



Holistic Approaches to
Combating Iron Overload
Disorder in Black Rhinoceros

Treatment of Iron Overload Disorder at Disney's Animal Kingdom[®] (DAK)

- Diet Modification / Monitoring
 - Pellet diet low in iron
 - Remove high iron / vitamin C items
 - Offer browse (30%)
- Chelation Research
 - HBED
- Large Volume Phlebotomy
 - > 3 liters

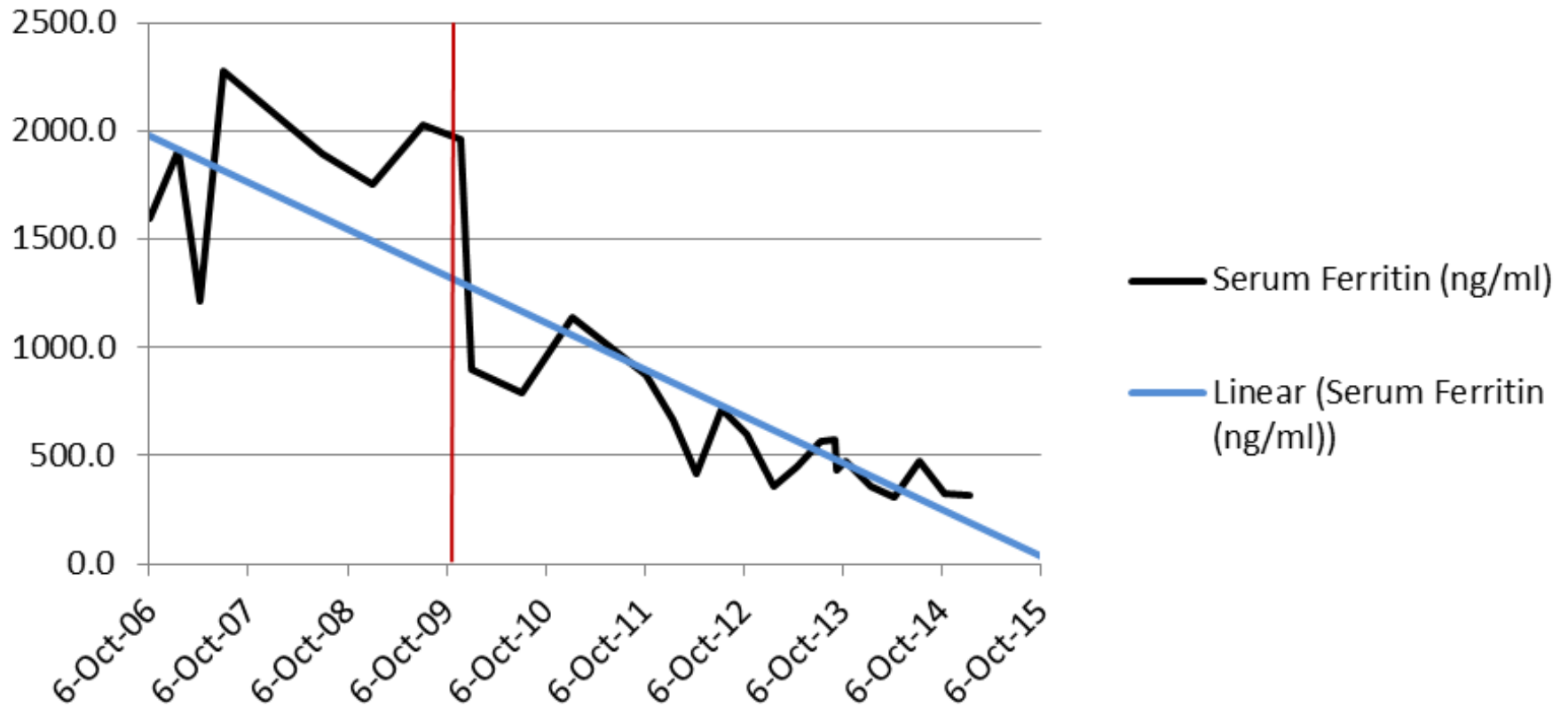
Diet Modification / Monitoring

- Switch rhino to low iron pellet in October 2009
- Grass hays (rather than alfalfa / lucerne which can be higher in iron, calcium and protein)
- Remove or limit enrichment high in iron / vitamin C
- All rhino display drop in serum ferritin and iron saturation

1.0 Bomani – 13.5 years old

Serum Ferritin (ng/ml)

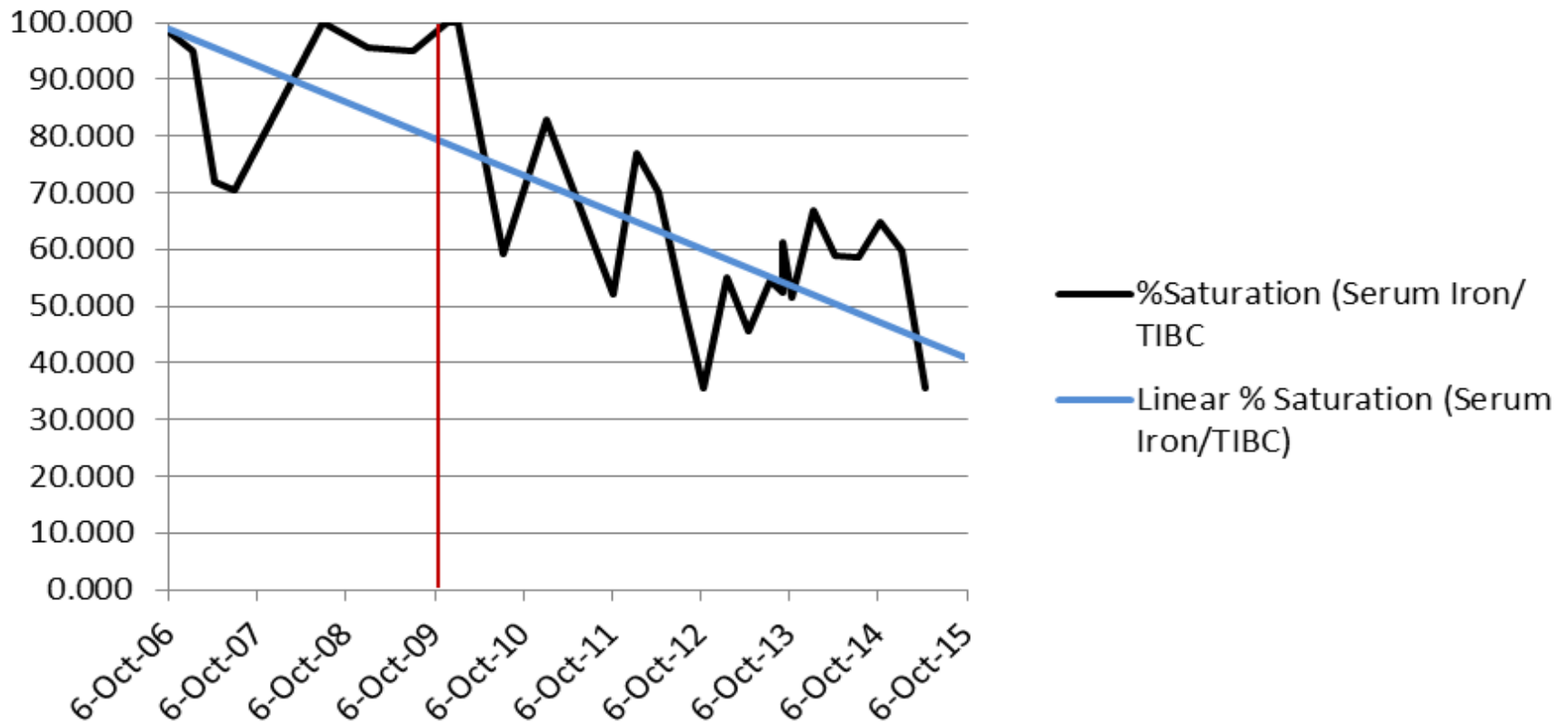
3 Years Prior Diet Change - Current



1.0 Bomani – 13.5 years old

% Saturation (Serum Iron/ TIBC)

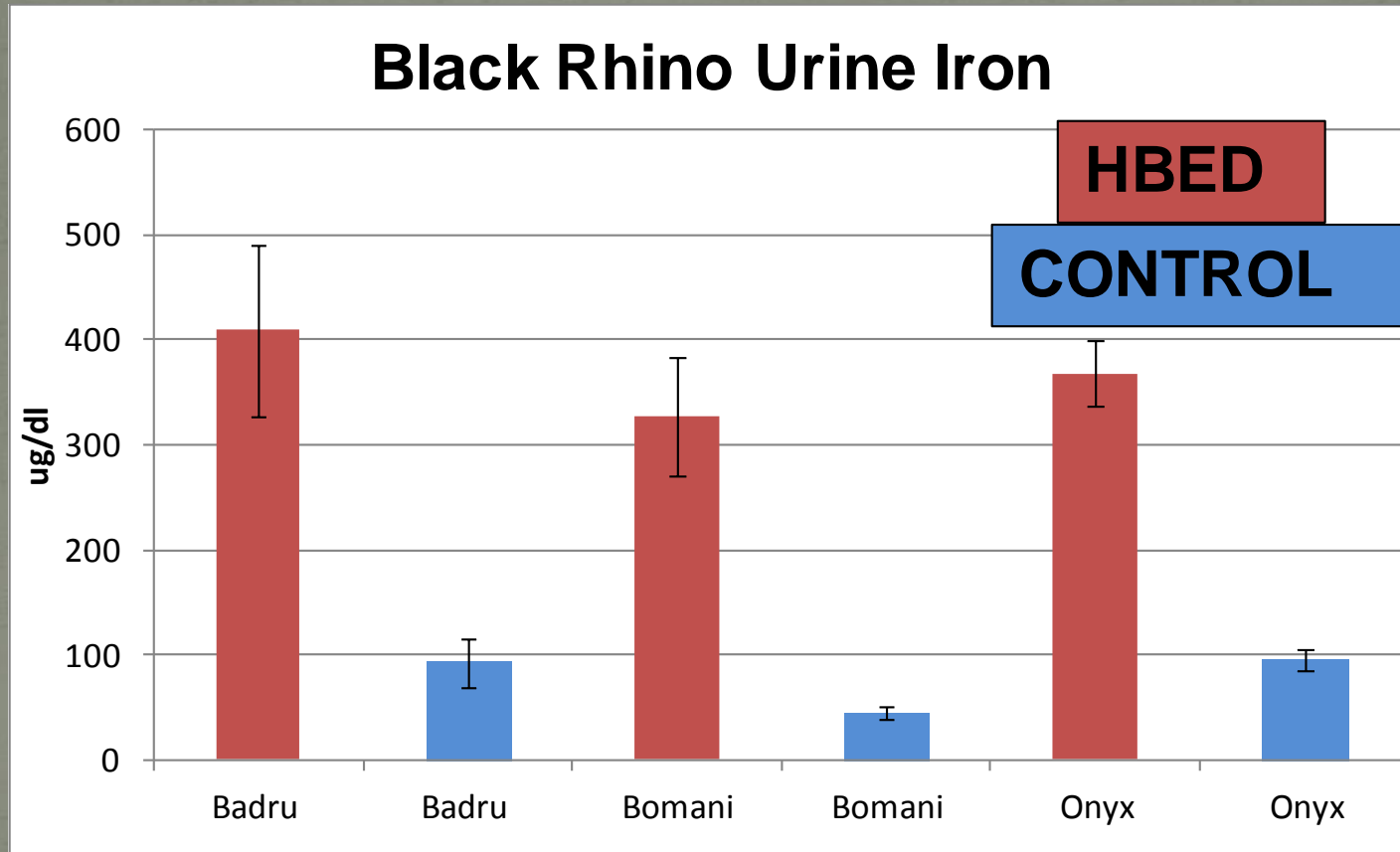
3 Years Prior Diet Change - Current



Iron Chelation

- Compound that binds iron, removes from body
- HBED (N,N'-bis (2-hydroxybenzyl) ethylenediamine-N,N'-diacetic acid)
- Controlled study on 2.1 rhino (funded by Morris Animal Foundation)
- Results warrant further investigation

HBED Did Promote Excretion



Contact our team at DAK for further discussion

Large Volume Phlebotomy (LVP)

- Therapeutic care not critical care
- 3.0 liters – 10.0 liters per procedure
- Voluntary and immobilized



Backstage photo, Disney's Animal Kingdom



Backstage photo, Disney's Animal Kingdom



Backstage video, Disney's Animal Kingdom

LVP Concerns



Backstage photo, Disney's Animal Kingdom

“You can’t remove enough to make a difference”

~~10 Liters~~

4 Liters



Backstage photo, Disney's Animal Kingdom

“There is no proof LVP works”

1.0 Travis – 17 year old

Collection Date	Serum Fe (µg/dl)	TIBC (µg/dl)	Serum Ferritin (ng/ml)	% Saturation (Serum Fe / TIBC)	Therapeutic Phlebotomy (mL)
2-Oct-09	189.0	195.0	10465.0	96.923	Last sample before change to DAK rhino browser
12-Nov-09	193.0	203.0	4181.0	95.074	10000.00
25-Nov-09	141.0	189.0	5725.0	74.603	22.11% drop in saturation and 37% increase in ferritin
10-Mar-11	326.0	480.0	1910.0	67.917	10000.00
22-Mar-11	137.0	261.0	1297.0	52.490	22.39% drop in saturation and 32% drop in ferritin
21-Dec-11	148.0	231.0	2022.0	64.069	10000.00
16-Jan-12	158.0	274.0	1003.0	57.664	10.94% drop in saturation and 50% drop in ferritin

0.1 Kit – 20 year old

Collection Date	Serum Fe (µg/dl)	TIBC (µg/dl)	Serum Ferritin (ng/ml)	% Saturation (Serum Iron/ TIBC)	
29-Jul-02	145.0	302.0	2104.0	48.013	Baseline - 8.9 years old
07-Jul-03	158.0	306.0	2449.0	51.634	9.9 yrs old
06-Jul-04	183.0	257.0	2491.0	71.206	10.9 yrs old
05-Jul-05	201.0	238.0	4521.0	84.454	11.9 yrs old
06-Jul-06	201.0	204.0	4874.0	98.529	12.9 yrs old
01-Jul-08	182.0	182.0	8147.0	100.000	13.9 yrs old
06-Aug-09	165.0	169.0	12274.0	97.633	Last sample before change to DAK Rhino Browser - 15.9 yrs old
20-Oct-09	154.0	154.0	7926.0	100.000	Phlebotomy training started September 2009 - 16.1yrs old
15-May-10	233.0	241.0	2119.0	96.680	First large volume phlebotomy performed - 16.7 yrs old
17-May-11	196.0	240.0	2635.0	81.667	One year post large volume phlebotomy - 17.7 yrs old
14-May-12	175	287	2404	60.976	Two years post large volume phlebotomy - 18.7 yrs old
13-Aug-12	133	236	2355	56.356	20.850 liters in 3 months / 6.95 average per month - 18.9 yrs old
13-May-13	173	323	1753	53.560	Last sample collected at DAK - 19.7 yrs old

1.0 Badru – 14.5 year old

Collection Date	Serum Fe (µg/dl)	TIBC (µg/dl)	Serum Ferritin (ng/ml)	% Saturation (Serum Iron/ TIBC)	
29-Jul-02	214.0	356.0	481.0	60.112	Baseline-1.7 yrs old
3-Aug-05	204.0	279.0	2040.0	73.118	Whole year range- Fe 1,000-2,000 40-80% Saturation- 5 yrs old
20-Oct-09	164.0	246.0	2737.0	66.667	Last sample before change to DAK Rhino Browser- 8.6 yrs old
10-Oct-11	144	258	1144	55.814	Two years post diet change/no phlebotomy- 10.9 yrs old
17-Apr-12	185	285	773	64.912	Phlebotomy training started June 2012- 11.4 yrs old
6-Jan-13	186	352	760	52.841	First large volume phlebotomy performed- 12.1 yrs old
14-Jan-13	172	347	719	49.568	Sample collected 5 days before 4.0 liter collection- 12.1 yrs old
22-Jan-13	137	375	481	36.533	Sample taken 72 hrs after a 4.0 liter collection- 12.1 yrs old
9-Jun-13	157	361	329	43.490	One year post phlebotomy training implemented- 12.5 yrs old
15-Jan-14	147	298	398	49.329	One year post large volume phlebotomy - 13.1 yrs old
18-Jun-14	142	329	376	43.161	Two years post phlebotomy training implemented- 13.5 yrs old
15-May-15	134	332	217	40.361	Current values - 14.5 yrs old

“Is it safe?”

1.0 Travis

~ 2 year span

59.58 Liters

0.1 Kit

~3 year span

75.51 Liters

1.0 Badru

~3 year span

57.70 Liters



“It will take too much time”

- Initial training investment
 - Rhino and staff
- Ongoing investment
 - One half-hour/month

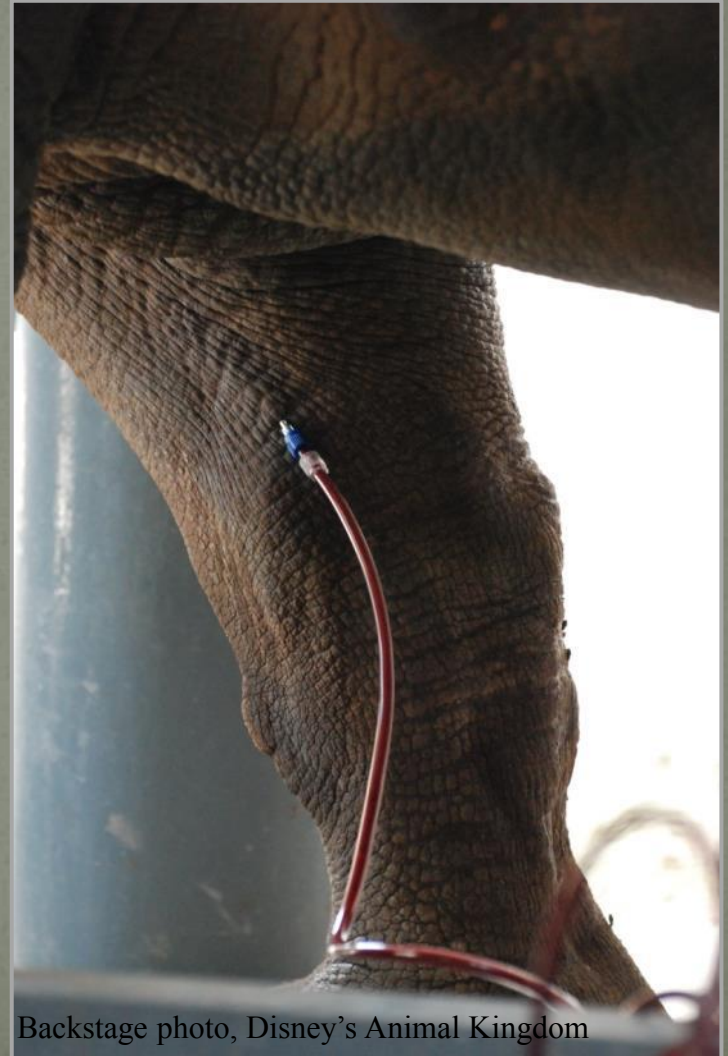


Backstage photo, Disney's Animal Kingdom

Dual Lines: 4 Minutes = 1 Liter

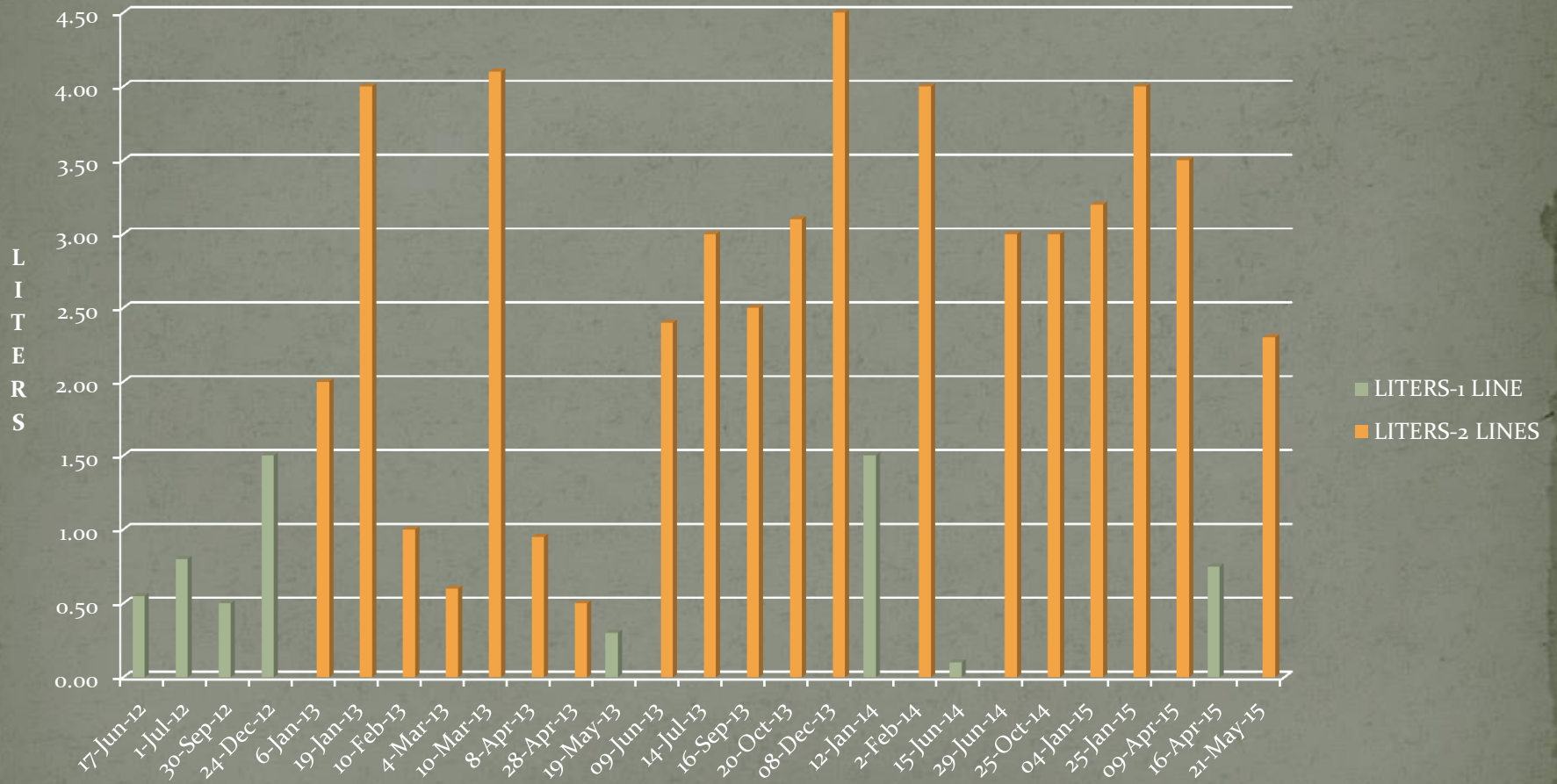


Backstage photo, Disney's Animal Kingdom



Backstage photo, Disney's Animal Kingdom

BADRU - 30 MIN SESSIONS



“It is too expensive”

- Alcohol or Nolvasan solution
- Gauze
- 18 - 20 gauge needle
- 500ml - 1000 ml evacuated container
- Mila collection tubing with burette
- Sample tubes
- **Approximate cost (American) = \$60.00 per 4L phlebotomy**
- **Approximate cost (European) = EU25.00 per 4L phlebotomy**



Backstage photo, Disney's Animal Kingdom

“I’m just a keeper, what can I do?”

- Learn about and understand the disorder
- Ask for rhino to be tested
- Develop a LVP training plan
- Propose action to management / veterinary staff
- Seek out assistance if needed (DAK, Rotterdam)

“Our rhinos don’t have IOD”

Since chronic iron toxicity is as insidious as it is pernicious, it generally remains undetected until terminal failure of some critical organ system occurs. Nonetheless, progressive dysfunction of various organs contributes to deteriorating quality of life in affected animals as well as shortened life spans.

(Dr. Don Paglia, 2004, AAZV)

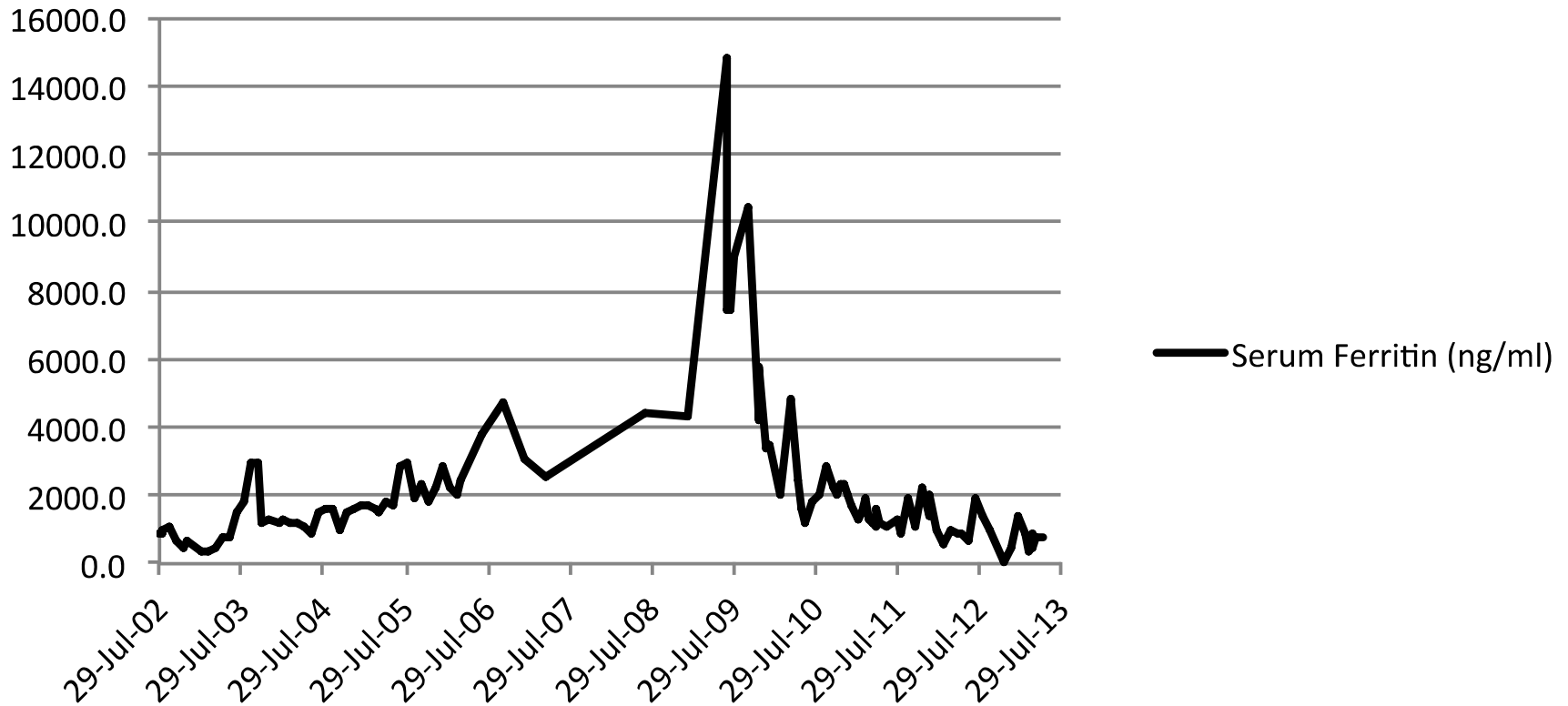
Questions?



Backstage photo, Disney's Animal Kingdom

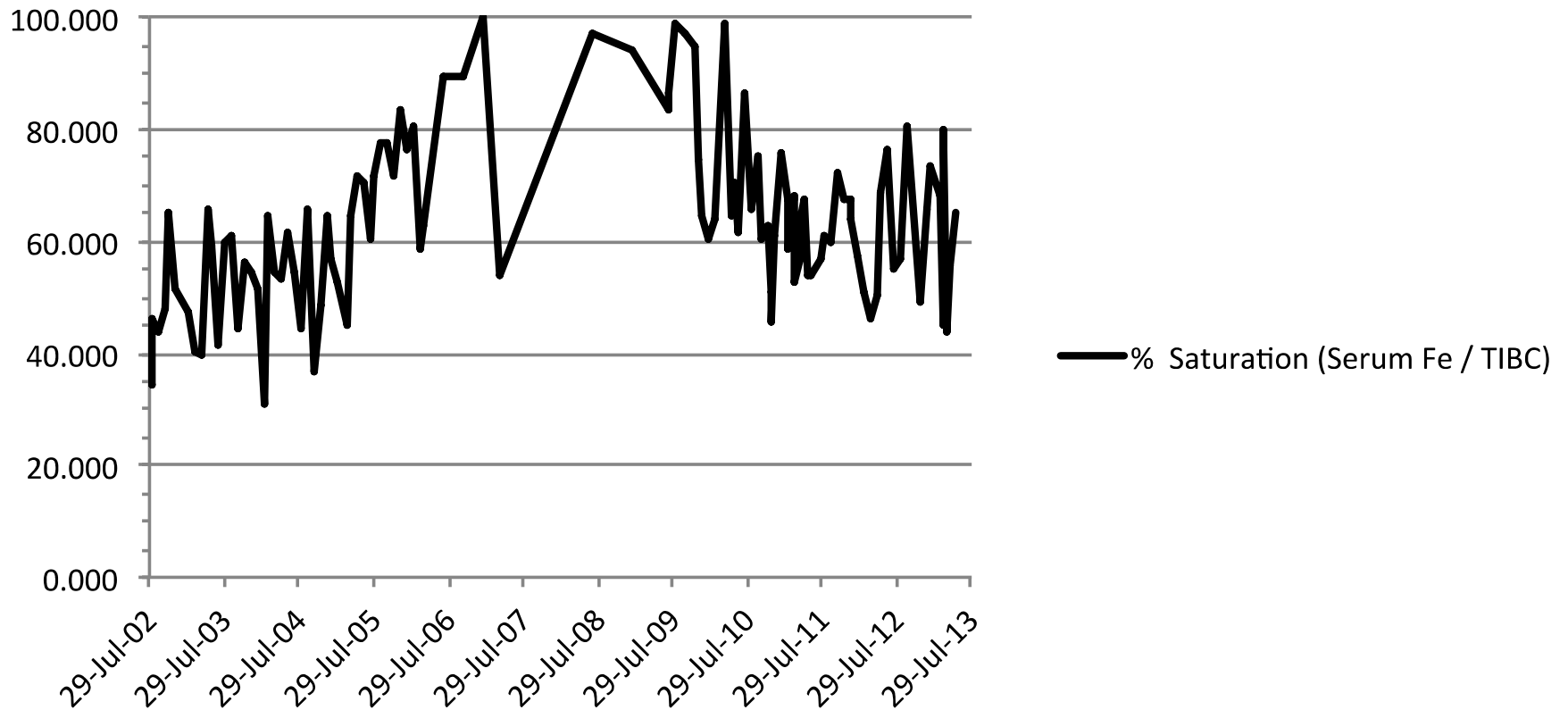
Travis Graph

Serum Ferritin (ng/ml)



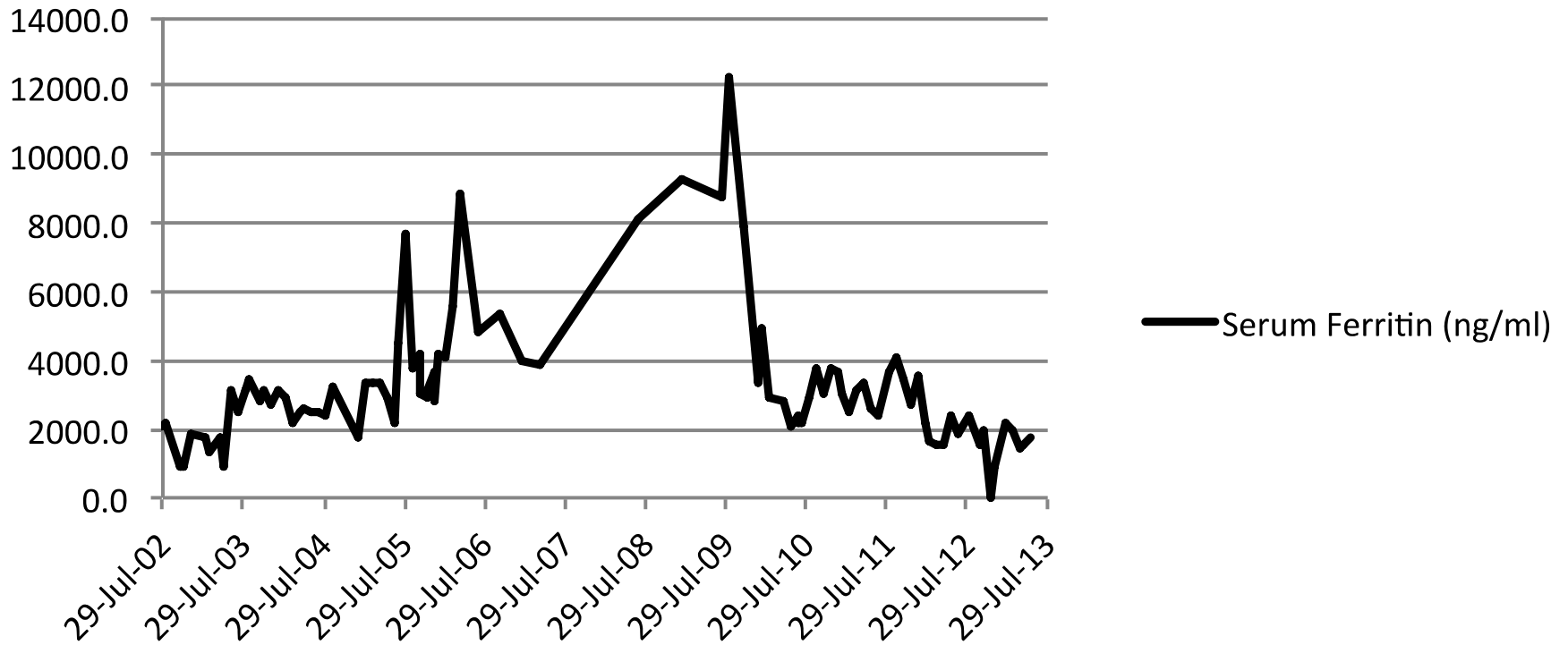
Travis Graph

% Saturation (Serum Fe / TIBC)



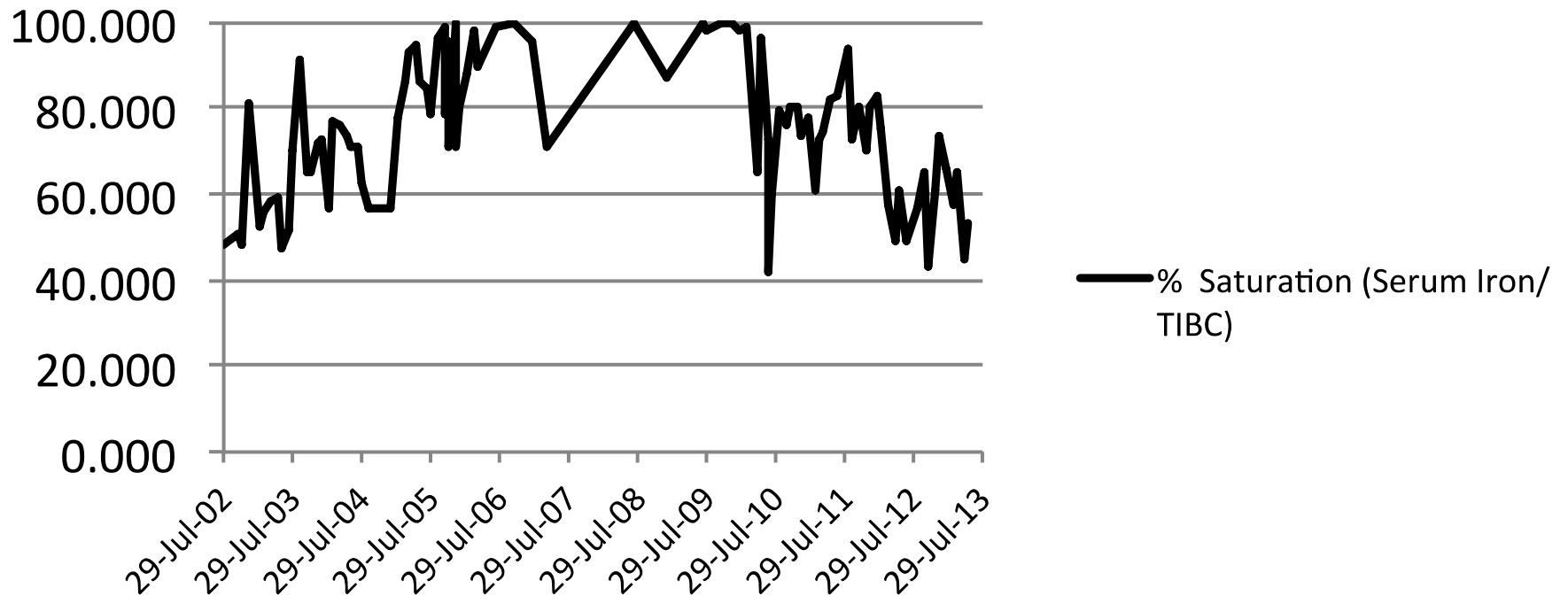
Kit Graph

Serum Ferritin (ng/ml)



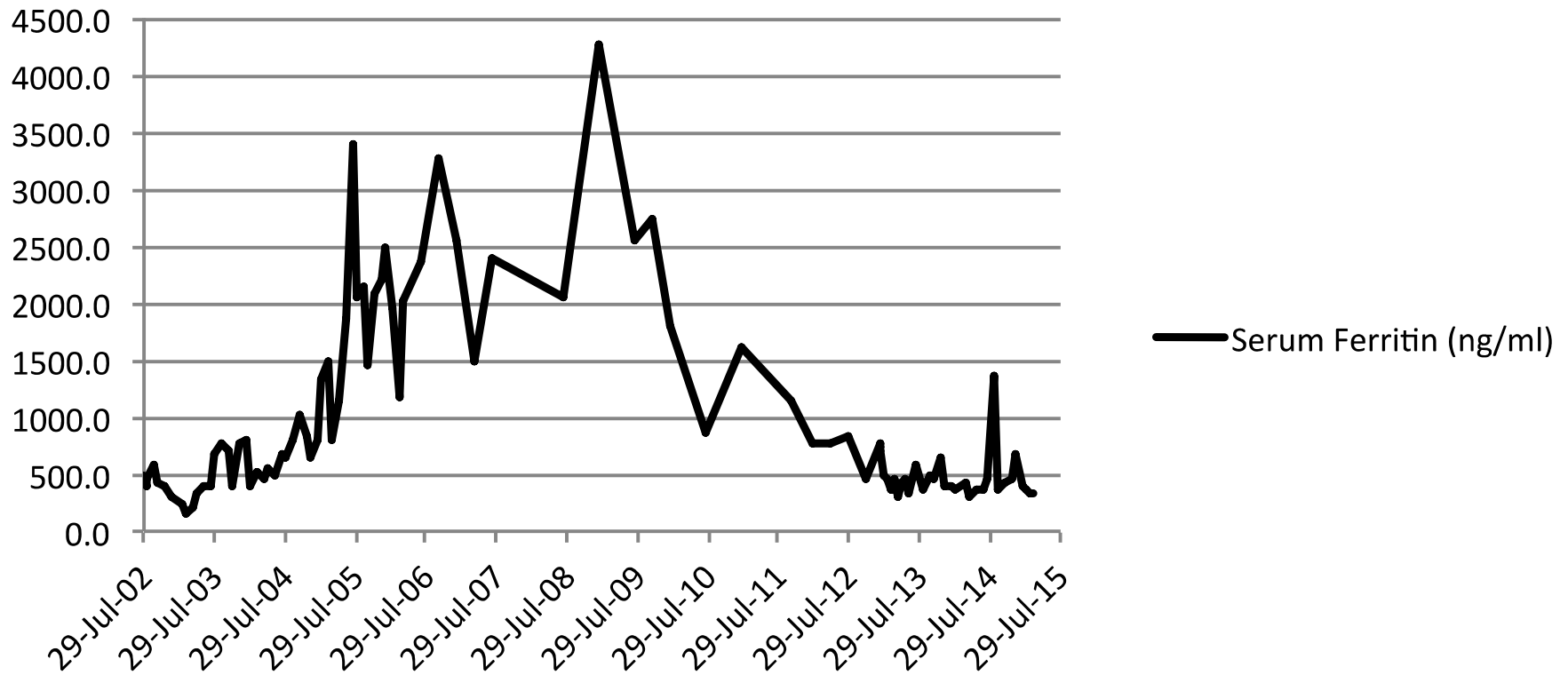
Kit Graph

% Saturation (Serum Iron/ TIBC)



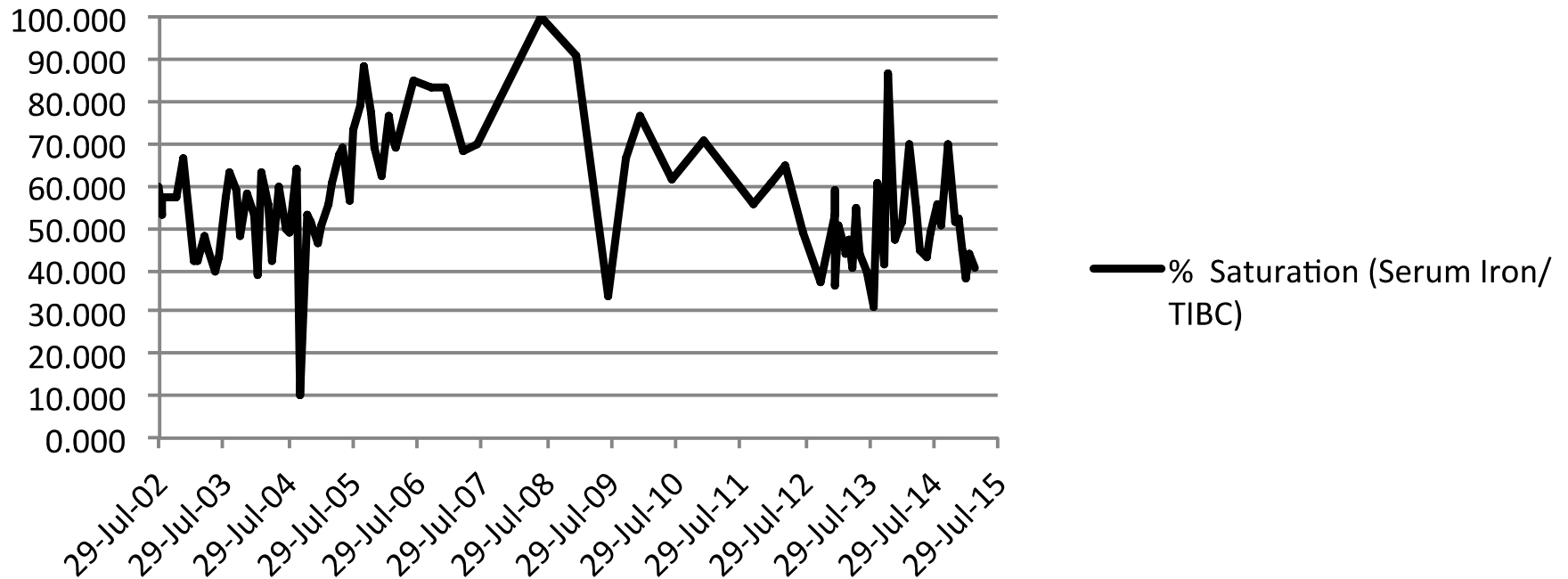
Badru Graph

Serum Ferritin (ng/ml)



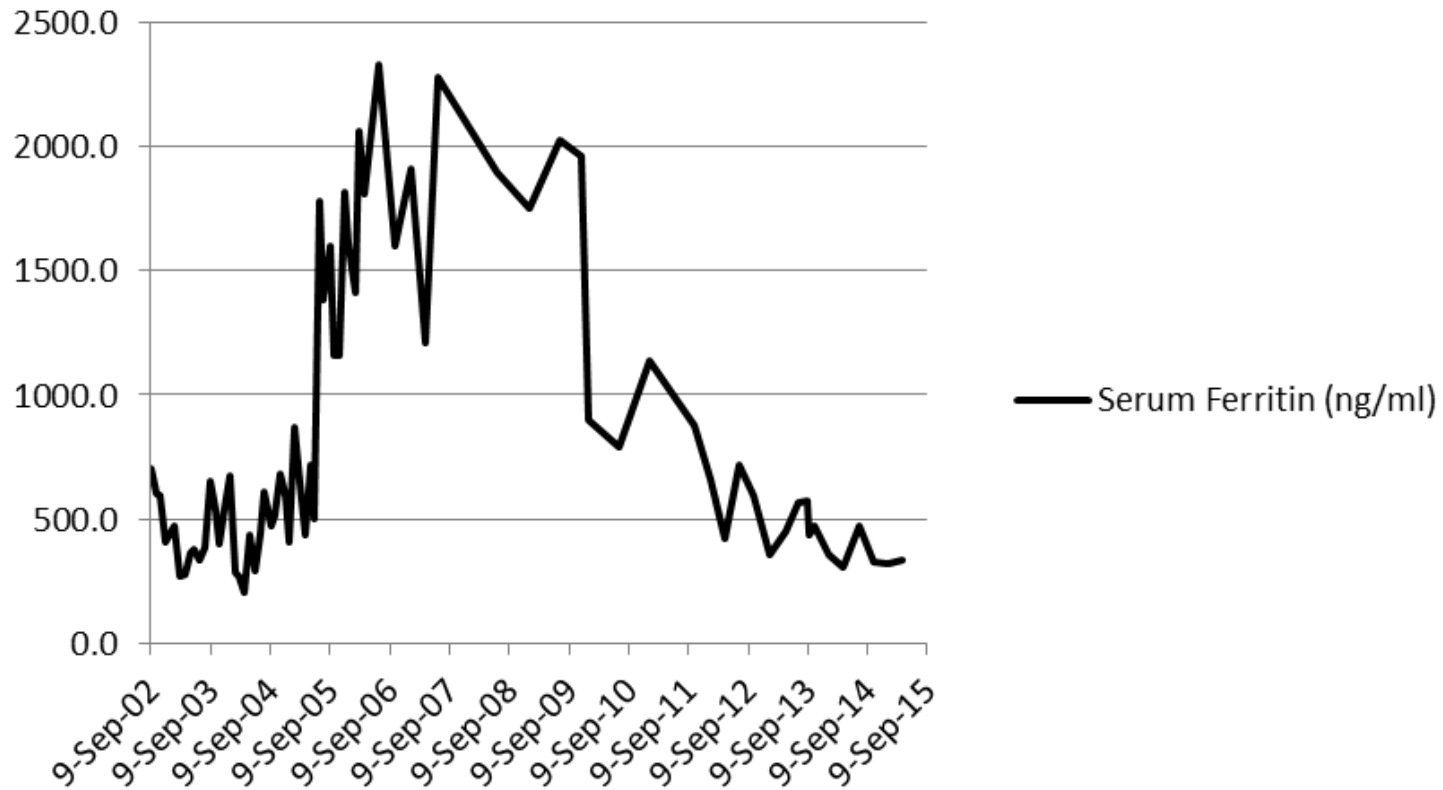
Badru Graph

% Saturation (Serum Iron/ TIBC)



Bomani Graph

**1.0 Bomani 13.5 year old
Serum Ferritin (ng/ml)**



Bomani Graph

1.0 Bomani - 13.5 year old % Saturation (Serum Iron/ TIBC)

