

Milking a White Rhino Dam to Feed Calf Born Temporarily Blind

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Kees Poortman, 2010

Executive Summary

In March 2010 a male White Rhino calf, 'Ubuntu' was born at Hamilton Zoo with bilateral intraocular haemorrhages. The pressure of his birth had forced blood into the chambers of both eyes, and as a result he was functionally blind on arrival. After an anxious wait for him to find the right place to suckle, staff eventually had to intervene as it was obvious his blindness and his first time mother's inexperience meant he was unlikely to succeed in finding her udder.

Staff were able to hand-milk the female first for her colostrum and later for her milk. What we managed to collect from the dam was made up to volume with commercially available foal formula, and bottle-fed to the calf. Topical treatment was applied several times daily to Ubuntu's eyes which slowly resolved until he had reasonable sight by day 6. This was also the day that we finally watched him suckle from his mother, to much relief from all.

Throughout the process mother and calf were only separated for brief periods, such as when milking or bottle feeding. This maintained the bond between first time mother and calf, and also kept her producing milk – although it took several months for her supply to catch up to his demand and we continued to offer the foal formula during this time.

This paper will detail the process and milestones which resulted in the best outcome – a healthy parent-raised young Rhino.

Milking a White Rhino dam to feed calf born temporarily blind

How I Met Your Mother

In the 1980's and 1990's seven major Zoos in the Australasian region held Southern White Rhinoceros (Rookmaaker, 1998). Due to a lack of breeding success, it was decided that a regional import of multiple males and females was needed if the species was to continue in the region. In 1999 a shipment of 12 animals was brought in direct from Kruger National Park. Auckland Zoo received one male, two females; Hamilton Zoo received one male, two females; Werribee Open Range Zoo received one male, three females, and Perth Zoo received one male, one female. In 2002 Monarto Zoo and Taronga Western Plains Zoo brought in a second shipment: one male, one female to Monarto; two males, three females to Western Plains.

Kito

Kito was born at Auckland Zoo, New Zealand, in June 2000. Although Kito was captive born, she was wild conceived, i.e. her mother was pregnant to a wild male at the time of her capture and transfer. After the early deaths of her dam and sister, Kito became a 'founder animal' for the Australasian population.

Kito's mother and sister died in September 2003 from a suspected mycotoxin present in the hay causing haemorrhagic enteritis. Unfortunately this left Kito without female companions and attempts were made to integrate her with the two older bulls, Kruger and Mandhla. After little progress had been made over several months, it was decided that Kito be transferred to Hamilton Zoo where she could socialise with other female rhino.

On arrival in Hamilton, Moesha, a wild caught female, took Kito under her wing. She developed into a confident, calm and good tempered young rhino. At nine years of age Kito gave birth to her first calf, sired by the male Kruger.

Kruger

Kruger is one of the original wild caught rhino from Kruger National Park. He was estimated to be born around 1989, making him approximately 22 years old. He was first held at Auckland Zoo after his arrival, but there were no breeding opportunities for him after the death of the two females.

In 2007 there was a swap of male rhino between Hamilton and Auckland Zoos recommended by the ASMP (Australasian Species Management Program) species coordinator. Zambezi (wild born) and his two sons Inkosi and Mtoto (captive born) were transferred to Auckland Zoo from Hamilton Zoo and Kruger was brought down from Auckland to Hamilton Zoo, as he was then an unrepresented founder.

Kito and Kruger were reunited and once Kito became sexually mature mating was observed.

Hearing the Pitter Patter of Big Feet?

All rhino at Hamilton Zoo walk through our conditioning chute, and are regularly stopped and trained.



Figure 1. A view of the chute from the side and rear (with front and rear doors closed)

Kim Preston

The chute is positioned between the display exhibit and off-display yards, so all rhino encounter it daily. By sliding closed the front door and placing lucerne hay at the front of the enclosed space, the rear door can be closed after rhino entry – securing the animal. They are all very comfortable with this process and are rewarded with lucerne hay, tactile reinforcement and sometimes small amounts of Horse and Pony pellets to facilitate training. Keepers can visually and physically check each animal, take faecal samples from the rectum and blood samples from the ear, and assist with ultrasound scanning, to name just a few procedures. Having this daily conditioning means the animals are very calm in this enclosed space and are used to having a variety of people and activities around them. Being able to complete procedures without sedation is a huge benefit considering the risks and stress involved in the sedation of such a large animal.

Faecal hormone monitoring is an ongoing practice at Hamilton Zoo, used to monitor reproductive cycles and pregnancies. Faecal samples from the mature females are collected three times a week from the individual night yards or straight from the rectum. These samples are then frozen until analysis takes place. The samples are freeze- or oven-dried, then steroid extracted and analysed by Enzyme Immuno Assay for progesterone metabolites (Morrow *et. al.* 2009).

Regular transrectal ultrasound conditioning and exams for all adult females began in 2007. These exams are useful to confirm early pregnancies, and to monitor the progress of the foetus. We also aim to increase our ability to visualise the entire reproductive tract and identify any pathology which may be of concern, particularly in acyclic females.

An ultrasound conducted in November 2008 by Veterinarian Andrew Gore confirmed Kito was pregnant. Further ultrasounds in December, January, February, March and April 2009 confirmed the foetus was healthy and developing well.



Figure 2. First glimpses of Kito's calf.

Samantha Kudeweh

Towards the end of February 2010 two cameras and infra red lighting were installed in Kito's night-yard in the hope of recording the birth for an upcoming television series. The cameras were linked to a computer system, also set up in the Rhino House next to Kito's yard, which allowed keepers to rewind, fast forward and view real time footage. All recordings were saved to the hard-drive. This was a very useful way of monitoring Kito's behaviour right up until the birth.

Hamilton Zoo has had much success in the breeding of our rhino herd. Caballe and Zambezi (both wild caught) produced three offspring over the years, two males and one female. All three were healthy calves and there were no complications with the births. Moesha, a second mature female at Hamilton Zoo, was acyclic over the several years that Caballe was producing offspring. The introduction of a new male (Kruger) and a reduction in time housed with the more dominant Caballe resulted in Moesha spontaneously resuming ovulation, and she produced a healthy male calf in 2009 (Kudeweh, 2010). With this positive record of rhino births, staff were hoping for the same outcome with Kito.

The Eagle has Landed

On the morning of 12 March 2010 Kito gave birth to a male calf. When keepers arrived shortly after 8am the calf appeared very new, still wet, and the umbilicus looked as if it had only just separated from the placenta. Kito looked exhausted and had some tears to her vulva, which was swollen and sore.



Figure 3. First photo of Kito and her very new calf.

Vanessa Smith

Unfortunately there was an unexpected power cut the afternoon before and the computer was not restarted. The birth was not recorded; we were unable to see what had happened.

On closer inspection of the new calf, he had bilateral ocular haemorrhaging, or blood blisters in both eyes. Believed to be a difficult birth, pressure on the calf forced blood into the anterior chamber of each eye. The left eye did not seem as bad as the right, and he tended to turn to the left when moving which suggested there may have been slight vision in the left eye. At this stage it was not known whether there was permanent damage to the eyes, or what if any chance there was of him regaining sight.

Kito and calf were monitored closely all morning. Around midday the calf was struggling to find Kito's udder and being a first-time mother she was a little unaware about what was going on, not standing well for him or assisting him to find her udder.



Figure 4. The right and left eyes, cloudy and bloodshot.

Mike Goold

Keepers Intervene

Later that afternoon it was decided that keepers needed to intervene or this little one was not going to survive. The calf needed to get that all important colostrum from Kito.

The next step was milking Kito by hand. This was to be carried out in the chute, where all hands-on procedures take place. During Kito's last months of pregnancy, her udder was gently touched and squeezed so keepers could get an idea of how she was filling up and the closeness of the birth. She was comfortable with this, so it was hoped she would be fine with the milking process.

The calf was left in the yard while Kito was led down to the chute with lucerne hay. Having a close, trusting relationship with keepers, Kito was able to be moved a fair distance from her calf. Staff were well aware of the risks in taking Kito from her calf, even for a short time. High importance was placed on maintaining and monitoring the maternal bond, recognising that she could possibly reject or lose interest in him.

Once Kito was comfortable eating the lucerne, keepers proceeded to strip Kito of her colostrum by hand. Approximately 250 millilitres was obtained.



Figure 5. Keepers stripping Kito

Kees Poortman

With Kito back in the yard next to her calf, we offered him the colostrum in a two-litre (cow) calf bottle with a black rubber teat. After a lengthy procedure he eventually took 150 millilitres. Two hours later the remaining 100 millilitres of colostrum was mixed with Vetpro Foalmilk Powder (Foal Formula), a horse foal milk replacer. This was mixed at a rate of 80 milligrams per litre, which is less than the recommended mix of 200 milligrams per litre for foals. This measurement followed advice from Taronga Western Plains Zoo, where a White Rhino had been successfully hand-raised in the past. He drank 1.6 litres of this mixture; his suckling function had improved since the first attempt.

At 7pm that night keepers tried to strip Kito again but she was uncooperative, not wanting to leave her calf. It was decided to feed him just the Foal Formula. The calf was very keen to drink and took two litres well. At 10pm when mother and calf were checked again, the calf was sleeping and Kito could not be separated from him.

Day Two

With the cameras up and running again, keepers were able to go back through overnight footage to observe behaviours and suckling attempts. The calf was seen trying to suck various parts of Kito's body, but had no luck finding the teats.

The calf was bottle-fed Foal Formula at 6am and was very keen to drink. At 9am keepers tried unsuccessfully to encourage Kito down to the chute for milking. Not wanting to push her too hard we left her, happy that a strong bond was still evident between mother and calf. The calf was given another two litres of Foal Formula at this time.

At midday Kito was successfully led down to the chute and stripped of 150 to 200 millilitres. The calf was fed this and topped up with one litre of Foal Formula. He was bottle-fed Formula twice more that evening and seemed a little frisky and playful. Urination occurred several times throughout the day.

The Following Days

Keepers adopted a routine of feeding the calf two litres six times a day (every three hours) between the hours of 6am and 9pm. Kito was able to be milked two to three times a day, obtaining around one litre each time. What keepers obtained from Kito was fed to the calf at the next feeding time, topped up to two litres with the Foal Formula.

In between feeds the calf was seen circling Kito, possibly looking for a teat. Defecation and urination were regular and his weight was consistent if not increasing.

Sight in his left eye was improving daily, which was a great relief to everyone. The right eye developed a moderate keratitis in the cornea, which was cloudy. A phone discussion between Hamilton Zoo Veterinarian Mike Goold and Veterinary Ophthalmology Specialist Dr Peter Collinson suggested that the use of Maxitrol eye drops may be advantageous. Both eyes were treated with two drops of Maxitrol from the 3pm feed on Day 4 and at each feed thereafter.

A sample of Kito's milk was sent to the lab for analysis to assist in feeding the correct balance of Foal Formula.

At this stage the calf developed several skin abrasions on the knee and hock areas. These were treated topically with a mixture of Tecaderm cream and Negasunt. This had not been an issue with previous calves born at the Zoo. It was interesting to note in a paper 'Hand raising a Southern White Rhinoceros calf at Western Plains Zoo' (written by Jane Burgess, Jodie Lardner-Smith and Jo Corney of Taronga Western Plains Zoo) that they found a similar problem with their hand-raised calf who obtained 'several cuts, grazes and lacerations during the hand raising process' (Burgess *et al*, 2006).

Day 6 Brings Relief

At the 6am feed the calf did not seem hungry and was a little lethargic. Just before the 9am feeding time, the video footage was checked and to the keeper's surprise between 5.38am and 5.50am it looked as though the calf was suckling from Kito while she was lying on her side.

With no further evidence of suckling throughout the day, it was decided that keepers would try and put the calf straight onto Kito's teat, but a safe area was needed for this. An impromptu chute was made in the yard adjoining Kito's by putting four large posts in the ground 1.2 metres out from the yard fence. Keepers were planning to lead Kito into the chute and feed her lucerne. Once she was comfortable, the calf would have been able to be manoeuvred onto Kito's teat.

The gate was opened for Kito to move into the next yard. The calf eagerly followed, and before keepers could begin leading Kito down to the new chute, the calf latched on to Kito's teat and fed himself without keeper assistance.

Not Out of the Woods Yet

Overnight video footage was closely monitored for feeding behaviour and the length of time feedings took place. The calf was often keen for the morning feed and again in the afternoon, suggesting that he may not be getting enough from Kito.

The Foal Formula concentration was increased to a rate of 120 milligrams per litre and two litres was fed to the calf in the morning and offered again in the afternoon. The plan was to keep the calf a little hungry so he would keep trying to feed from Kito, hopefully stimulating her milk production to increase to meet his needs.

Veterinarian Dr Peter Collinson inspected the calf's eyes. The left eye appeared normal and the right eye still had some blood clot in the vitreous. Dr Collinson could see enough to determine that the retina was not detached and there was no evidence of adhesions anywhere. The prognosis for the right eye was good. Maxitrol ointment was placed into the right eye two to three times daily.

Over the next few weeks weight gain was good, and the treatment for eyes and skin lesions was stopped. Two litres of Foal Formula were fed twice a day. He was also starting to chew on lucerne hay.

Disadvantaged by Colostrum Intake?

At five weeks old the calf became lethargic and was passing rather loose yellow faeces. He was not keen to take Foal Formula but was still feeding from Kito. Attempts were made to get electrolytes into him mixed with the Foal Formula, but this was unsuccessful. Over the next few days there was no improvement. He was injected with anti-inflammatory Flunixin (100mg intra-muscular).

Lab results showed a heavy growth of *Yersinia pseudotuberculosis*. Because the calf had a low colostrum intake, he may have been susceptible to septicaemia. He was injected with a mixture of Enrofloxacin (5mg/kg) and Flunixin (100mg) for two days and Enrofloxacin only the following two days. He was manually restrained by at least two keepers for medication.

The Future Looks Bright

Coming right after this bout of sickness, weight gain continued and he was keen for the Foal Formula. The concentration of the Foal Formula was increased again at this stage to 150 milligrams per litre. Two feeds a day were offered for two weeks, and then one feed a day thereafter. He was observed suckling from Kito during the day. Towards the end of June his weight was recorded at 147 kilograms and it was decided to wean him off Foal Formula altogether. We offered him one litre of Formula every second morning until the batch of powder was finished. By early July he was completely weaned off Foal Formula, leaving Kito's milk as his main food source. Weight gain continues.

In the early days of bottle-feeding the calf had earned himself the name Bunty. This arose from his antics and attitude towards the bottle once he'd finished his allocated milk. Wanting to give him an African name like the rest of the herd, a public naming competition was run. The winning name was Ubuntu, which is a classical African concept focusing on allegiances and relations with each other.

Always Learning

Kito's Milk Composition

A sample of Kito's milk and the Foal Formula powder were sent to Gribbles Veterinary Pathology in Hamilton for food chemistry testing. The table below outlines the percentages of total fat, protein and total sugars for the Foal Formula mixed at a rate of 80 milligrams per one litre of water, and Kito's milk on the forth day post-parturition.

	Foal Formula (80g/L)	Kito's Milk
Fat (total)	1.07 %	1.6 %
Protein	1.61 %	3.7 %
Total Sugars	3.57 %	5.2 %

Table 1: Milk composition.

Ubuntu was started on the Foal Formula at a rate of 80 milligrams per one litre of water, a lower concentration of fat, protein and sugar. The reasoning behind this was to decrease the risk of him developing diarrhoea and/or scouring, especially if he had not taken in enough colostrum. He was also taking small amounts of Kito's milk which had the increased percentages. Kito's milk and the Foal Formula had not been tested for constituents at this stage. Only one paper, 'Milk composition of a free-ranging white rhino (*Ceratotherium simum*) during late lactation (2008)', was found on White Rhino milk composition. With a shortage of information, it was a challenge to get the consistency right – thus the changes made thereafter.

The Foal Formula concentration was increased to 120 milligrams at 12 days post-parturition, as we were confident that he was responding well with the mix of Kito's milk and lower concentration Foal Formula. Concentration was increased a third time at eight weeks to 150 milligrams per litre and he was weaned at that rate.

Ubuntu's Weight Gain

Graph 1 on the following page shows Ubuntu was much slower to gain weight compared to other calves born at Hamilton Zoo. The hand-raised calf (Amira) from Taronga Western Plains Zoo also seemed to be in line with the Hamilton parent-raised calves for the first few months. At 10 and a half months Ubuntu's weight was recorded as 298 kilograms. Again, this is lighter than the other calves who, at this age, weighed around 400 kilograms.

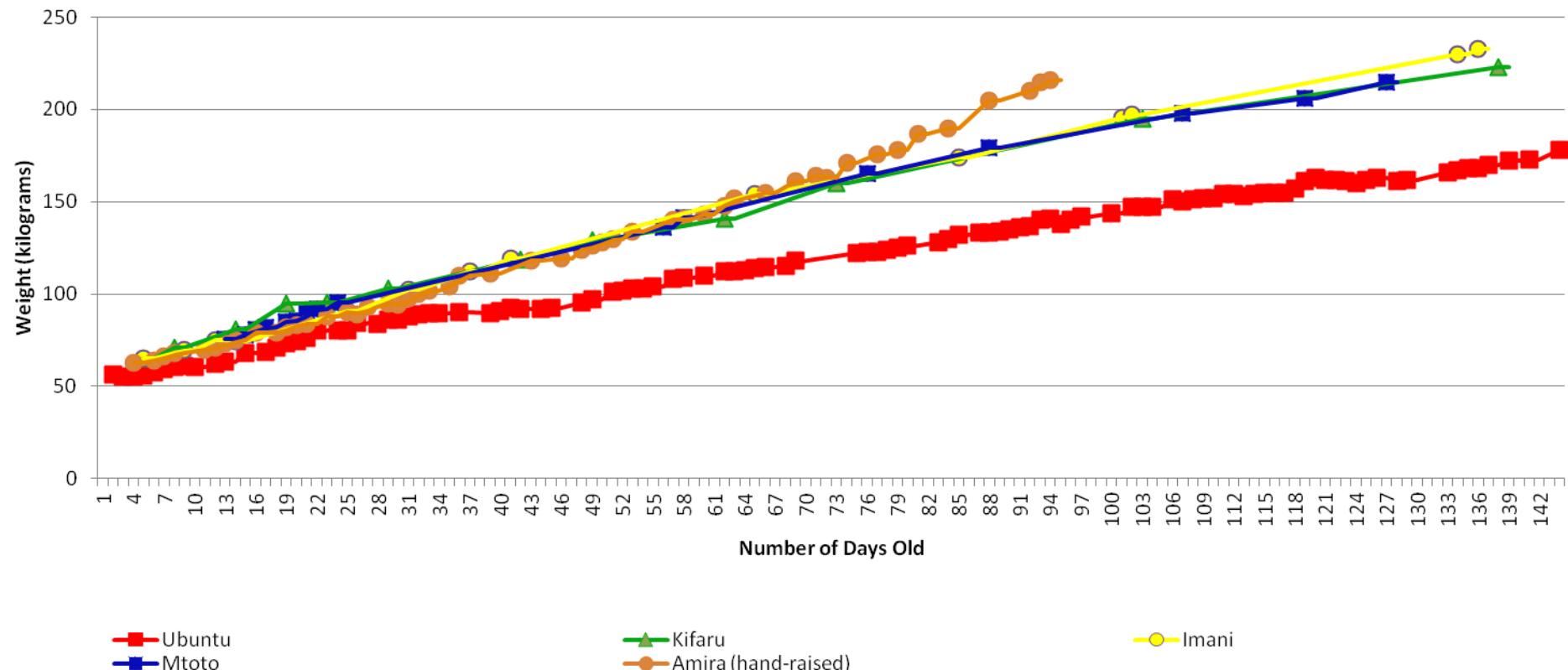
A Big Learning Experience

Helping Kito raise her first calf in the first few months has been one big learning experience. It has reiterated that a solid base of conditioning and keeper interaction means that interventions such as this are possible without undue stress or complication to animal relationships.

We now have a better understanding of the composition of White Rhino milk in early lactation and what we should be feeding White Rhino calves.

It has been a team effort of hard work, research and communication with other institutions to get things right and give Ubuntu the best chance at life, so he too can contribute to the breeding program for Southern White Rhinoceros.

Ubuntu's weight gain during the first five months against three parent-raised calves and one hand-raised calf



Graph 1: Ubuntu's weight gain during the first five months against three parent-raised calves from Hamilton Zoo and one hand-raised calf from Taronga Western Plains Zoo.

References

Animal Record Keeping System (ARKS) Specimen Reports for AUCKLAND 100047 (Kito), HAMILTON 400186 (Kito), HAMILTON 400001 (Mtoto), HAMILTON 700033 (Imani), HAMILTON 900092 (Kifaru), HAMILTON B00023 (Ubuntu).

Burgess, J., Lardner-Smith, J., Corney, J. (2006). *Hand raising a southern white rhinoceros calf (Ceratotherium simum simum) at Western Plains Zoo, Dubbo, Australia*. Taronga Western Plains Zoo, Taronga Conservation Society Australia.

Kudeweh, S. (2010). *Species management report: southern white rhino*. Zoo Aquarium Association: Australasian Species Management Program. Final Draft for CEO Endorsement. Not published.

Medical Animal Record Keeping System (MedARKS). Individual Specimen Report: Ubuntu. Hamilton Zoological Gardens

Morrow, C., Kudeweh, S., Goold, M., Standley, S. (2009). *Reproductive cycles, pregnancy and reversal of long-term acyclicity in captive White Rhinoceros at Hamilton Zoo*. Poster presented at 2009 Australasian Regional Association of Zoological Parks and Aquaria Conference Sea World, Gold Coast

Osthoff, G., Hugo, A., de Wit, M. (2008). *Milk composition of a free-ranging white rhinoceros (Ceratotherium simum) during late lactation*. Mammalian Biology: 73 pgs 245-248. – Used in original research for milk concentration mix.

Rookmaaker, L.C. 1998. *The rhinoceros in captivity*. SPB Academic Publishing: The Netherlands

Appendices



Case No: DU1002835

Report To: Gribbles Veterinary Pathology Ltd-Animal/Herd: HAMILTON
 PO Box 195 Species: Food Testing Age: YEAR(S)
 Waikato Mall Centre Breed: Unknown Sex:
 HAMILTON 3240

Submitted by: GRIBBLES VETERINARY PATHOLOGY Date Sent: 17/03/2010 9:42
 Submitter ref: RHINO Date Received: 17/03/2010 9:42
 Owner: Gribbles Hamilton Date Tested: 17/03/2010 13:54

Phone: Notification: Fax
 Fax Number: 6478500770

Tests Requested:
 1x Food - Fat (total)
 1x Food - Lipid profile
 1x Food - Total Sugars

Food Chemistry

	FOAL MILK	Units	Ref Range
Lipid profile	See Below	%	
Fat (total)	13.4	%	
Protein	20.1	%	
Total Sugars	44.6	%	

Total fat extraction carried out after acid hydrolysis of the sample.
 Protein factor is 6.38
 Sugar breakdown: glucose 4.45%, lactose 40.0%, galactose 0.12%
 Results as per diluted milk (80g powder to 1L):
 Protein = 1.61%
 Total fat 1.07%
 Total sugars 3.57%
 Lactose 3.2%
 Galactose <0.01%
 Glucose 0.36%

Test methodology references are available on request.
 (Note: Results apply only to samples received, on an as found basis. Precision data will be supplied upon request. H = High result, L = Low result. Reference ranges are standard AHL reference ranges.)

Signed Denise Carlan-smith
 (Technical Officer - Du)

Report Date: 19/03/2010 14:45

Signed Denise Carlan-smith
 (Technical Officer - Du)

Final

Report Fee (ex GST): \$0

Gribbles Veterinary Pathology make every effort to collect, analyse and report the results of tests accurately and promptly but accepts no responsibility for any factors which influence the results that are beyond our control. This report should not be reproduced except in full.

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Gribbles LABNET - Dunedin
PO Box 371
Moseigel
Phone: 0800 474 225 ext 5
Fax: 03 489 8376

LIPID PROFILE REPORT - DU1002835

Sample:	Vet Pro Foal Milk
Submitted on:	18/03/2010
Report to:	Gribbles Veterinary, Hamilton PO Box 195 Hamilton 3240

Fatty acid profile - results reported per extracted fat basis (%)

C10:0 Capric	2.51	Saturated	66.81
C12:0 Lauric	6.07	Monounsaturated	19.22
C14:0 Myristic	13.22	Polyunsaturated	1.46
C14:1 Myristoleic	1.29		
C15:0 Pentadecanoic	1.25	Omega 6	1.15
C16:0 Palmitic	33.74		
C16:1 T Palmitelaidic	0.29		
C16:1n-7 Palmitoleic	1.72		
C17:0 Heptadecanoic	0.55		
C17:1 10-Heptadecenoic	0.35		
C18:0 Stearic	8.96		
C18:1n-9 Oleic	19.15		
C18:2n-6 Linoleic	1.15		
C18:2n-6 TT Linoleaidic	0.25		
C19:0	0.51		
C20:1 Eicosanoic	0.07		
C20:3n-6	0.06		

Note

Results apply to samples received, on an as found basis. Analytical references and precision provided on request.
This certificate may not be reproduced except in full. Testing sub-contracted.

Certificate date: 23/03/2010

Signed:

DL Carian-Smith (Technical Manager)



Gribbles Veterinary Pathology
PO Box 371
Mosgiel 9053
Ph: 03 489 4600
Fax: +6434898576

Case No: DU1002767

Report To: Gribbles Veterinary Pathology Ltd-Animal/Herd: HAMILTON
PO Box 195 Species: NA Age: YEAR(S)
Waikato Mail Centre Breed: Unknown Sex:
HAMILTON 3240
Submitted by: GRIBBLES VETERINARY PATHOLOGY Date Sent: 16/03/2010 9:50
Submitter ref: RHINO MILK Date Received: 16/03/2010 9:50
Owner: Gribbles Hamilton Date Tested: 16/03/2010 11:05
Notification: Fax
Phone: Fax Number: 6478500770

Tests Requested:
1 x Food - Fat (total)
1 x Food - Lipid profile
1 x Food - Total Sugars

Food Chemistry

1. RHINO MILK		Reference	Units	Ref Range
Fat (total)	1.8	Unadjusted	%	
Protein	3.7	Unadjusted	%	
Total Sugars	5.2	Unadjusted	%	
Lipid profile	See Below		%	

Total fat extraction carried out after acid hydrolysis of the sample.

Protein factor is 6.38

Sugar breakdown: lactose 5.2%

Refer separate fatty acid profile report.

Specimens are not usually repeatable. An accurate result is based on a repeatable and precise test. Reference ranges are not necessarily repeatable in full. Testing is not necessarily repeatable in full.

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Test methodology references are available on request.
(Note: Results apply only to samples received, on an as found basis. Precision data will be supplied upon request. H = High result, L = Low result. Reference ranges are standard AHL reference ranges.)

Signed Denise Carian-smith
(Technical Officer - Du)

Signed Denise Carian-smith
(Technical Officer - Du)

Report Date: 18/03/2010 17:50

Final

Report Fee (ex GST): \$0

Gribbles Veterinary Pathology make every effort to collect, analyse and report the results of tests accurately and promptly but accepts no responsibility for any factors which influence the results that are beyond our control. This report should not be reproduced except in full.

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Gribbles

Gribbles LABNET - Dunedin
PO Box 371
Mosgiel
Phone: 0800 474 225 ext 5
Fax: 03 489 8576

LIPID PROFILE REPORT - DU1002767

Sample:	'Rhino Milk'
Submitted on:	16/03/2010
Report to:	Gribbles Veterinary, Hamilton PO Box 195 Hamilton 3240

Fatty acid profile – results reported per extracted fat basis (%)

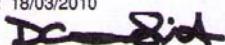
C8:0 Caprylic	0.22	Saturated	66.5
C10:0 Capric	24.61	Monounsaturated	18.8
C12:0 Lauric	17.71	Polyunsaturated	5.5
C14:0 Myristic	7.53	Omega 3	0.28
C14:1 Myristoleic	0.11	Omega 6	5.07
C15:0 Pentadecanoic	0.55		
C16:0 Palmitic	13.51		
C16:1 T Palmitelaidic	0.86		
C16:1n-7 Palmitoleic	2.24		
C17:0 Heptadecanoic	0.63		
C18:0 Stearic	1.77		
C18:1n-7 Vaccenic	0.59		
C18:1n-9 Oleic	13.76		
C18:2n-6 Linoleic	4.75		
C18:3n-3 Linolenic	0.14		
C20:4n-6 Arachidonic	0.32		
C20:3n-3 Eicosatrienoic	0.14		
C20:1 Eicosanoic	1.09		
C24:1 tetracosenoic	0.13		

Note

Results apply to samples received, on an as found basis. Analytical references and precision provided on request.
This certificate may not be reproduced except in full. Testing sub-contracted.

Certificate date: 18/03/2010

Signed:



DL Carian-Smith (Technical Manager)

Feeding Regime

Date	Time	Amount of Milk	Milk Mix	Calf Weight	Toileting	Behaviour Note	Kito Milked
12 March	3pm	150 ml	Kito's Colostrum				
	4.50pm	1.6 L	Colostrum (150ml)/Foal Formula				
	7pm	2 L	Foal Formula			Calf adapting very well to bottle feeding	
13 March	6.20am	2 L	Foal Formula			Keen to drink	
	10am	2 L	Foal Formula		Urinated straight after (quite a lot)		
	11.45am	1.5 L	Foal Formula	56.2 kg			Kito stripped. Obtained 150-200ml.
	3.10pm	1.2L	Colostrum (150ml)/Foal Formula		Seen straining. Faeces found (solid)	Not very keen to drink	
	6pm	1.5 L	Foal Formula			A little frisky and playful	
	9.15pm	2 L	Foal Formula		Urinated straight after		
14 March	6.15am	2 L	Foal Formula			Seemed hungry	
	9am	2 L	Foal Formula		Urinated and faeces found	2L was enough	
	12pm	2 L	Foal Formula	55 kg		A little slow at drinking	Kito stripped 1.2L Still looked like Colostrum
	3pm	2 L	Colostrum (1.2L) Foal Formula (800ml)		Urinated and defecated		Kito milked 1 L. Looked more milky this time
	6pm	1.5 L	Kito's Milk (1L) Foal Formula (500ml)		Defecated	Not very hungry	
	9pm	2 L	Foal Formula			Hungry. Breathed heavily afterwards	
15 March	6am	2 L	Foal Formula				

	9am	1.5 L	Foal Formula			Vet Checked	Kito milked of 1 L
	12pm	1.95 L	Kito's Milk (1L) Foal Formula (950ml)	55.4 kg			Kito milked of 1 L
	3pm	2 L	Kito's Milk (1L) Foal Formula (1L)				Attempted to milk Kito with not much success
	6pm	2 L	Foal Formula			Left about 50ml. Quite full.	
	9pm	2 L	Foal Formula			Hungry. Would have taken more.	
16 March	6am	2 L	Foal Formula			Would have taken more again.	
	9am	2 L	Foal Formula			Vet checked	Kito milked obtaining 1.2L
	12pm	2 L	Kito's Milk (1.2L) Foal Formula (800ml)	56.1 kg			Kito milked of 1L
	3pm	2 L	Kito's Milk (1L) Foal Formula (1L)			Very bouncy and 'bunty' while waiting for more milk.	Kito milked of 1.2L
	6pm	2.2 L	Kito's Milk (1.2L) Foal Formula (1L)			Quite active	
	9pm	2 L	Foal Formula			Drinking slowed towards the end as he became full.	
17 March	6am	2 L	Foal Formula			Very slow – didn't seem keen.	
	9am	1.5 L	Foal Formula			Over night video footage checked. Between 5.38 and 5.50am it looks as though he was suckling from Kito, who was lying on her side at the time.	
	12pm	2 L	Foal Formula	57.7 kg			Kito milked of 1.2 L
	4pm		Drank from Kito!			Fed himself without	Kito stood very well

						assistance.	for him.
	4.30pm	1.2 L	Kito's Milk			Taken from bottle.	
	5.42pm		Suckling from Kito			Still a little confused about where to suckle. Suckled on and off for 8 minutes.	
	7.50pm		Suckling from Kito			On the left teat for 15 minutes. Didn't look like he was getting much but kept trying for 30-45 minutes.	Kito kept moving when he tried the right teat.
		1 L	Foal Formula			This was only offered - he was keen for it.	
18 March	12.20am		Trying to suckle from Kito				She was lying on her side.
	2am		Suckling from Kito				Lying on her side
	3.55am		Suckling from Kito				Standing
	4.47am		Suckling from Kito			Only lasted 2 minutes	
	5.42am		Suckling from Kito				Lying on her side
	6.03am		Trying to Suckle			Started trying when keeper arrived and woke them. Took a while to latch on.	
	6.40am	2 L	Foal Formula			Drained it quite quickly and still seemed hungry.	
	9.27am		Suckled from Kito			Lasted about 10 minutes	
	9.50am	2 L	Foal Formula				
	1.06pm	1 L	Foal Formula	59.2 kg		Hadn't suckled between 10am and 1pm.	
	4.30pm					Tape reviewed: Hadn't suckled since last bottle – but didn't seem hungry	

					until 3.30pm.	
	4.40pm		Suckled from Kito		Lasted for 15 minutes	Keeper gave her lucerne to keep still.
		1.5 L	Foal Formula		Still keen to take this.	
	7.53pm		Suckled from Kito		Lasted 7 minutes	
	8.40pm		Suckled from Kito		On and off while Keeper around	
		1.2 L	Foal Formula		Wasn't very hungry	
	11pm		Suckled from Kito		Lasted 8 minutes	
19 March	12.30am		Suckled from Kito		Lasted 10 minutes	
	1.15am		Suckled from Kito		Lasted 12 minutes	
	1.52am		Suckled from Kito		Lasted 7 minutes	
	4.04am		Suckled from Kito		Lasted 8 minutes	
	5.00am		Suckled from Kito		Lasted 6 minutes	
	6.03am		Suckled from Kito		Lasted 2 mintues	
	6.15am	200 ml	Foal Formula		Was offered this but not too keen (good sign!)	
	8.45am	1L	Foal Formula	60.7 kg	Would have taken more but wanting to encourage suckling.	
	7.16pm		Suckled from Kito		5 minutes	
	8.56pm		Suckled from Kito		6 minutes	
	10.39pm		Suckled from Kito		7 minutes	
	11.16pm		Suckled from Kito		5 minutes	
20 March	12.48am		Suckled from Kito		4 minutes	
	3.00am		Suckled from Kito		5 minutes	
	3.40am		Suckled from Kito		7 minutes	
	4.23am		Suckled from Kito		4 minutes	
	5.30am		Suckled from Kito		6 minutes	
	6.55am		Suckled from Kito		5 minutes	
	7.24am		Suckled from Kito		5 minutes	
	7.42am		Suckled from Kito		6 minutes	

	8.46am		Suckled from Kito			8 minutes	
	10am	1 L	Foal Formula				
	3.30pm	1 L	Foal Formula	60.8 kg			
	6.43pm		Suckled from Kito			6 minutes	
21 March	12.52am		Suckled from Kito			6 minutes	
	4.23am		Suckled from Kito			6 minutes	
	6.49am		Suckled from Kito			7 minutes	
	10.03am		Suckled from Kito			2 minutes	
	10.10am	2 L	Foal Formula	60.5 kg			
	3.30pm	400ml	Foal Formula			Was offered 2 L but only took a little.	
	5.08pm		Suckled from Kito			4 minutes *Keeper may have missed other feedings (only a quick scan through footage)	
22 March	12.57am		Suckled from Kito			5 minutes	
	8.44am		Suckled from Kito			6 minutes *additional feedings may have been missed	
	9.30am	>100 ml	Foal Formula			Offered 2 L	
	10.38am		Suckled from Kito			6 minutes	
23 March	6.07am		Suckled from Kito			5 minutes	Lying on her side
	6.43am		Suckled from Kito			7 minutes	Lying on her side
	7.16am		Suckled from Kito			6 minutes	Lying on her side
	8.18am		Suckled from Kito			5 minutes	Standing
	8.40am		Suckled from Kito				Moving around a lot
	10.30am		Suckled from Kito				Lying on her side
	10.56am		Suckled from Kito				Standing
	12.00pm	1.5 L	Foal Formula	62.1 kg		Cameras removed today – not all feeds from Kito recorded from this point forward	
24 March	10.00am	1 L	Foal Formula			Quite hungry	
	12.00pm	1 L	Foal Formula	63.3 kg		Not so enthusiastic	
	3.00pm	1 L	Foal Formula				
25 March	10.00am	2 L	Foal Formula				
	4.00pm	500 ml	Foal Formula				

26 March	10.00am	0	Foal Formula			Offered 2 L but didn't take any.	
	4.00pm	2 L	Foal Formula	68.3 kg			
27 March	10.00am	900 ml	Foal Formula				
	4.00pm	900ml	Foal Formula			Separated from Kito for weighing & was making a fuss	
28 March	10.00am	1 L	Foal Formula				
	4.00pm	0	Foal Formula	68.7 kg		As soon as he was back with Kito began suckling	
	5.00	1 L	Foal Formula			Offered to top him up – happily took it	
29 March	10.00am	2 L	Foal Formula				
	1.30pm		Suckled from Kito			Took from both teats	
	3.45pm	2 L	Foal Formula	71 kg			
30 March	10.30am	2 L	Foal Formula			Playing with the rubber teat for a while before drinking seriously	
	1.00pm		Suckled from Kito				
	3.30pm		Suckled from Kito				
	4.00pm	2 L	Foal Formula	73.5 kg		Still quite happy to take this after feeding from Kito recently	
31 March	10.00am	2 L	Foal Formula			A little grumpy and silly this morning	

First experience out on exhibit today (half an hour)

	4.00pm	2 L	Foal Formula	74.4 kg			
1 April	10.00am	1 L	Foal Formula			Wasn't very hungry. Offered 2 L	
	4.00pm	2 L	Foal Formula	76.3 kg		Hungrier this time	
2 April	3.30pm	2 L	Foal Formula	80.2 kg			
3 April				No supplementary feeding today			

4 April	10.00am	2 L	Foal Formula				
	4.00pm	2 L	Foal Formula	80 kg			
5 April	10.00am	1.5 L	Foal Formula				
	4.00pm	1 L	Foal Formula	80.3 kg			
6 April	10.00am	2 L	Foal Formula			On exhibit for 3.5 hours	
	4.00pm	1.6 L	Foal Formula	84.3 kg			
7 April	No supplementary feeding today. Introduced to other rhino (Caballe, Imani) on exhibit for first time.						
8 April	10.00am	1 L	Foal Formula	84 kg		Introduced to more rhino today (Moesha, Kifaru)	
	4.00pm	1 L	Foal Formula				
9 April	10.00am	1 L	Foal Formula	86 kg			
	4.00pm	1 L	Foal Formula				
10 April	4.00pm	1 L	Foal Formula	86 kg			
11 April		2 L	Foal Formula	88 kg		* record unclear whether bottle feeds took place in morning and/or afternoon	
12 April	10.00am	1 L	Foal Formula	89 kg			
14 April	10.00am	1 L	Foal Formula	89.5kg			
16 April	Observed to be not well. Didn't take formula offered in morning. Passing runny yellow faeces. Offered 2 L 25% Foal Formula 75% Electrolytes – took 1.25 L. 90 kg.						
17 April	Still unwell. Bottle fed with Foal Formula containing Diaprost K – took 500ml.						
18 April	Still unwell. Has been feeding from Kito. Not keen on bottle.						
19 April	Still unwell. Seen feeding from Kito 4 times. 89.5 kg						
20 April	Positive for yersinia pseudotuberculosis. Injected with Flunixin and Baytril. 91 kg.						
21 April	Injected with Baytril. 92.5 kg						
22 April				92 kg			
23 April	Final injection of Baytril given.						
24 April	10.00am	1.5 L	Foal Formula	92 kg		He would have taken more.	
	4.00pm	2 L	Foal Formula				
25 April	10.00am	2 L	Foal Formula	92.5 kg			
27 April	4.00pm	4 L	Foal Formula			Still hungry afterwards	
28 April	4.00pm	4 L	Foal Formula	95.5 kg			
29 April	4.00pm	4 L	Foal Formula	97 kg			
1 May	10.00am	2 L	Foal Formula	101 kg			

	4.00pm	2 L	Foal Formula				
2 May	10.00am	2 L	Foal Formula	102 kg			
	4.00pm	2 L	Foal Formula			Still quite ravenous	
3 May	10.00am	2 L	Foal Formula	103 kg			
	4.00pm	2 L	Foal Formula				
4 May	10.00am	2 L	Foal Formula	103 kg			
	4.00pm	2 L	Foal Formula				
5 May	10.00am	2 L	Foal Formula	104 kg			
	4.00pm	2 L	Foal Formula			Concentration of Milk Powder Slightly increased. (150g/L)	
6 May	4.00pm	2 L	Foal Formula				
7 May	10.00am	2 L	Foal Formula	108 kg			
8 May	10.00am	2 L	Foal Formula	109 kg			
	4.00am	2 L	Foal Formula				
10 May	10.00am	2 L	Foal Formula	110 kg		Only offer one 2 L feed daily from now on.	
11 May	10.00am	2 L	Foal Formula				
12 May	10.00am	2 L	Foal Formula	112 kg			
13 May	10.00am	2 L	Foal Formula	112 kg			
14 May	10.00am	2 L	Foal Formula	113 kg			
15 May	10.00am	2 L	Foal Formula	114 kg			
16 May	10.00am	2 L	Foal Formula	114.5 kg			
17 May	10.00am	2 L	Foal Formula				
18 May	10.00am	2 L	Foal Formula	115 kg			
19 May	10.00am	2 L	Foal Formula	118 kg			
20 - 31 May	Given 2 L Foal Formula every morning. Weight up to 126 kg						
1 - 23 June	Given 2 L Foal Formula every morning. Weight up to 147 kg						
24 June	To be weaned off Formula from now. Given 1 L every second morning until current batch of powder finished.						
8 July?	Weaned of Formula. Watch weight gain and monitor feeding from Kito.						

