

THE EFFECT OF THE EQUITONIC 3
"INFRATONIC" TREATMENT UPON
THE SYNOVIAL FLUID WITHIN
THE TARSOCRURAL (HOCK) JOINT
OF THE RACING STANDARDBRED

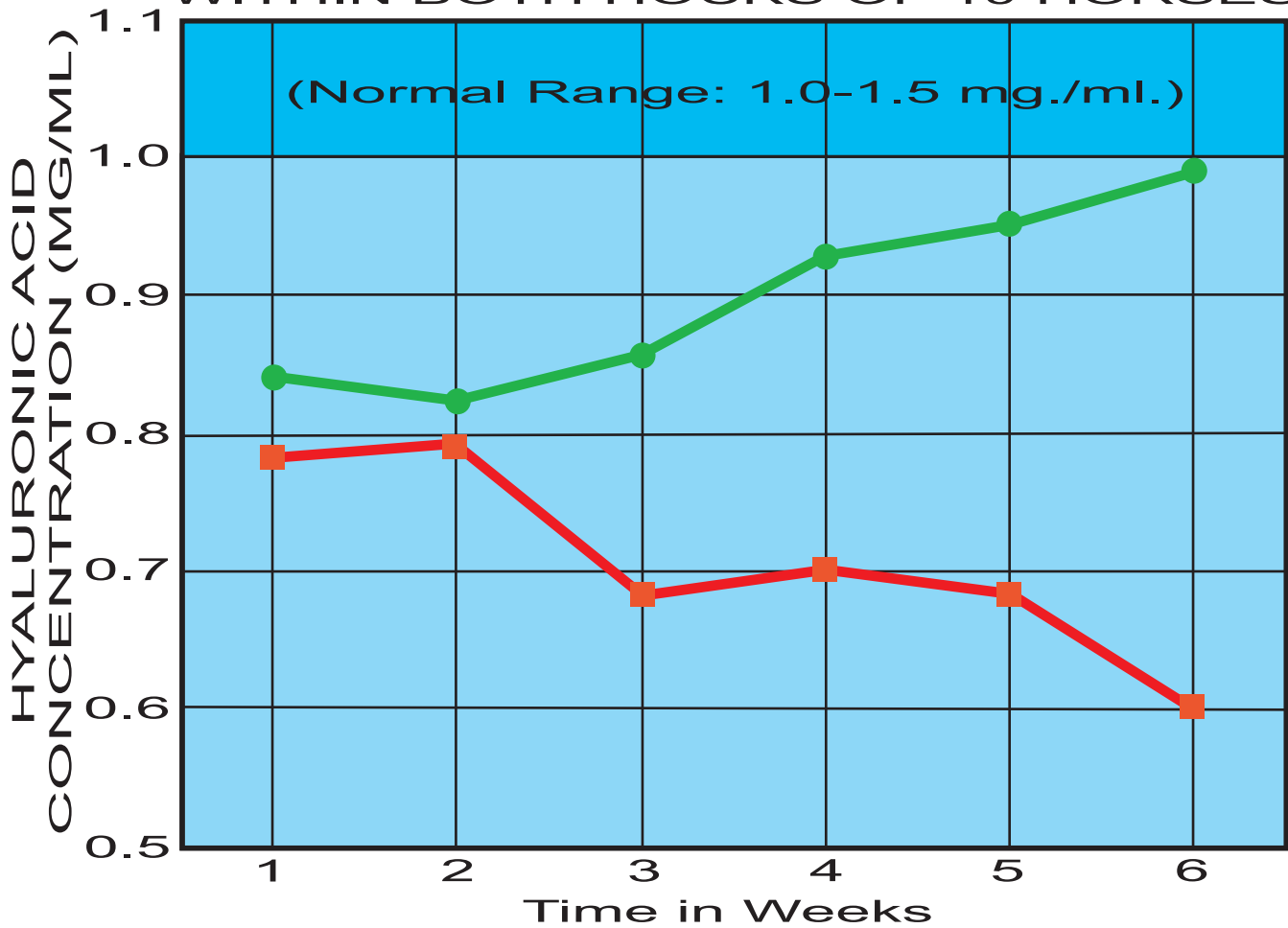
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THE AVERAGE HYALURONIC ACID CONCENTRATION (MG/ML) LEVELS WITHIN THE SYNOVIAL FLUID OF BOTH THE RIGHT AND LEFT HOCKS

TABLE NINE

ANIMAL	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	NORMAL	INCR/DECR
R HOCK	0.84	0.82	0.86	0.93	0.95	0.99	1.0-1.5	0.15
L HOCK	0.78	0.79	0.68	0.7	0.68	0.6	1.0-1.5	0.18

AVERAGE HYALURONIC ACID CONCENTRATION WITHIN BOTH HOCKS OF 10 HORSES

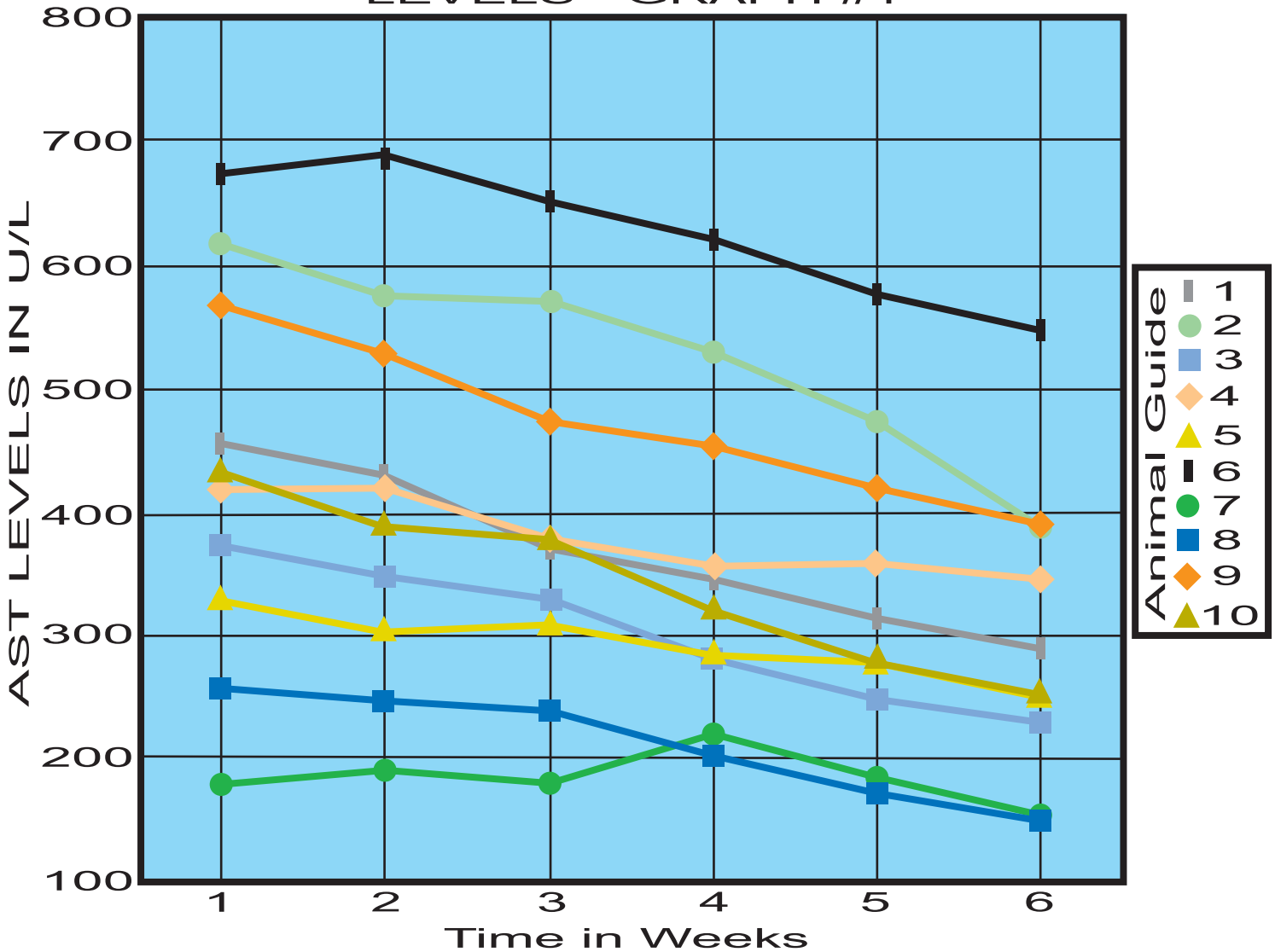


● Averages of Right Hock - Treated with the Equitonic
 ■ Averages of Left Hock - Control Group

**AST AVERAGES FOR ALL TEN ANIMALS
TABLE ONE**

ANIMAL	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	DECREASE
1	465	428	372	346	312	298	167
2	622	584	576	528	473	396	226
3	384	356	336	29	245	220	164
4	411	422	376	353	362	354	57
5	330	301	308	293	287	268	62
6	684	693	650	615	587	543	141
7	184	192	173	212	189	164	20
8	268	257	243	203	173	162	106
9	572	538	479	461	412	395	177
10	533	497	482	426	383	367	166

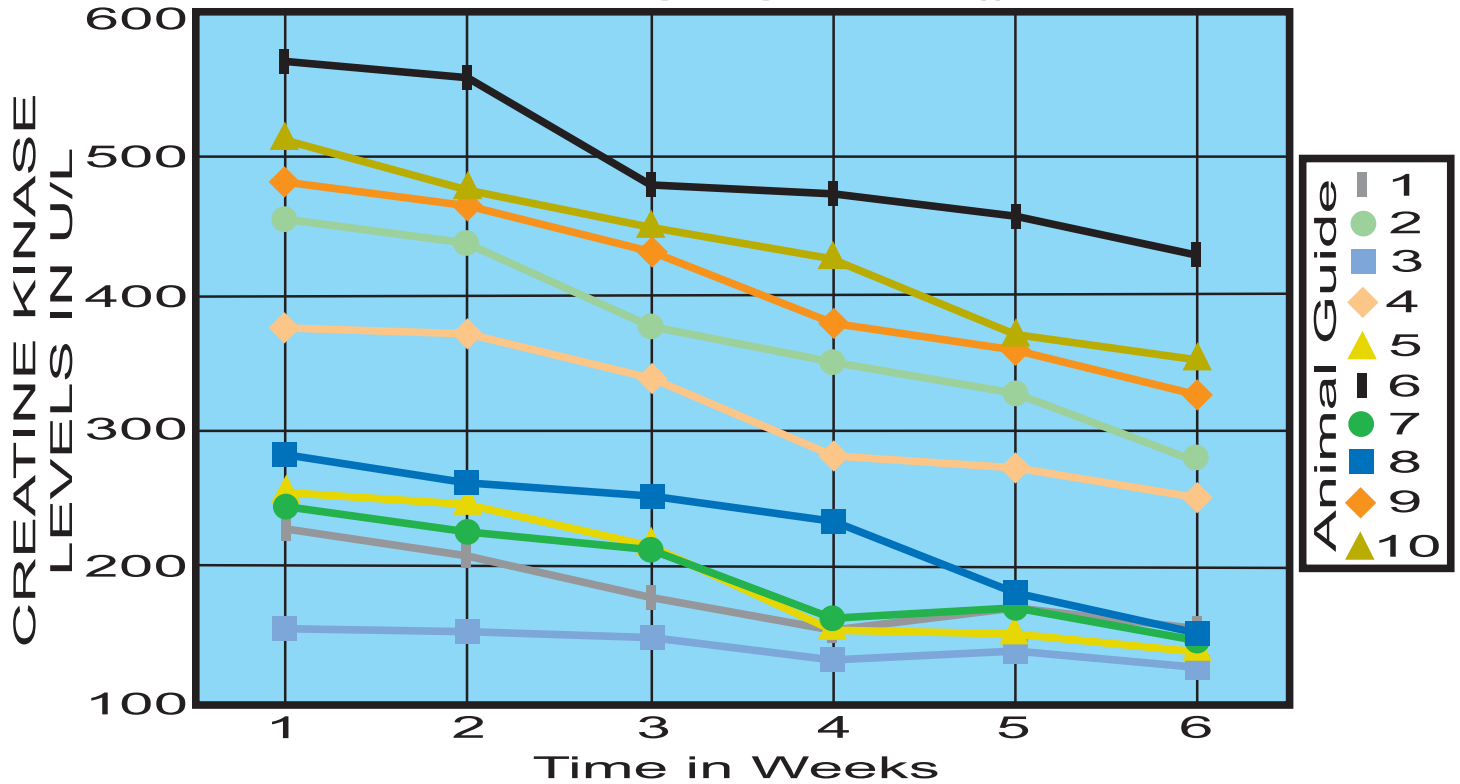
**ASPARTATE AMINOTRANSFERASE
LEVELS - GRAPH #1**



**CREATINE KINASE (CK) (U/L) LEVELS FOR ALL TEN ANIMALS
TABLE TWO**

ANIMAL	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	DECREASE
1	224	203	186	164	174	157	67
2	465	443	387	354	326	284	181
3	164	158	147	132	138	125	39
4	389	374	342	286	274	263	126
5	264	243	212	168	164	133	131
6	574	563	486	478	465	435	139
7	243	228	212	168	172	148	95
8	287	265	252	238	186	142	145
9	487	465	434	382	364	328	159
10	512	486	454	436	380	356	156

**CREATINE KINASE
LEVELS - GRAPH #2**

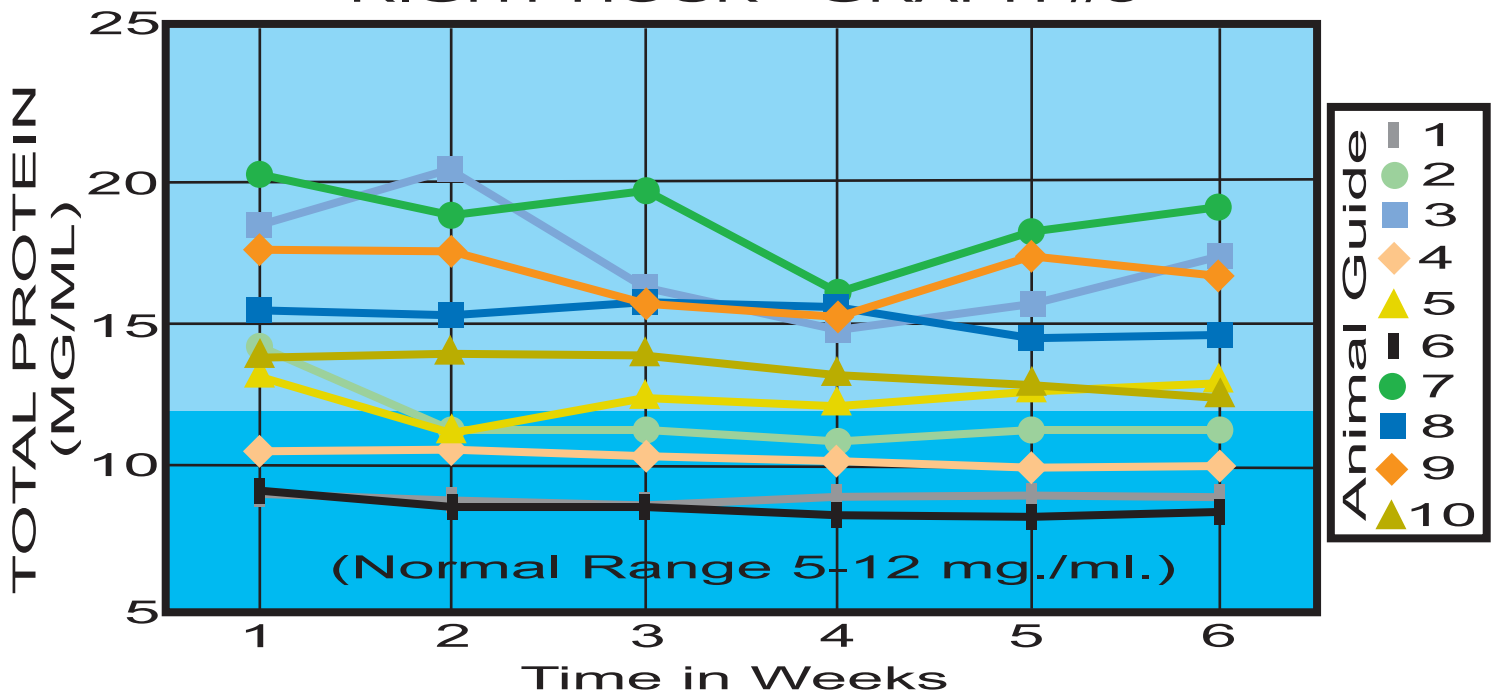


TOTAL PROTEIN (MG/ML) LEVELS WITHIN THE SYNOVIAL FLUID OF THE RIGHT HOCK
TABLE THREE

ANIMAL	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	NORMAL	DECREASE
1	8.6	8.4	8.42	8.5	8.45	8.5	5-12	0.1
2	14.6	12.4	12.6	11.5	12.4	12	5-12	2.6
3	18.4	20.2	16.4	14.8	15.4	17.3	5-12	1.1
4	10.4	10.8	10.6	10.4	10	10.2	5-12	0.2
5	13.6	11.2	12.8	12.4	13.2	13.6	5-12	0
6	9.4	8.6	8.8	7.8	7.8	8.2	5-12	1.2
7	20.5	18.6	19.5	16.4	18.4	18.8	5-12	1.7
8	15.6	15.2	16.2	15.4	14.6	14.8	5-12	0.8
9	17.4	17.2	15.9	15.6	16.8	16.4	5-12	1
10	14	14.6	14.2	13.7	13.6	13.2	5-12	0.8

*The Average Decrease in Total Protein Within the Synovial Fluid is .95 mg/ml.

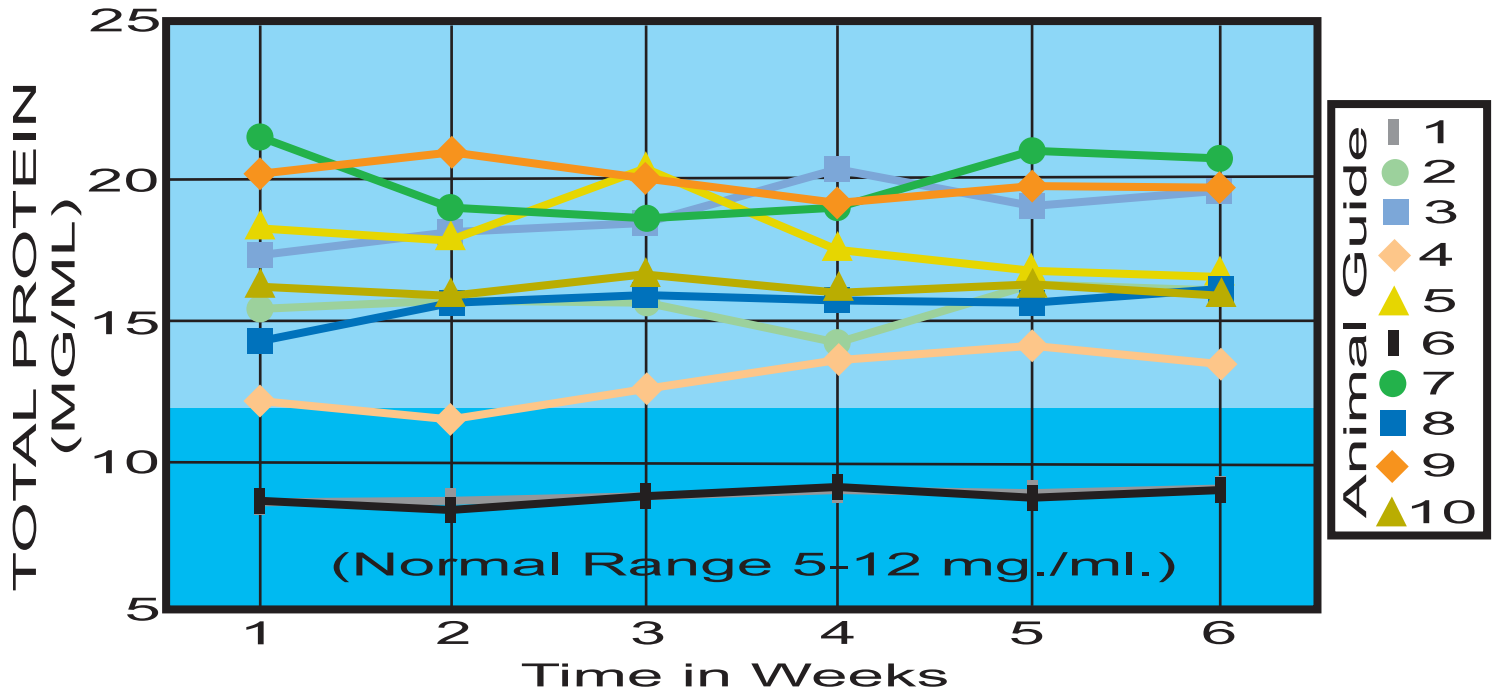
TOTAL PROTEIN LEVELS WITHIN THE SYNOVIAL FLUID OF THE RIGHT HOCK - GRAPH #3



TOTAL PROTEIN (MG/ML) LEVELS WITHIN THE SYNOVIAL FLUID OF THE LEFT HOCK
TABLE FOUR

ANIMAL	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	NORMAL	DECREASE
1	8.4	8.4	8.6	8.8	8.6	8.8	5-12	0.2
2	15.4	15.6	15.4	14.6	16.4	16	5-12	0.8
3	17.2	18.6	18.8	20.2	18.6	19.5	5-12	2.3
4	12.4	11.6	13.2	14	14.6	13.6	5-12	1.2
5	18.2	17.4	20.4	17.2	16.6	16.6	5-12	1.6
6	8	7.6	8.2	8.5	7.8	8.3	5-12	0.3
7	22	18.4	17.3	18.4	21.2	20.8	5-12	1.2
8	14.2	15.6	16.2	16	15.7	16.5	5-12	2.3
9	20.1	20.9	20	18.8	19.6	19.4	5-12	0.7
10	16.8	16.4	17.2	16.8	17.1	17	5-12	0.2

TOTAL PROTEIN LEVELS WITHIN THE SYNOVIAL FLUID OF THE LEFT HOCK - GRAPH #4



COLOR APPEARANCE OF THE SYNOVIAL FLUID WITHIN BOTH HOCKS - TABLE FIVE

ANIMAL	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	NORMAL
#1 RT.	C/PY	C	C	C	C	C	C/PY
#1 LT.	C/PY	C	C	C/PY	C/PY	C/PY	C/PY
#2 RT.	C/PY	C/PY	C	C	C	C	C/PY
#2 LT.	C/PY	C/PY	C/PY	C/PY	C/PY	C/PY	C/PY
#3 RT.	PY	PY	PY	PY	PY	PY	C/PY
#3 LT.	PY	PY	PY	PY	PY	PY	C/PY
#4 RT.	C/PY	C/PY	C	C	C	C	C/PY
#4 LT.	C/PY	C/PY	C/PY	C/PY	C/PY	C/PY	C/PY
#5 RT.	YEL	YEL	C/PY	C/PY	C/PY	C/PY	C/PY
#5 LT.	YEL	YEL	YEL	YEL	YEL	YEL	C/PY
#6 RT.	C	C	C	C	C	C	C/PY
#6 LT.	C	C	C	C	C	C	C/PY
#7 RT.	PY/OPAQ	PY/OPAQ	PY/OPAQ	PY/OPAQ	PY/OPAQ	PY/OPAQ	C/PY
#7 LT.	PY/OPAQ	PY/OPAQ	PY/OPAQ	PY/OPAQ	PY/OPAQ	PY/OPAQ	C/PY
#8 RT.	PY	PY	PY	PY	PY	PY	C/PY
#8 LT.	PY	PY	PY	PY	PY	PY	C/PY
#9 RT.	YEL/FLOC	YEL/FLOC	YEL/FLOC	YEL/FLOC	YEL	YEL	C/PY
#9 LT.	YEL	YEL	YEL	YEL	YEL	YEL	C/PY
#10 RT.	PY/OPAQ	PY/OPAQ	PY	PY	PY	PY	C/PY
#10 LT.	PY/OPAQ	PY/OPAQ	PY/OPAQ	PY/OPAQ	PY/OPAQ	PY/OPAQ	C/PY

C = Clear Sample With No Opacity or Yellow Color

PY = Pale Yellow in Color

YEL = Yellow in Appearance

OPAQ = Opaque in Color

FLOC = Flocculent Material Present

G = Good; Formation of a Single, Compact Clot

F = Fair: Formation of a Single, Soft Clot in a Turbid Solution

P = Poor; Friable Clot in a Cloudy Suspension

VP = Very Poor: Flecks of Precipitate in a Cloudy Suspension

MUCIN CLOT QUALITY WITHIN THE SYNOVIAL FLUID OF BOTH HOCKS - TABLE SIX

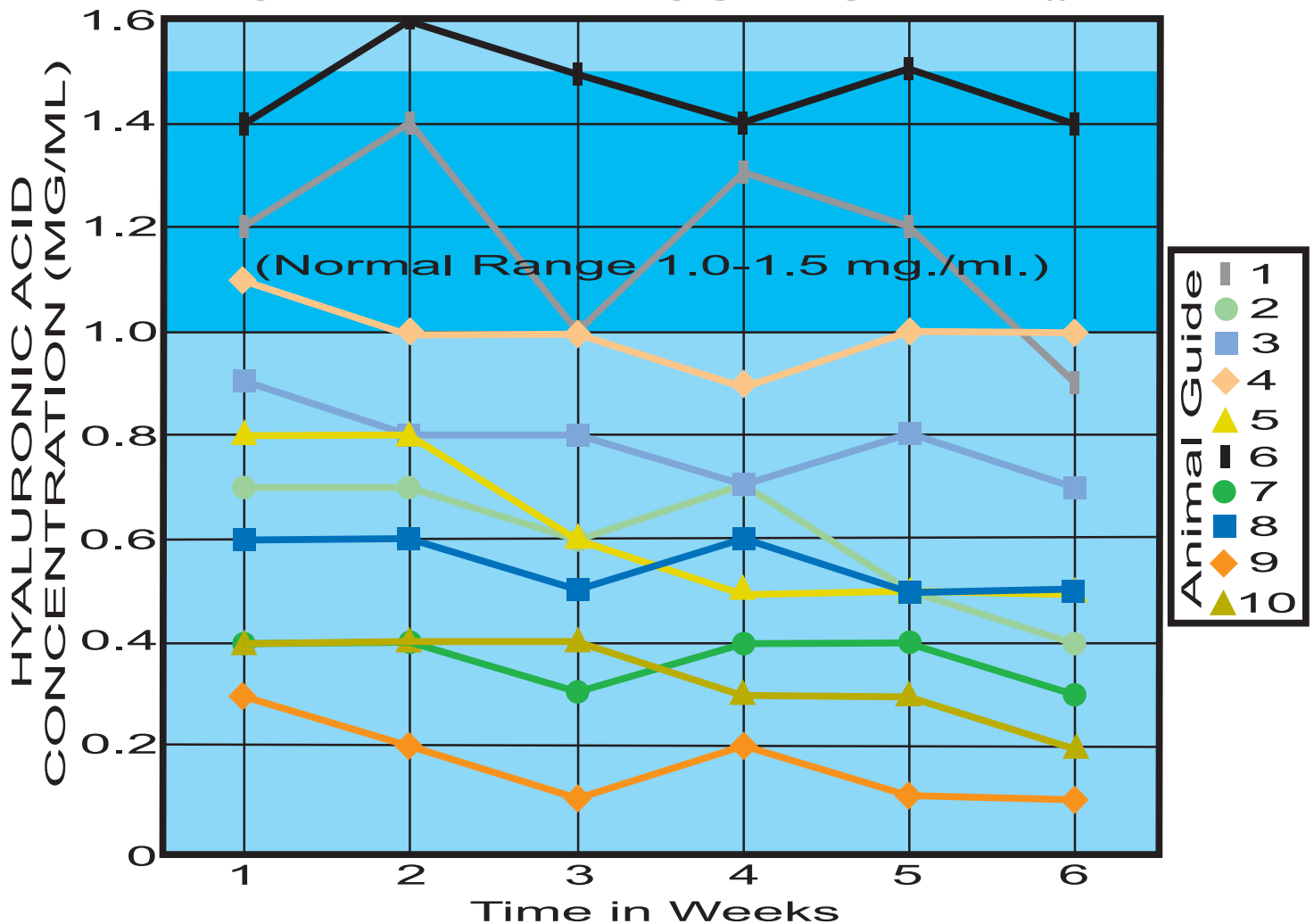
ANIMAL	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	NORMAL
#1 RT.	G	G	G	G	G	G	G
#1 LT.	G	G	G	G	G	G	G
#2 RT.	F	F	G	G	G	G	G
#2 LT.	F	F	F	F	F	F	G
#3 RT.	F	F	F	F	G	G	G
#3 LT.	F	F	F	F	F	F	G
#4 RT.	G	G	G	G	G	G	G
#4 LT.	G	G	G	G	G	G	G
#5 RT.	F	F	G	G	G	G	G
#5 LT.	F	F	F	F	P	P	G
#6 RT.	G	G	G	G	G	G	G
#6 LT.	G	G	G	G	G	G	G
#7 RT.	P	P	P	F	F	F	G
#7 LT.	P	P	P	P	P	P	G
#8 RT.	F	F	F	F	F	F	G
#8 LT.	F	F	F	F	F	F	G
#9 RT.	F	F	G	G	G	G	G
#9 LT.	P	P	P	P	P	P	G
#10 RT.	F	G	G	G	G	G	G
#10 LT.	F	F	F	F	F	F	G

**HYALURONIC ACID CONCENTRATION (MG/ML) LEVELS WITHIN
THE SYNOVIAL FLUID OF THE LEFT HOCK**

TABLE SEVEN

ANIMAL	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	NORMAL	INCR/DECR
1	1.2	1.4	1	1.3	1.2	0.9	1.0-1.5	0.3
2	0.7	0.7	0.6	0.7	0.5	0.4	1.0-1.5	0.3
3	0.9	0.8	0.8	0.7	0.8	0.7	1.0-1.5	0.2
4	1.1	1	1	0.9	1	1	1.0-1.5	0.1
5	0.8	0.8	0.6	0.5	0.5	0.5	1.0-1.5	0.3
6	1.4	1.6	1.5	1.4	1.5	1.4	1.0-1.5	0
7	0.4	0.4	0.3	0.4	0.4	0.3	1.0-1.5	0.1
8	0.6	0.6	0.5	0.6	0.5	0.5	1.0-1.5	0.1
9	0.3	0.2	0.1	0.2	0.1	0.1	1.0-1.5	0.2
10	0.4	0.4	0.4	0.3	0.3	0.2	1.0-1.5	0.2

**HYALURONIC ACID CONCENTRATION
LEVELS WITHIN THE SYNOVIAL FLUID
OF THE LEFT HOCK - GRAPH #7**

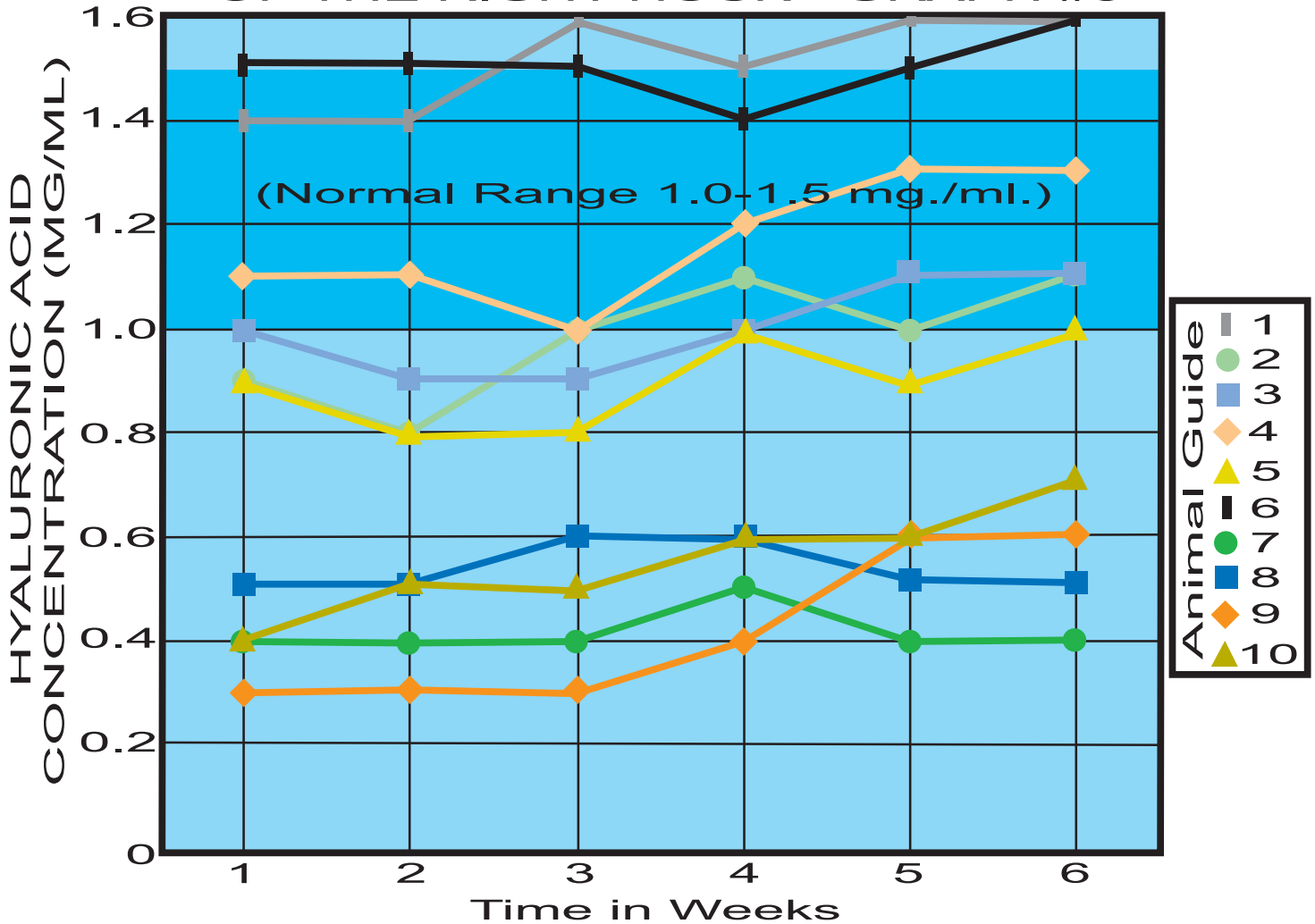


HYALURONIC ACID CONCENTRATION (MG/ML) LEVELS WITHIN THE SYNOVIAL FLUID OF THE RIGHT HOCK

TABLE EIGHT

ANIMAL	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5	WEEK 6	NORMAL	INCR/DECR
1	1.4	1.4	1.6	1.5	1.6	1.6	1.0-1.5	0.2
2	0.9	0.8	1	1.1	1	1.1	1.0-1.5	0.2
3	1	0.9	0.9	1	1.1	1.1	1.0-1.5	0.1
4	1.1	1.1	1	1.2	1.3	1.3	1.0-1.5	0.2
5	0.9	0.8	0.8	1	0.9	1	1.0-1.5	0.1
6	1.5	1.5	1.5	1.4	1.5	1.6	1.0-1.5	0.1
7	0.4	0.4	0.4	0.5	0.4	0.4	1.0-1.5	0
8	0.5	0.5	0.6	0.6	0.5	0.5	1.0-1.5	0
9	0.3	0.3	0.3	0.4	0.6	0.6	1.0-1.5	0.3
10	0.4	0.5	0.5	0.6	0.6	0.7	1.0-1.5	0.3

HYALURONIC ACID CONCENTRATION LEVELS WITHIN THE SYNOVIAL FLUID OF THE RIGHT HOCK - GRAPH #8



RESULTS AND DISCUSSION:

Serological Results:

Serum samples were obtained each week and evaluated for AST (Aspartate Aminotransferase) and CK (Creatine Kinase) levels. In all ten of the animals, these levels dropped throughout the entire six-week duration of the study.

(See tables one and two and their respective graphs, p.3-4)

Aspartate Aminotransferase is abbreviated AST and is a synonym for the old term SGOT (serum glutamic oxaloacetic transaminase). This enzyme occurs in almost all cells within the body but it is used to primarily diagnose disorders within the tissues of the liver and muscles. These two tissues have the highest activity of this enzyme. This enzyme in itself is not specific for a liver disorder but is more diagnostic for disorders within the muscle tissues.

Aspartate Aminotransferase is present in the mitochondria and the cytoplasmic fluid within the cells. The serum levels of this enzyme are increased following hard exercise or skeletal muscle injury. Circulating concentrations of this enzyme will peak approximately 24 hours after an inciting incident and return to normal within 7-10 days.

The lowering of the AST levels can be attributed to a decrease within the inflammatory response within the muscle tissues. Only the right half of the animal was treated and the decrease within the AST levels correlated with a definite desensitization within the musculature along the lumbar spine along the treated side only. This was determined through digital palpation of these anatomical areas. This was especially evident the day after a hard training session when the right side palpated as being less painful than the left.

Creatine Kinase is abbreviated CK and is the most origin specific of all the clinical enzymes. Most serum CK activity levels are from muscular origin. The plasma half-life of this enzyme is short and will peak as early as six hours. However, after an inciting incident, this enzyme will then only take 2-3 days to return to normal.

All ten of the subjects within the study experienced a drop in their serum CK activity levels during the six-week duration. This can be attributed to a reduction within the inflammatory response within the musculature even during hard training.

Joint Fluid Analysis:

Total Protein Concentration

Synovial fluid is a filtrate of the plasma and the proteins that it contains are in direct proportion to those proteins found within the plasma. Under normal conditions, the large molecular weight proteins are excluded from the synovial fluid. When there is an inflammatory condition within the synovial membranes, this filtration system becomes “leaky” and the quantity and the molecular weight of the proteins escaping from the plasma into the synovial fluid increases. This process is called effusion. Therefore, there is a direct correlation between the increase within the total protein content of the synovial fluid and the amount of inflammation within the synovial membrane.

The data within table three and its corresponding graph reveal a slight decrease within the total protein concentration, within the synovial fluid content, in all ten animals that were treated on the right side. Five of the ten animals experienced an immediate drop within the first week of the study whereas the other five decreased gradually throughout the six-week duration. Those animals that started with total protein concentration levels within the normal limits of 5-12mg./ml. experienced a lesser drop than those animals with higher levels at the initiation.

The data within table four and its corresponding graph reveal the total protein concentrations within the control side (left) of the animals. Seven of the ten animals experienced an increase within the total protein concentration values during the six weeks. Three of the animals within this group experienced a slight decrease in concentration values. These decreases could be theorized as less trauma to these hocks due to the animal placing more weight upon the treated limb.

The Physical Appearance of Synovial Fluid

Equine synovial fluid should be either clear or pale yellow in color with no opacity or suspended particulate material. Six of the ten animals within the study started the study with normal appearing synovial fluid; four did not.

(See table six on page 7)

Animal #1: Both synovial samples from this animal revealed normal color upon the initiation of the study. After the second week, the synovial fluid originating from the right tarsocrural joint went from being pale yellow in appearance to being clear. The left (control) sample changed from a clear/pale yellow sample to a clear sample during weeks two and three back to a clear/pale yellow sample till the end of the study.

Animal #2: Both synovial fluid samples from this animal were clear/pale yellow in appearance. The sample from the right tarsocrural joint changed to being a clear sample after three weeks. The sample from the left tarsocrural joint remained unchanged throughout the study.

Animal #3: Both of the samples from this animal remained unchanged throughout the study. They all remained pale yellow (normal) in appearance.

Animal #4: The samples from this animal mirrored the samples obtained from the second animal in the study. The synovial fluid taken from the right tarsocrural joint became clear after three weeks whereas the left remained unchanged.

Animal #5: Initially both samples were light yellow in appearance. After three weeks, the treated right side lightened to a clear/pale yellow appearance. The fluid obtained from the untreated left side remained unchanged.

Animal #6: The synovial fluid samples taken from both the right and left tarsocrural joints remained clear throughout the study.

Animal #7: All of the samples taken from this animal from both the right and left tarsocrural joints remained pale yellow and slightly opaque in color throughout the entire duration of the study.

Animal #8: All of the synovial fluid samples taken from this animal remained pale yellow in appearance throughout the entire six weeks of the study.

Animal #9: During the first four weeks of the study, the fluid taken from the right tarsocrural joint appeared yellow in color with the presence of some flocculent material. The samples taken during week five and six revealed a disappearance of the flocculent material and the yellow color become slightly lighter. The synovial fluid samples taken from the left tarsocrural joint remained yellow in color throughout the entire six weeks.

Animal #10: The synovial fluid collected from the right tarsocrural joint was pale yellow in color with a slightly opaque aspect for the first two weeks of the study. During the third week, the opacity disappeared from these samples. The color of the samples collected from the untreated left tarsocrural joint remained pale yellow and opaque in appearance throughout the entire six weeks of the study.

Mucin Clot Quality

Using an aqueous solution of acetic acid combined with synovial fluid, a mucinous clot of acid-glycoprotein will be formed. The quality of this clot is a representative indicator of the viscous property and quality of hyaluronic acid present in the synovial fluid.

(See table six on page 7)

There are four classifications of this clot that can be named or numbered. They are:

1. **Good:** This is the best score and indicates the formation of a single, compact clot.
2. **Fair:** After the completion of this test there is a single, soft clot in a turbid solution.
3. **Poor:** This result yields a friable clot in a cloudy suspension.
4. **Very Poor:** The completion of the test reveals no clot formation; only flecks of precipitate in a cloudy solution.

Animal #1: All of the mucin clot tests were classified good throughout the duration of the entire study for both the left and right tarsocrural joints.

Animal #2: The synovial fluid collected from the left tarsocrural joint resulted in a fair clot throughout the entire six weeks. The synovial fluid collected from the right tarsocrural joint graded fair the first two weeks and then changed to reveal a good clot thereafter.

Animal #3: The mucin clot quality remained fair throughout the entire six weeks for the synovial fluid collected from the left tarsocrural joint. The mucin clot quality graded fair for the first four weeks of the study on those samples collected from the right tarsocrural joint which then graded good the final two weeks.

Animal #4: Samples from both the right and left tarsocrural joint graded good throughout the entire study.

Animal #5: The samples from the right tarsocrural joint graded good after being only fair the first two weeks. The samples from the left tarsocrural joint graded fair for the four weeks and then deteriorated to a poor rating the last two weeks.

Animal #6: The synovial fluid samples from both the right and left tarsocrural joints graded good throughout the study.

Animal #7: Both the right and left samples graded poor initially. The samples collected from the right tarsocrural joint improved to fair the final three weeks of the study whereas the samples collected from the left (control) tarsocrural joint remained poor throughout the study.

Animal #8: The samples collected from both the right and left tarsocrural joints graded fair throughout the study.

Animal #9: The samples from the right tarsocrural joint graded fair the first two weeks of the study and then improved to good thereafter. The samples collected from the left tarsocrural joint graded poor throughout the study.

Animal #10: Both the left and right samples graded fair initially. The samples collected from the right tarsocrural joint improved to a good grade beginning the second week of the study whereas the left tarsocrural joint samples remained fair throughout.

Hyaluronic Acid Concentration

Lubrication of the equine tarsocrural joint is dependent upon two systems. There is the soft tissue system and the cartilage on cartilage system. Both of these systems rely on molecules of hyaluronate that are found within the synovial fluid. These molecules of hyaluronate, along with other fluids within the synovial fluid, form a boundary between these anatomical structures. Therefore, the concentration of the hyaluronic acid within the synovial fluid becomes significant in that a lower concentration results in a compensated lubrication within these joint systems.

The results of the hyaluronic acid (H.A.) concentration within the collected synovial fluid samples are as follows:

(See tables seven and eight and their corresponding graphs, p.8-9)

Animal #1: The mucin clot quality was good throughout the entire duration of the study for both the right and left tarsocrural joints. Therefore, the initial values for both the right and left tarsocrural joints were within the normal range for a racing standardbred in heavy training. The concentration of hyaluronic acid did decrease within the untreated left side and did increase within the treated right.

Animal #2: The initial values were slightly below normal in both the right and left tarsocrural joints. As the study progressed, the values for the left hock gradually fell whereas those of the right hock rose slightly.

Animal #3: Initially, the values for both tarsocrural joints were just slightly below normal. Those concentration levels within the right joint rose slightly to within normal limits whereas those values found within the left joint gradually fell.

Animal #4: The H.A. concentration levels were within normal limits initially for both tarsocrural joints. The values of the right side rose throughout the six weeks whereas those values collected from the left tarsocrural joint fell only slightly.

Animal #5: The initial H.A. concentration levels were just below normal limits for both the right and left tarsocrural joints. The values of the samples collected from the right tarsocrural joint increased to the lowest of the normal values whereas the values of those collected from the left tarsocrural joint dropped 62.5%.

Animal #6: The H.A. concentration levels collected from samples from both tarsocrural joints remained within the normal parameters throughout the entire duration of the study.

Animal #7: The H.A. concentration levels were quite low for both the right and left tarsocrural joints. Those levels found within the left tarsocrural joint dropped only slightly whereas those found within the right tarsocrural joint remained unchanged throughout the study.

Animal #8: The samples from both the right and left tarsocrural joints remained unchanged throughout the duration of the study.

Animal #9: Initially, the samples were both below normal values. The samples collected from the right tarsocrural joint gradually rose throughout the study whereas those samples from the left tarsocrural joint gradually fell.

Animal #10: The samples collected from this animal followed the same pattern as those found with animal #9.

Cytological Examination

Synovial fluid was collected into tubes that contained salts of EDTA to allow cytological examination. Total erythrocyte and leukocyte counts were made from each sample.

In all the samples taken, the total number of leukocytes present were within the normal limits. In those samples that contained blood, the source of the erythrocytes was from the rupture of subsynovial capillaries that occurred during the aspiration technique. None of the samples depicted blood that was from an acute arthritic condition.

An examination for bacteria was made in each sample collected. There were no bacteria found in any of the samples throughout the study.

SUMMARY:

- In all ten animals the AST and CK levels dropped throughout the duration of the study. This reflected a decrease in the inflammatory response within the muscle tissues of the animals even during hard training.
- There is a slight decrease within the total protein content of the synovial fluid collected from the right tarsocrural joint. This is caused by a decrease within the inflammatory response within the tissues of the synovial membrane resulting in less effusion of the large plasma proteins into the synovial fluid.
- Seven of the ten animals depicted an increase in the total protein content within the synovial fluid samples collected from the left tarsocrural joints. This side was untreated which allowed an inflammatory response to exist within the synovial membranes of the left tarsocrural joint. This inflammatory reaction, resulting from hard training, allowed larger plasma protein molecules to “leak” into the synovial fluid.
- Three of the ten animals depicted a decrease in total protein content within the synovial fluid samples collected from the left tarsocrural joint. It could be theorized that the animal was placing more weight on the treated right hind limb resulting in lesser amounts of trauma to the left. Therefore, the inflammatory response on the left was lessened to some degree by treatment upon the right.

- Six of the synovial fluid samples collected from the right tarsocrural joint improved in color and appearance during the duration of the study. Most of this change in appearance occurred within the first three weeks of the study.
- Only one of the samples collected from the left tarsocrural joint changed in color or appearance during the duration of the study.
- Six of the ten animals improved the quality of the mucin clot obtained from testing the synovial fluid collected from the right tarsocrural joints during the duration of the study. This indicates that there a lesser degree of polymerization of hyaluronic acid within the synovial fluid.
- One of the samples (animal #5) revealed a decrease in the quality of the mucin clot within the synovial fluid collected from the left tarsocrural joint. This indicated an increased polymerization of the hyaluronic acid within the synovial fluid of the left tarsocrural joint.
- In eight of the ten animals, the hyaluronic acid concentration increased within the synovial fluid of the right tarsocrural joints. The average increase in the hyaluronic acid concentration within the synovial fluid samples collected from all of the right tarsocrural joints during the duration of the study was 0.15mg./ml.
- In nine of the ten animals, the hyaluronic acid concentration decreased within the synovial fluid of the left tarsocrural joints. The average decrease within the hyaluronic acid concentration within the synovial fluid samples collected from all of the left tarsocrural joints was 0.18mg./ml.

Correlating both the serum chemistry findings and the synovial fluid analysis results reveals proof that the Equisonic QGM 4.0 unit is effective in reducing the inflammatory response within the tarsocrural joint of the racing standardbred.

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