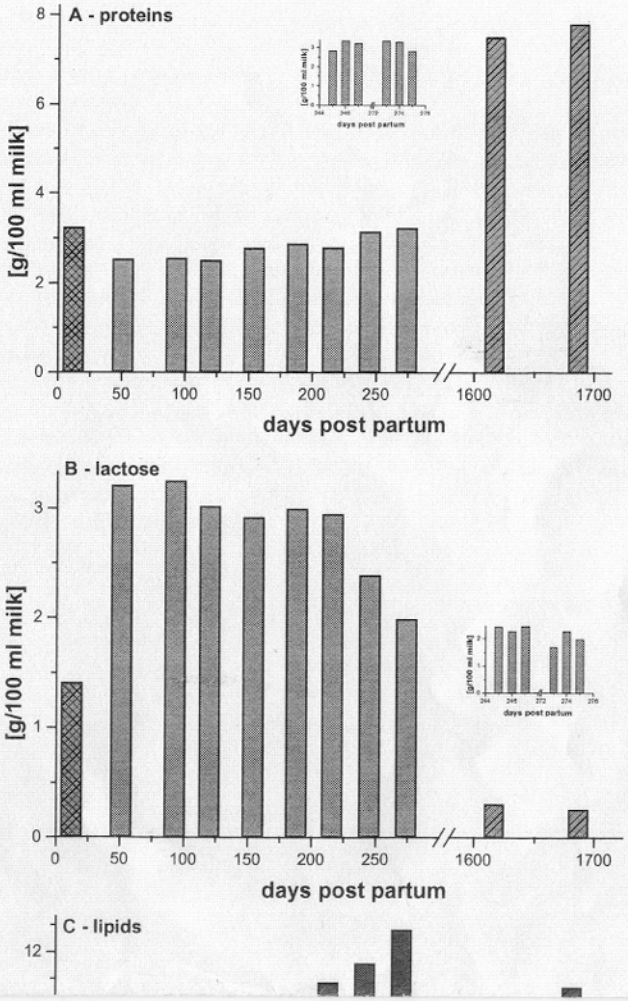
Since up to date only a few data on the milk composition during the whole lactation time of elephants are available we started our project in cooperation with Tierpark Hagenbeck, Hamburg, Germany.



Scheme 1: Preparation and analysis of major components in milk of Asian Elephants

Material and Methods

In the present study the mature milk of one Asian Elephant taken during early (51-274 days post partum) and late (4.5 years, i.e. around 1650 days post partum of the previous calves lactation period) lactation for major nutrient components was analysed. To minimise faults due to deviations in sampling ~ 20 ml of milk from the early point of time on three consecutive days every four weeks were collected. Since the first month was missed and in order to get an idea of the composition of the very early milk one sample of another Asian Elephant taken at day 12 post partum after stillbirth of the calf was analysed. The preparation and analysis of major milk components was carried out



according to Scheme 1.

Results

Our results show that the contents of proteins, fat and lactose have not changed significantly during the first nine months post partum. With regard to the total protein content a slight increase from 2.5% at day 51 to 3.2% at day 274 post partum (Fig. 1A) was observed. The protein pattern remained unaltered within this observation period (Fig. 2). However significant changes of protein content and -pattern were observed in the milk of late lactation. Protein levels in samples taken after 4.5 years (1617 dpp) were enhanced by more than 100% and the ratio of caseins and whey proteins was shifted to the latter.

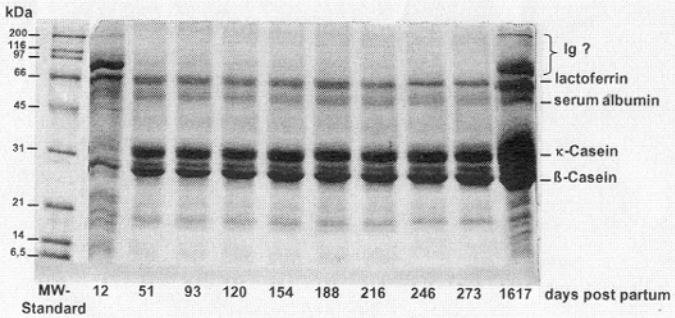


Fig. 2: SDS PAGE of EM proteins obtained from different stages of lactation

elephant	SYQECIKAIA ANEADAVTLD SGLVFEAGQN PYKL-PVVAE VYATK PQT YYYAVAVVKK
man	SPIQCIQAIA ENRADAVTLD GGFIYEAGLA PYKLRPVAAE VYGTERQPRT HYYAVAVVKK
horse	SSFECIQAIA ANKADAVTLD GGLVYEAGLH PYKLRPVAAE VYQTRGKPQT RYYAVAVVKK
cow	FALECIRAIA EKKADAVTLD GGMVFEAGRD PYKLRPVAAE IYGTKESPQT HYYAVAVVKK
goat	SALECIRAIA GKNADAVTLD SGMVFEAGLD PYKLRPVAAE IYGTEKSPQT HYYAVAVVKK
mouse	STRQCIQAIV TNRADAMTLD GGTMFDAGKP PYKLRPVAAE VYGTKQPRT HYYAVSVVKN
pig	SPTDCIRAIA AKRADAVTLD GGLVFEAGQ- -YKLRPVAAE IYGTEENPQT YYYAVAVVKK
dromedar	SRFECIQAIS TEKADAVTLD GGLVYDAGLD PYKLRPIAAE VYGTENNPQT HYYAVAIAKK

Fig. 3: Alignment of peptide sequences deduced from CID spectra of tryptic peptides obtained from the protein band assigned as lactoferrin in Fig. 2 along with lactoferrin amino acid sequences from other species. (aa in red strongly conserved)

inconsistent, probably, due to difficulties in milk sampling [4,6]. The data obtained for the lipid concentration are therefore not very reliable.

The fatty acid composition of elephant milk is considerably distinct from that of many other species and most of the naturally occurring fats. A very high content of short chain saturated fatty acids especially capric (52.0%) and lauric acid (26.6%) and only low amounts of longer chain saturated and unsaturated fatty acids were detected (Fig. 4 and Tab. 1). Fatty acid patterns of coconut and sunflower oil are shown for comparison as well. Sunflower oil, like most common vegetable oils, comprises mainly longer chain saturated and unsaturated fatty acids. In contrast, coconut oil contains a similar pattern of saturated short chain fatty acids, like elephant milk fat. Therefore, it is used as the fat of choice for elephant milk substitutes despite the different ratio of the individual fatty acids.

The correct assignment of the protein bands on bases of molecular weights is ambiguous and there is a lack of adequate information on the elephant genome and elephant proteins. Therefore, the milk proteins were analysed by use of mass spectrometry followed by *de-novo* sequencing and homology search. The alignment of elephant milk lactoferrin peptides along with those of other species is exemplarily shown in Fig. 3.

In contrast to the protein contents the lactose concentration reveals a decrease from 3.2% to 2.0% within the first nine month of lactation (Fig. 1B). This tendency seems to proceed since for day 1687 post partum 0.2% lactose was found.

On first glance the data shown in Fig. 1C suggest an increase of the lipid concentration during the first nine month of lactation. However, the values obtained for the fat content of three consecutive days (insert Fig. 1C) are at closer inspection

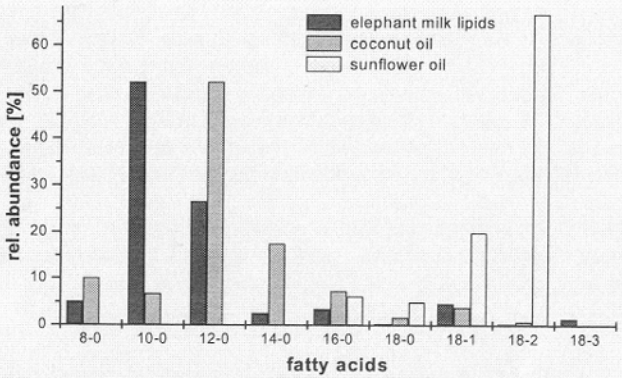


Fig. 4: Comparison of the most abundant fatty acids in milk of Asian Elephants (188 dpp) with those in coconut oil (as the major source for milk replacers) and sunflower oil (as an example for conventional vegetable oils).

Tab. 1: Summary of low abundant fatty acids in milk of Asian Elephants.

fatty acid	rel. abundance [%]	fatty acid	rel. abundance [%]
6-0	0.3	20-1ω9	0.05
11-0	0.4	20-3ω 6	0.05
13-0	0.1	20-4ω6	0.05
16-1ω7	0.4	24-1ω9	0.05

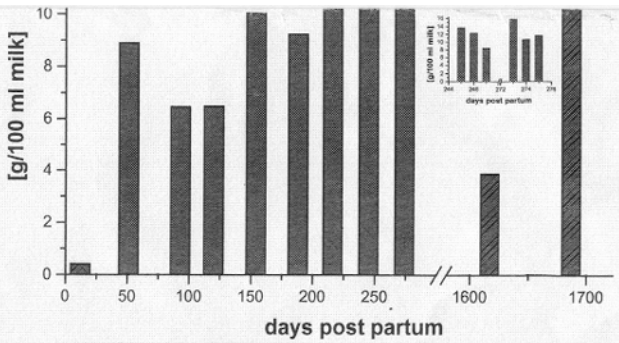


Fig. 1: Major nutrient contents in the milk of Asian Elephants in the course of lactation. A: proteins; B: lactose; C:lipids. milk from a different elephant milk from the previous lactation period Inserts show the nutrient contents obtained at three consecutive days, respectively.

Discussion and Outlook

The concentrations of lactose and protein in the milk of Asian Elephants can be determined rather accurately since the data obtained on three consecutive days were consistent. Obviously, the analytical methods for these compounds are very reliable and their amounts seemed to be relatively independent of milk sampling. Since their contents have not changed significantly during the first six month of lactation a replacement of lactose and proteins in hand-raising diets should not be a problem for this time. In contrast, variations of fat levels - even in samples of three consecutive days - and the unusual fatty acid composition may be more difficult to standardise. Moreover, an accurate fatty acid content is regarded to be important to prevent chronic diarrhea. According to this, one of our objectives is to perform a detailed analysis of the fatty acid pattern and its composition during lactation.

Since it is known that milk is the sole food for elephant calves during the first six month and that they are milk dependent for the first two years a more sophisticated knowledge on milk constituents during this time of lactation would be desirable, in particular during the first two month post partum, including colostrum. Therefore, we plan to extent our investigations on a larger amount of samples - especially from the first four weeks post partum - and we would like to increase the number of collaborating zoos. Thus, our further analyses may be helpful for adjusting a formula to the requirements at different stages of lactation.

Acknowledgements

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