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## **Racehorse Study**

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**THE CORRELATION OF TRAINING  
TIMES, THERMOGRAPHIC AND SERUM  
CHEMISTRY LEVELS TO PROVIDE EVIDENCE AS TO  
THE EFFECTIVENESS OF THE USE OF ORAL ALAVIS  
MSM (METHYLSULFONYLMETHANE) UPON  
THE MUSCULATURE OF THE RACING  
STANDARD BRED**

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# **THE CORRELATION OF TRAINING TIMES, THERMOGRAPHIC AND SERUM CHEMISTRY LEVELS TO PROVIDE EVIDENCE AS TO THE EFFECTIVENESS OF THE USE OF ORAL ALAVIS MSM (METHYLSULFONYLMETHANE) UPON THE MUSCULATURE OF THE RACING STANDARDBRED**

**Introduction:** ALAVIS MSM, given orally to the equine athlete, is taken up by every cell as part of the organo-sulfur molecules. All of the case studies in the literature are anecdotal yet all those in equine practice, for any period of time, have seen improvement within those animals to which it was administered.

Methylsulfonylmethane (MSM) is a natural component within the environment. Each molecule of MSM is one-third sulfur by weight. It contains two hydrocarbon units attached to a unit with one sulfur and two oxygen atoms. It is found in both plants and animals (including horses and humans). Commercially, it is an oxidation product (enzymatic conversion) of DMSO, which is also from the natural environment. In fresh plants it is very volatile and is lost upon drying. An example of this is fresh alfalfa is very high in MSM but alfalfa hay is not.

When given orally to the racing standardbred, Alavis MSM serves as an organic source of sulfur. The element sulfur has a long history of medicinal attributes. Ancient Greeks, Mozart and Beethoven all bathed in the naturally occurring sulfur springs and reported relief from their numerous ailments. The proven medicinal actions of sulfur (MSM) are as follows:

- ◆ Sulfur is needed to provide biochemical functions in the formation of the cross-bridges/ links between the collagen molecules. This alters the formation of scar tissue.
- ◆ These sulfur cross-bridges also add strength and stability to the collagen rich tissues such as tendons, ligaments and joint tissues.
- ◆ MSM acts as a cholinesterase inhibitor which stops the excessive passage of nerve impulses from one nerve cell to the next. This reduces muscle spasm and promotes muscle relaxation.
- ◆ MSM has the ability to pass through the cellular membranes of the body.
- ◆ MSM has an anti-inflammatory action in that it renders the bodies own natural anti-inflammatory hormone more effective at lower doses. This hormone is cortisol that is produced by the adrenal glands. It has been shown in the literature that oral administration of MSM has allowed a reduction in swelling with a lowered dose of administered cortisone.
- ◆ The administration of MSM inhibits fibroblast proliferation which reduces the formation of scar tissue.

- ◆ The administration of oral MSM has been shown to be incorporated into the amino acids methionine and cysteine. These are essential for the synthesis of protein.

The racing standardbred is subjected to constant strain and trauma from normal training regimes. If proper administration of ALAVIS MSM would provide analgesia and an anti-inflammatory action, the quality of life and athletic potential for these animals would be greatly enhanced.

**Goals:** Questions that will be answered.

- ◆ What is the ideal dosage of oral ALAVIS MSM for the 500kg animal?
- ◆ What will be the thermographic effect and the duration of these effects to the standardbred following oral administration of ALAVIS MSM?
- ◆ Will there be an improvement in performance (i.e. racing times) within the animals given oral ALAVIS MSM?
- ◆ Will there be any effect on the serum chemistries within the animals receiving oral ALAVIS MSM?
- ◆ During the racing season, are the animals receiving oral ALAVIS MSM less prone to routine lameness problems?

**Procedure:** Thirty standardbred racehorses will be used for the study. Each will be three or four years of age and will have the same level of training and similar exercise regimes. All will have a history of having no intra-articular injections within the last three weeks. All topical applications to the animal will have been withdrawn within the last three weeks. These animals will be thermographically symmetrical within 25%.

These animals will then be divided randomly into three groups of ten animals each. The first group will be the control group. The second group will receive 10 grams of ALAVIS MSM orally each day through the use of a dose syringe. The third group will receive 20 grams of ALAVIS MSM orally each day. The study will last for 12 weeks.

Each animal will be thermographed initially and then at the following intervals:

1. 24 hours
2. 48 hours
3. 72 hours
4. 96 hours
5. 5 days
6. 6 days
7. 7 days
8. 9 days
9. 11 days
10. 13 days
11. 15 days
12. Every 3 days until six weeks has passed.

After six weeks the animals will be thermographed every five days for another six weeks.

Infrared thermography provides an image depicting the quanta of thermal radiation being emitted from the subject. This is a measurement of surface temperature that is a reflection of the underlying tissues. Therefore, if there is an inflammatory process present within the underlying tissues, the thermal gradients within that anatomical area will exhibit an increase within the measured thermal gradients.

Blood samples will be drawn initially and at weekly intervals to be submitted for serum chemistry analysis. These samples will be tested for the following parameters:

1. Complete blood count:
  - ❖ RBC count.
  - ❖ WBC count
  - ❖ Packed cell volume
  - ❖ The types of WBC's
2. Serum chemistry analysis:
  - ❖ Albumin levels – 35-50% of the serum protein
  - ❖ Alkaline Phosphatase levels – hepatic function
  - ❖ BUN – renal function
  - ❖ Calcium – calcium metabolism
  - ❖ Creatinine – renal function
  - ❖ Glucose – measured to monitor other diseases
  - ❖ Magnesium – magnesium metabolism
  - ❖ Phosphorus – phosphorus metabolism
  - ❖ **AST (Aspartate aminotransferase)** (SGOT)
  - ❖ Serum protein – nutritive function
  - ❖ Total bilirubin – hepatic function
  - ❖ Sodium – electrolyte balance
  - ❖ Potassium – electrolyte balance
  - ❖ Chloride – electrolyte balance
  - ❖ GGT – renal function
  - ❖ **CK (Creatine kinase)**
  - ❖ A/G ratio – albumin/globulin ration: total protein values
  - ❖ Globulin – calculated by subtracting the albumin conc. from the total protein concentration
  - ❖ Lipemic index – hepatic function
  - ❖ Hemolytic index – a value that may affect other tests
  - ❖ Icteric index – hepatic function

Aspartate aminotransferase (AST) is an enzyme that occurs in almost all cells within the body. This is a new term and it is a synonym for the old term SGOT (serum glutamic oxaloacetic transaminase). The liver and muscle cells have the highest activity of this

enzyme and its presence within the circulation is used primarily to diagnose liver and muscle disease. In itself it is not specific for a liver disorder but is more diagnostic for 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.

Creatine kinase (CK) is a very organ specific enzyme. Most serum CK activity is from a muscular origin. The plasma half-life of this enzyme is short and will peak as early as six hours. This enzyme will then only take 2-3 days to return to normal.

Racing and training mile records will be kept throughout the entire study.

Each week a lameness evaluation will be made including flexion tests, digital palpation and hoof testers.

## **Results:**

**Group One:** Control: There was no addition of ALAVIS MSM to the diet.

This group exhibited a wide array of thermal gradients when examined thermographically. All had their own unique thermal pattern at the initiation of the study, which then changed over the duration of the twelve weeks. Seven of the ten animals within this group exhibited increases within the thermal gradients during the twelve weeks. This increase in thermal gradients along the back correlated with an increased amount of soreness over the musculature during palpation. The other three animals within this group showed a decrease within the thermal gradients and improved lameness evaluations throughout the twelve weeks.

**(See data sheet entitled “Percent Change in Thermal Gradients when Compared to the Initial Thermograph – Group One” and the following graph of this data)**

Animal #4 was used as an example within this group. This animal exhibited a 78.65% increase within the thermal gradients found along the dorsal surface of the back. This correlated with increased muscle soreness along the right shoulder, the lumbar spine and the anatomical area of the lumbosacral joint and sacrum. As the weeks progressed, the muscle soreness increased upon palpation.

**(See the fourteen sequential thermographs taken within timed intervals during the twelve-week period and the following data from animal #4 and the graph of these thermographic results)**

The only parameters within all of the blood work taken on these animals that showed constant change throughout the study were those of the enzymes AST and CK. There

were some other minor changes within the blood work but these were caused by temporary conditions of dehydration, slight anemia and electrolyte imbalances but these were not at all consistent within the samples taken.

In eight out of the ten animals within this group, there was an increase within the AST levels throughout the twelve weeks. Only animal #2 and #9 revealed a decrease in this enzyme level during this twelve week time period. This increase in the AST levels was significant in that it was evidence to the presence of the inflammatory conditions within the muscle tissues.

**(See the data table entitled “Aspartate Aminotransferase Levels within Group One” and the following graph of this data)**

Animals #2 and #7 were the only animals out of the control group that displayed a decrease within the CK levels. All of the other animals within this group showed a large increase within the enzymatic CK levels. This specific muscle enzyme present in the circulating system is a result of the inflammatory reactions within the musculature of the entire body.

**(See the data table entitled “Creatine Kinase Levels within Group One” and the following graph of this data)**

Correlated to the data collected both thermographically and through the blood work, the training times of the control group one were as expected. Only four out of the ten animals experienced a drop in their training times. These were animals #2, #7, #8 and #9. All of the other animals within this group experienced an increase within their training times with one having an increase of 10.2 seconds.

**(See the data table entitled “Training Times For Group One”)**

**Group Two:** This group received ten grams of ALAVIS MSM orally each day

Thermographically, there was a decrease within the thermal gradients in all ten of the animals within this group. The average decrease within the thermal gradients of this group was 73.45%. Unique to this group is the observation that the decreases within the thermal gradients did not start to occur until the third and fourth week of the study. After the fourth week, the decreases occurred rapidly.

**(See the data chart entitled “Percent Change in Thermal Gradients when Compared to the Initial Thermograph – Group Two” and the following graph of the data)**

The lameness exams that were performed at timed intervals correlated with this data. The first few weeks of the study revealed little change in the palpation of the musculature along the animal's shoulders, lumbar spine, and the anatomical areas surrounding the lumbosacral joint and sacrum. Some animals such as animal #8 even revealed an increased soreness, when compared to the initial exam, for the first two weeks. After

three or four weeks had passed, the soreness that was evident upon palpation started to dissipate.

There are twenty-one sequential thermographs that were taken at timed intervals throughout the twelve-week study of each animal. Animal #9 exhibits the thermograph evidence that is seen within this group. Initially, there is an increase within the thermal gradients that lasts for almost two weeks. Then a drastic change occurs whereas the thermal gradients begin to decrease at a rapid rate. When compared to the initial thermograph, there is a reduction within the thermal gradients of 94.85%. This animal, which was sore over the lumbar areas, and the left shoulder, was almost completely pain free after the twelve-week administration of ALAVIS MSM.

**(See the twenty-one sequential thermographs taken of animal #9 at timed intervals, the data chart entitled “Percent Change in Thermal Gradients when Compared to the Initial Thermograph – Animal #9 – Group Two” and the following graph)**

All ten animals exhibited a decrease in AST levels throughout the entire twelve-week duration of the study. These decreases were more prominent after the animals had been receiving Alavis MSM orally for four to six weeks. The less dramatic decreases are due to the clearance time of 7-10 days for this enzyme.

**(See data table entitled “Aspartate Aminotransferase Levels Within Group Two” and the following graph)**

Animal #9 exhibits an initial increase in AST levels before they start to decline around week five. The AST levels of animal #9 are quite high at first and almost make it into normal range by week twelve.

Creatine kinase levels peak within 24 hours of an inflammatory incident and only take 2-3 days to return too normal. This is an important fact to remember when examining the data from these levels within group two. These levels change very rapidly in response to hard training or a particularly strenuous race. Within this group, however, all ten animals depicted a decrease within these muscle enzyme levels. Seven of the ten animals started this study with higher than normal CK levels and all ten animals finished within normal ranges.

Animal #9 exhibited the biggest drop in CK levels within this group. This animal started the study with a level of 640 U/L and finished with a level of 187 U/L. The normal range for this enzyme in the equine is 60-330 U/L.

**(See data table entitled “Creatine Kinase Levels Within Group Two” and the following graph)**

The training times correlated with the thermographic, AST and CK levels. The training times for this group did not start to fall until the fourth through the sixth week. **The**

**training times of all ten of these animals fell during this twelve week period an average of 2.09 seconds!**

**(See data table entitled “Training Times for Group Two”)**

**Group Three:** This group of ten animals received twenty grams of ALAVIS MSM orally each day.

There was a dramatic and almost immediate response thermographically in each of the ten animals within this group. Within 96 hours all but two of the animals were showing a decrease within the thermal gradients over their musculature. After six days, only one of the group was not showing a decrease within the thermal gradients and this one (animal #4) responded by day thirteen. All ten of the animals decreased within their thermal gradients over 56% with one (animal #6) reaching a 95.00% reduction.

**(See data table entitled “Percent Change in Thermal Gradients When Compared to the Initial Thermograph – Group Three” and the following graph)**

The data table containing the decrease in thermal gradients for animal #6 depicts the rapid onset within this group. After 48 hours the thermal gradients have reduced 10% and within six days they have been reduced to 58.06% of their initial levels. Palpation of this animal revealed pain relief along the lumbar spine within five days after the administration of ALAVIS MSM.

**(See the twenty-one sequential thermographs taken at timed intervals of animal #6, the data table entitled “Percent Change in Thermal Gradients when Compared to the Initial Thermograph – Animal #6 – Group Three” and the following graph)**

The AST levels within group three gradually decreased in all ten animals within this group. The reduction in eight of the ten was within a seven-day period of time. The other two animals started to reduce by week three. These values correlated with the rapid onset of thermal gradient reduction.

**(See data table entitled “Aspartate Aminotransferase Levels Within Group Three” and the following graph)**

The CK results were remarkable in that all ten animals experienced a reduction in CK levels within the first seven days of the study. These all continued to decline at a rapid rate with all but one animal finishing the study within the normal parameters for this enzyme. The #3 animal had a level of 341 U/L whereas 330 U/L is within normal limits. The rapid rate of decent is due to the rapid clearing time of this enzyme from the circulation.

**(See data table entitled “Creatine Kinase Levels Within Group Three” and the following graph)**

**Group three averaged a decrease in training times of 2.62 seconds!** This drop in training time correlates the thermographic and serologic evidence. As the season progresses, the animals do become more physically fit, however some become sore or lame and this reduction in training time is truly remarkable since all ten animals decreased in time.

(See data table entitled "Training Times for Group Three")

### **Conclusions:**

There are numerous conclusions that can be drawn from this study and the study in itself creates new questions that require answers and further investigation.

- The dosage of 20 grams of ALAVIS MSM orally per day has a more rapid effect upon the horse than the administration of a 10-gram dose orally.
- Results were seen in just a few days at the 20-gram level vs. the three to six weeks required for the 10-gram dose to show results.
- To maintain a maintenance level for the equine, the 10-gram dose was sufficient after a period of time of six weeks.
- This study revealed that an initial dose of 20 grams or more for six weeks provided immediate results and these results could be maintained at the 10 gram level after this initial time period.
- The administration of ALAVIS MSM orally has an anti-inflammatory action as evidenced by the reduction within the thermal gradients of both groups two and three.
- The administration of ALAVIS MSM orally has an analgesic effect upon the muscle tissues. The onset of this is very rapid with the administration of 20 grams orally for at least four weeks.
- There is an improvement in performance with animals that receive ALAVIS MSM orally. This is due to the analgesic and anti-inflammatory properties of the ALAVIS MSM.
- There were no side effects after the administration of ALAVIS MSM. The blood work performed upon these animals each week showed no variation within any of the parameters that would indicate anemia, electrolyte imbalances, liver disorders, kidney problems, bowel disorders or any allergic reactions.
- There seemed to be an increase in hoof growth but this was not measured. This was discovered through casual observation and was more prevalent in the group receiving 20 grams orally per day.
- Casual observation revealed an improved hair coat within the group receiving 20 grams per day orally.
- Those animals in group three recovered from exercise faster and manifested a better appetite than those within the other groups.

- Since there were no side effects and only positive results from the administration of ALAVIS MSM, one can only imagine what even higher doses would accomplish.

**Summary:**

This study proves that there is a great benefit to the equine athlete when ALAVIS MSM is administered orally. The animals in the control group did not compare athletically to those two groups that received ALAVIS MSM. The thermographic evidence, the serum chemistry analysis and training times all correlated in the proof that ALAVIS MSM is an effective natural analgesic and anti-inflammatory substance that provides a great benefit not only to the equine athlete but also to all of the equine species that receive it.

## REFERENCES

DiPadove, S. "S-adenyl-methionine in the treatment of osteoarthritis: Review of clinical studies." *American Journal of Medicine*, 1987,83, Supplement 5A: 60-65.

Evans, M. S., et al. "Dimethyl sulfoxide (DMSO) blocks conduction in peripheral nerve C fibers: a possible mechanism of analgesia." *Neuro-science Letters*, 1993, 150: 145-148.

Hucker, H. B. et al. "Studies on the absorption, excretion and metabolism of dimethyl sulfoxide (DMSO) in man." *Journal of Pharmacology and Experimental Therapeutics*, 1967, 155 (2): 309-17.

Huxtable, Ryan J. *Biochemistry of Sulfur*. New York: Plenum Press, 1986.

Jacob, S.W., ed. *Biological Actions of Dimethyl Sulfoxide*, Volume 243. New York: New York Academy of Sciences, 1975.

Jacob, S.W., Lawrence, R.M., Zucker, M. *The Miracle of MSM*. New York: New York: G. P. Putnam's Sons Publishers, 1999.

Lawrence, R.M. "Methylsulfonylmethane (MSM): A double-blind study of its use in degenerative arthritis." *International Journal of Anti-Aging Medicine*, Summer 1998, 1 (1): 50.

Lovelock, J.E. "Atmospheric dimethyl sulphide and the natural sulphur cycle." *Nature*, 237, 1972,452-453.

Mitchell, Stephen C. *Biological Interactions of Sulfur Compounds*. Bristol, PA: Taylor and Francis, 1996.

Richmond, V.L. "Incorporation of methylsulfonylmethane sulfur into guinea pig serum proteins." *Life Sciences*, 1986, 39:263-268.

Tarshis, Barry. *DMSO -The True Story of a Remarkable Pain-Killing Drug*. New York: Morrow, 1981.

# **GROUP ONE: CONTROL**

**SEQUENTIAL THERMOGRAPHIC EVIDENCE OF  
ANIMAL NUMBER FOUR, THE ENTIRE GROUP; AST  
AND CK LEVELS FOR ANIMAL NUMBER FOUR AND  
THE ENTIRE GROUP; TRAINING TIMES**

## ANIMAL #4 -- GROUP ONE

1

2

3

4

5

6

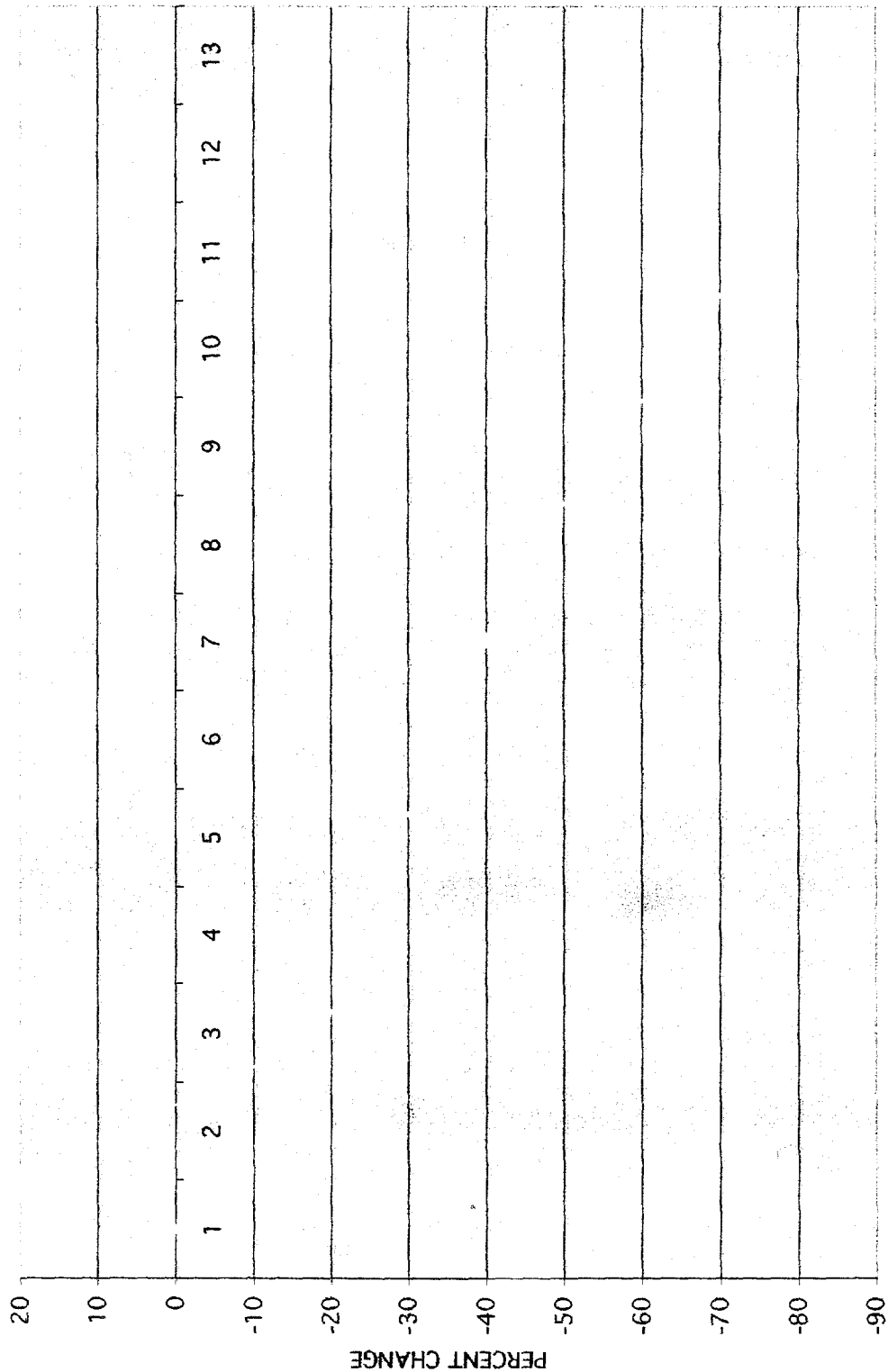
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9

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PERCENT CHANGE IN THERMAL GRADIENTS WHEN COMPARED TO THE INITIAL  
THERMOGRAPH - ANIMAL #4

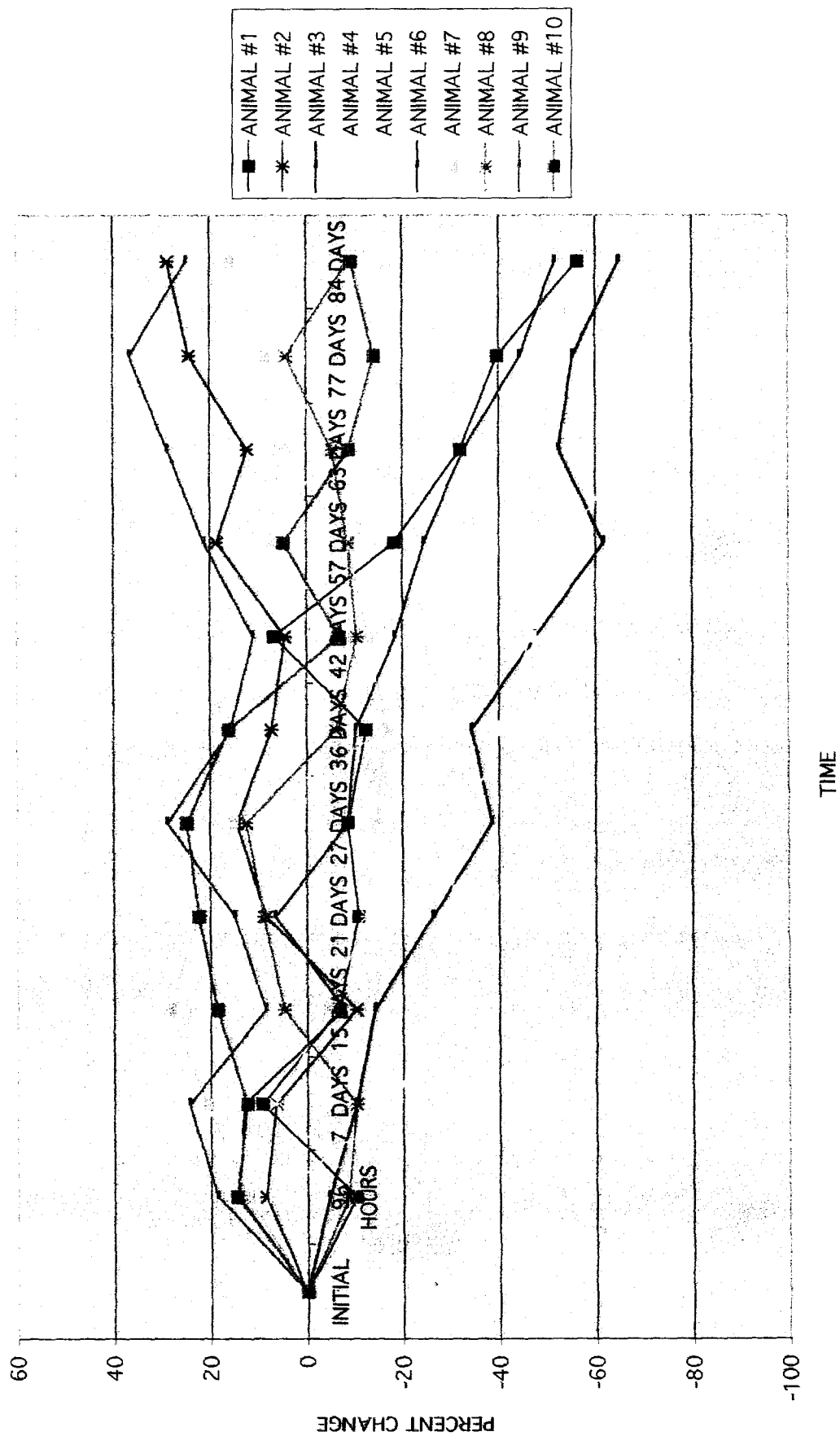


ANIMAL #4

PERCENT CHANGE IN THERMAL GRADIENTS WHEN COMPARED TO THE INITIAL THERMOGRAPH  
GROUP ONE

ANIMAL	INITIAL	96 HOURS	7 DAYS	15 DAYS	21 DAYS	27 DAYS	36 DAYS	42 DAYS	57 DAYS	63 DAYS	77 DAYS	84 DAYS
1	0	-10.25	9.35	-6.7	-10.75	-8.55	-12.45	6.8	-18.25	-32	-39.6	-56.3
2	0	8.55	6.45	-10.25	8.5	14.55	7.35	4.5	18.65	12.3	24.25	28.75
3	0	-4.65	-10.45	-14.25	-26.4	-38.6	-34.4	-47.8	-61.75	-52.55	-55.4	-64.85
4	0	6.85	-18.55	-25.35	-28.65	-34.25	-39.5	-46.85	-54.35	-66.4	-72.85	-78.65
5	0	-12.8	6.75	-4.45	-12.5	-14.6	-16.2	-8.45	7.5	5.6	-6.25	-16.7
6	0	14.25	12.85	-7.75	6.35	-8.7	-10.4	-18.6	-24.6	-32.8	-44.45	-51.7
7	0	12.4	20.85	28.45	22.6	15.45	-16.7	-12.8	-8.55	4.66	8.9	16.25
8	0	-8.7	-10.45	4.65	8.9	12.4	-6.25	-10.55	-8.7	-5.5	4.1	-8.75
9	0	18.45	24.25	8.5	14.75	28.65	15.75	10.85	21.1	28.6	36.4	24.8
10	0	14.65	12.5	18.65	22.4	24.85	16.2	-6.85	4.85	-8.75	-14.05	-9.35

PERCENT CHANGE IN THERMAL GRADIENTS WHEN COMPARED TO THE INITIAL THERMOGRAPH -- GROUP ONE

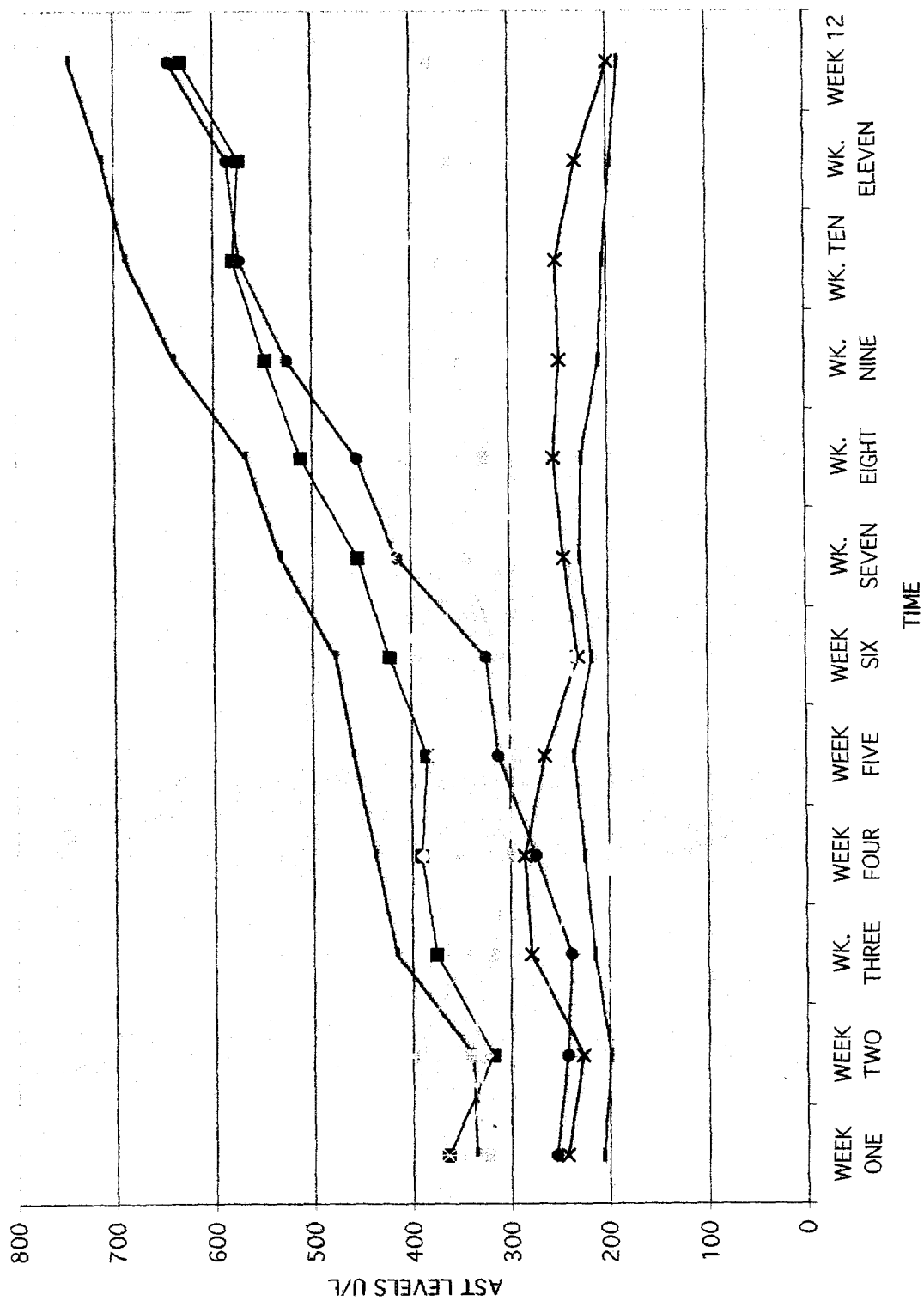


# ASPARTATE AMINOTRANSFERASE LEVELS WITHIN GROUP ONE

ANIMAL	WEEK ONE	WEEK TWO	WK. THREE	WEEK FOUR	WEEK FIVE	WEEK SIX	WK. SEVEN	WK. EIGHT	WK. NINE	WK. TEN	WK. ELEVEN	WEEK 12
1	364	318	375	390	384	422	454	512	548	580	574	632
2	242	226	278	285	264	230	244	254	248	251	231	198
3	254	242	238	274	312	324	415	455	526	574	586	645
4	335	338	415	436	458	476	532	567	639	688	712	745
5	344	325	358	388	376	356	374	354	368	342	362	372
6	188	174	212	198	223	238	278	332	364	385	468	482
7	364	398	345	354	374	395	418	410	385	346	335	324
8	285	274	256	232.00	212	242	258	274	285	263	294	288
9	206	198	214	224	234	216	228	226	208	204	196	188
10	324	342	318	302	295	312	345	328	356	376	364	384

NORMAL RANGE FOR THE EQUINE IS 160 - 412 U/L

ANIMAL #1  
ANIMAL #2  
ANIMAL #3  
ANIMAL #4  
ANIMAL #5  
ANIMAL #6  
ANIMAL #7  
ANIMAL #8  
ANIMAL #9  
ANIMAL #10



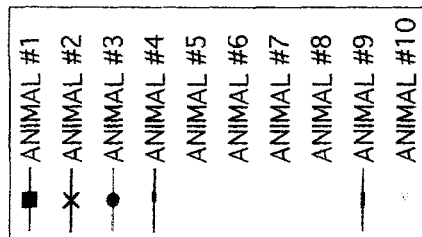
**CREATINE KINASE (CK) LEVELS WITHIN GROUP ONE  
(U/L)**

ANIMAL	WEEK ONE	WEEK TWO	WK. THREE	WEEK FOUR	WEEK FIVE	WEEK SIX	WK. SEVEN	WK. EIGHT	WK. NINE	WK. TEN	WK. ELEVEN	WEEK 12
1	240	236	285	392	345	388	396	413	380	424	448	464
2	296	264	314	294	274	263	228	234	212	188	174	145
3	134	154	176	236	228	279	345	421	464	484	488	492
4	285	426	443	464	487	513	524	536	554	588	596	640
5	247	263	251	274	287	254	242	236	267	281	273	297
6	153	226	327	423	483	433	462	417	393	385	362	327
7	176	185	223	214	234	316	343	337	246	156	132	124
8	246	254	242	237.00	226	246	252	274	252	261	253	264
9	212	168	233	237	243	256	264	274	268	283	296	287
10	262	243	267	333	374	353	385	426	438	479	457	462

**NORMAL RANGE FOR THE EQUINE IS 60 - 330 U/L**

CK LEVELS (U/L)

WEEK	CONTROL (Circles)	100 MG/KG (Squares)	200 MG/KG (Crosses)
WEEK ONE	150	250	280
WEEK TWO	150	250	250
WEEK THREE	200	280	280
WEEK FOUR	220	300	250
WEEK FIVE	250	350	250
WEEK SIX	280	350	250
WEEK SEVEN	300	380	250
WEEK EIGHT	350	400	250
WEEK NINE	400	420	250
WEEK TEN	450	450	250
WEEK ELEVEN	500	480	250
WEEK TWELVE	550	500	250



## **TRAINING TIMES GROUP ONE**

This group of ten horses did not receive any Alavis MSM throughout the study. The training times had a reciprocal relationship with the thermal gradients, AST and CK levels. This group did not exhibit any pattern of improvement. Several animals (5) actually increased their training times. The reason for this is the wear and tear soreness that every athlete experiences.

# TRAINING TIMES FOR GROUP ONE

ANIMAL	WEEK ONE	WEEK TWO	WK. THREE	WEEK FOUR	WEEK FIVE	WEEK SIX	WK. SEVEN	WK. EIGHT	WK. NINE	WK. TEN	WK. ELEVEN	WEEK 12	DECREASE
1	01:57.2	01:58.4	01:59.4	01:58.2	01:59.2	01:58.5	02:00.2	02:02.2	02:02.4	02:02.6	02:01.4	02:03.2	6.0 SECS
2	01:58.4	01:58.5	01:58.2	01:59.4	02:00.2	01:59.2	01:58.2	01:58.4	01:59.2	01:59.4	01:58.6	01:58.2	.2 SECS
3	01:57.4	01:58.4	01:57.2	01:58.5	02:04.2	02:02.2	02:03.4	02:04.2	02:04.5	02:06.2	02:05.2	02:06.6	9.6 SECS
4	01:58.2	01:58.5	01:59.4	01:59.2	01:57.2	01:59.4	01:59.5	02:01.2	02:02.6	02:04.2	02:06.2	02:08.4	10.2 SECS
5	02:01.2	02:00.2	02:01.6	02:10.2	02:02.4	02:02.2	02:04.2	02:02.5	2:01	02:02.4	2:00	02:02.2	1.0 SECS
6	02:01.2	02:01.6	02:02.2	02:01.2	02:02.4	02:03.4	02:05.2	02:04.2	02:06.2	02:07.4	02:07.6	02:08.2	7.0 SECS
7	01:59.4	01:58.5	01:58.4	01:59.2	02:00.2	02:01.2	02:02.2	01:59.4	01:58.4	01:58.5	01:59.2	01:58.2	1.2 SECS
8	02:02.2	02:00.2	02:01.2	02:12.2	02:04.2	02:02.4	02:04.2	02:03.6	02:02.2	02:01.6	02:02.2	02:01.8	.6 SECS
9	02:01.6	02:04.2	02:00.2	02:08.2	02:06.0	02:04.2	02:03.4	02:02.2	02:01.8	02:04.2	02:01.2	01:59.2	2.4 SECS
10	01:58.4	01:57.2	01:58.2	01:59.2	01:58.2	01:59.4	02:01.6	02:00.2	01:59.2	02:01.2	02:01.5	02:02.6	4.2 SECS

BOLD NUMBERS INDICATE AN INCREASE IN THE TRAINING TIME

THIS GROUP AVERAGED AN INCREASE IN TIME OF 2.52 SECONDS

**GROUP TWO:  
TEN GRAMS OF ALAVIS MSM ORALLY  
PER DAY**

**SEQUENTIAL THERMOGRAPHIC EVIDENCE OF  
ANIMAL NUMBER NINE, THE ENTIRE GROUP; AST  
AND CK LEVELS FOR ANIMAL NUMBER NINE AND THE  
ENTIRE GROUP; TRAINING TIMES**

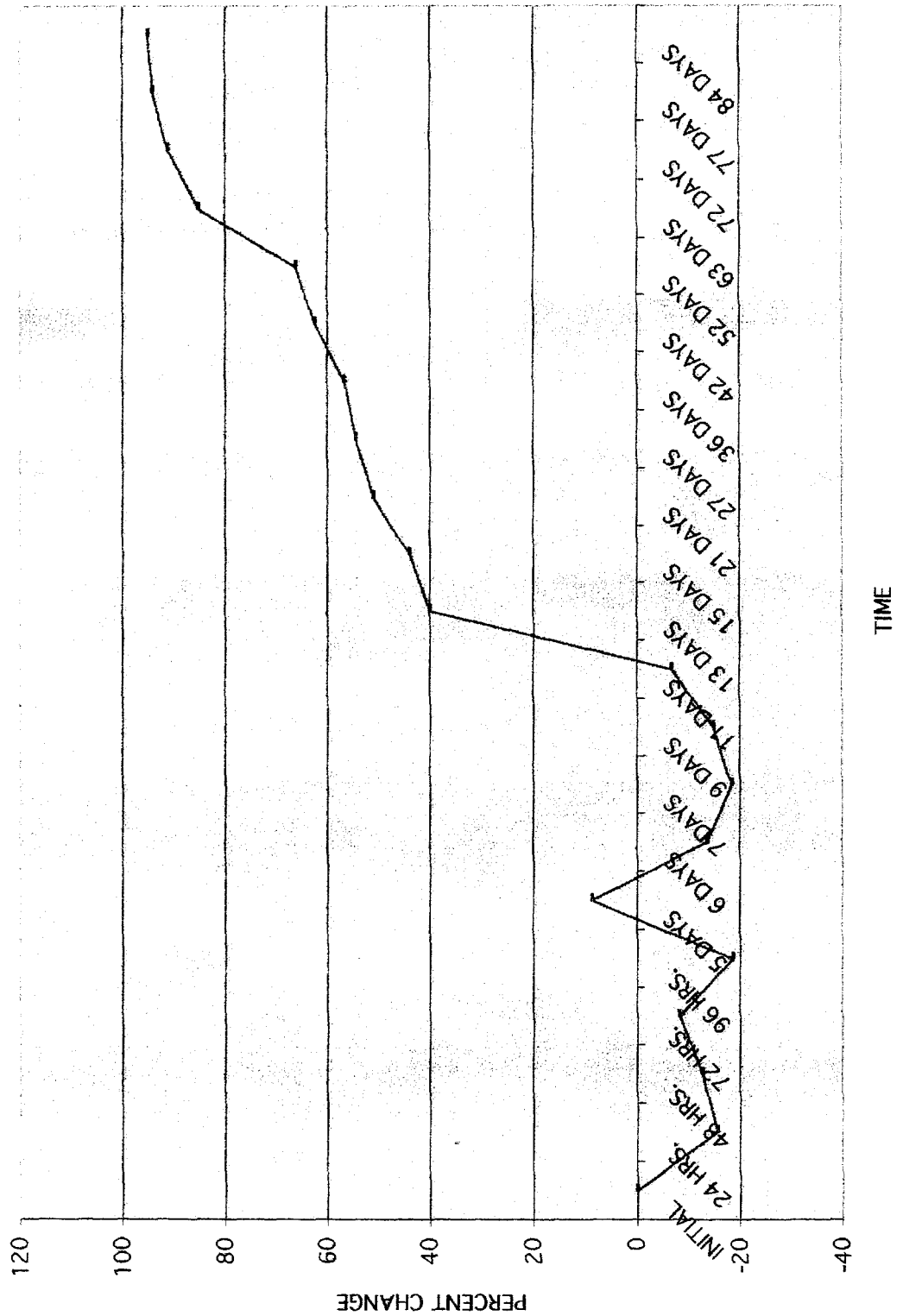
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PERCENT CHANGE IN THERMAL GRADIENTS WHEN COMPARED TO THE INITIAL THERMOGRAPH  
GROUP TWO

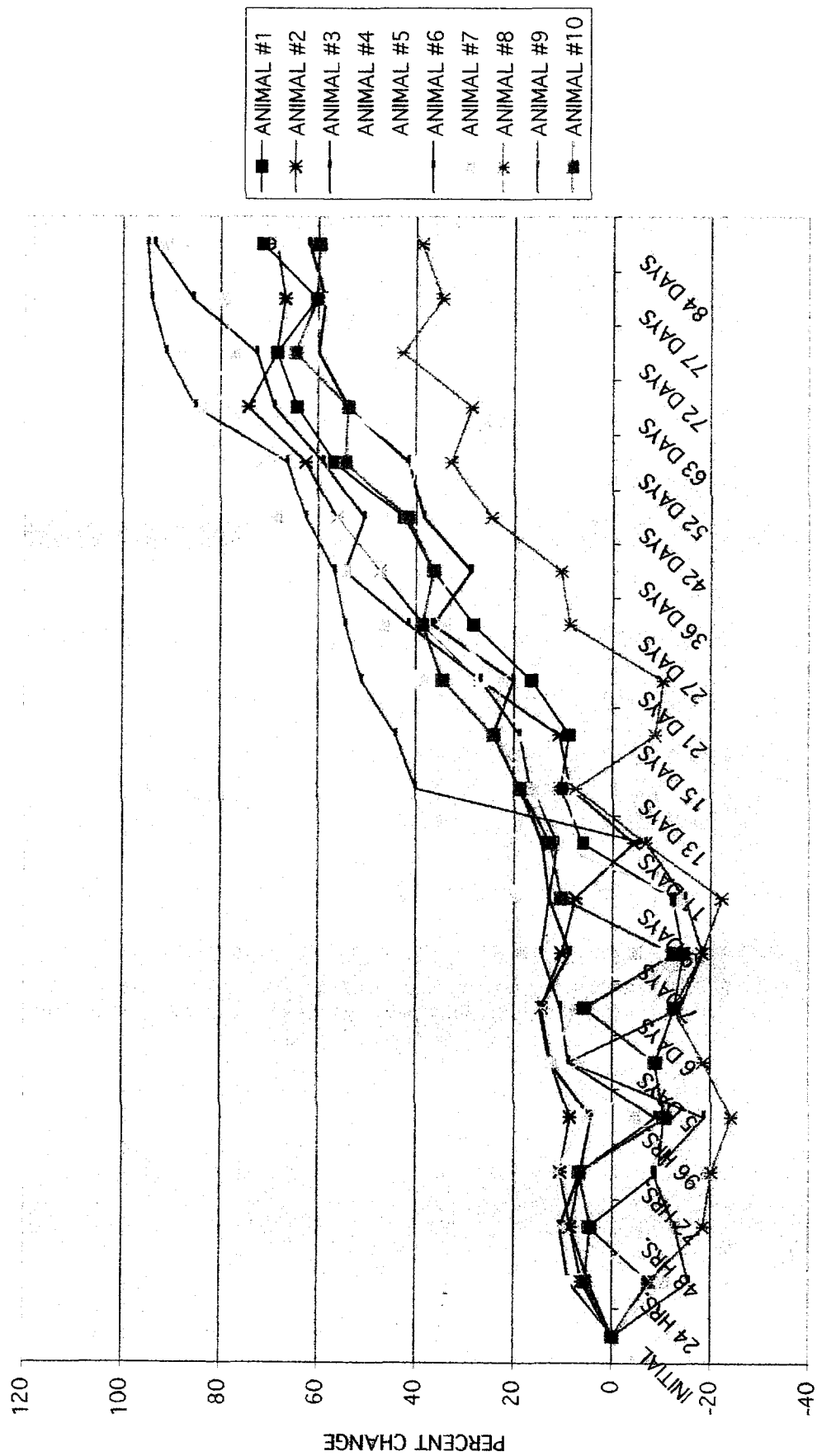
ANIMAL	INITIAL	24 HRS.	48 HRS.	72 HRS.	96 HRS.	5 DAYS	6 DAYS	7 DAYS	9 DAYS	11 DAYS	13 DAYS	15 DAYS	21 DAYS	27 DAYS	36 DAYS	42 DAYS	52 DAYS	63 DAYS	72 DAYS	77 DAYS	84 DAYS
1	0	-7.45	4.65	-9.3	-10.45	-8.75	-12.6	-14.4	-12.35	6.25	10.45	8.75	16.45	28.35	36.4	42.5	55.6	64.3	68.4	60.25	71.45
2	0	6.25	8.45	10.6	8.7	12.45	14.45	10.35	7.45	-4.3	8.45	10.75	26.75	38.45	47.45	55.35	62.45	74.35	68.45	66.75	66.45
3	0	8.75	10.6	5.45	4.35	12.6	14.7	5.6	12.75	14.25	18.75	24.3	20.1	36.4	28.75	38.4	41.2	53.7	59.7	58.4	61.75
4	0	9.45	-12.4	-10.4	-14.15	-6.75	-4.3	-9.3	-10.35	8.5	7.45	17.4	26.6	38.4	32.7	41.7	39.75	64.2	61.3	68.75	67.45
5	0	-8.3	10.2	11.4	5.35	5.45	14.5	18.4	19.75	21.45	12.4	24.5	22.4	34.2	47.6	55.4	69.2	78.4	88.45	79.4	87.4
6	0	4.65	8.4	5.35	-8.75	8.75	10.4	14.3	12.8	11.1	16.4	18.75	26.7	41.4	54.3	50.45	58.75	68.75	72.4	65.6	93.4
7	0	-10.4	-12.46	-18.75	-4.35	12.45	7.3	-4.6	-14.3	12.45	16.2	24.35	38.75	46.7	54.5	68.75	72.45	84.2	77.4	79.38	91.2
8	0	-7.35	-18.45	-20.2	-24.2	-18.5	-12.4	-18.35	-22.4	-6.75	7.3	-8.75	-10.4	8.6	10.4	24.6	32.7	26.5	42.6	34.5	38.75
9	0	-15.65	-12.75	-8.35	-18.65	8.65	-13.75	-18.45	-14.9	-6.85	39.86	43.92	50.98	54.23	56.57	62.4	66.03	85	91.02	94.05	94.85
10	0	5.5	4.5	6.75	-10.7	-8.55	5.65	-12.45	10.4	12.65	18.75	24.2	34.6	38.75	36.43	41.75	54.3	53.75	64.7	60.25	59.75

AVERAGE DECREASE IN THERMAL GRADIENT FOR GROUP TWO = 73.45%

PERCENT CHANGE IN THERMAL GRADIENTS WHEN COMPARED TO THE INITIAL  
THERMOGRAPH - GROUP TWO -- ANIMAL #9



PERCENT CHANGE IN THERMAL GRADIENTS WHEN COMPARED TO THE INITIAL THERMOGRAPH -- GROUP TWO

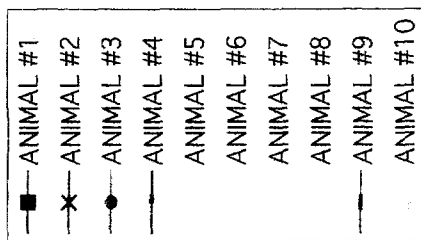


# ASPARTATE AMINOTRANSFERASE LEVELS WITHIN GROUP TWO

ANIMAL	WEEK ONE	WEEK TWO	WK. THREE	WEEK FOUR	WEEK FIVE	WEEK SIX	WK. SEVEN	WK. EIGHT	WK. NINE	WK. TEN	WK. ELEVEN	WEEK 12
1	524	486	466	424	428	364	374	356	338	320	288	294
2	385	374	346	356	324	288	294	306	278	284	268	258
3	264	288	254	256	224	212	201	196	185	214	206	195
4	394	426	432	454	384	354	344	352	362	324	294	306
5	268	334	354	348	284	265	249	232	245	254	232	212
6	310	288	274	285	248	238	224	242	254	236	242	228
7	465	474	454	462	421	395	418	412	395	366	348	334
8	622	654	648	634.00	592	598	576	574	543	538	495	512
9	824	814	773	742	720	644	612	586	526	484	493	461
10	432	486	324	346	364	323	345	338	316	256	278	280

NORMAL RANGE FOR THE EQUINE IS 160 - 412 U/L

Week	Subject 1 (Circles)	Subject 2 (Squares)	Subject 3 (Crosses)
Week One	850	480	400
Week Two	800	450	380
Week Three	750	420	350
Week Four	700	400	320
Week Five	650	550	450
Week Six	200	480	380
Week Seven	200	450	350
Week Eight	200	420	320
Week Nine	200	400	300
Week Ten	200	380	280
Week Eleven	200	350	250
Week Twelve	200	420	250

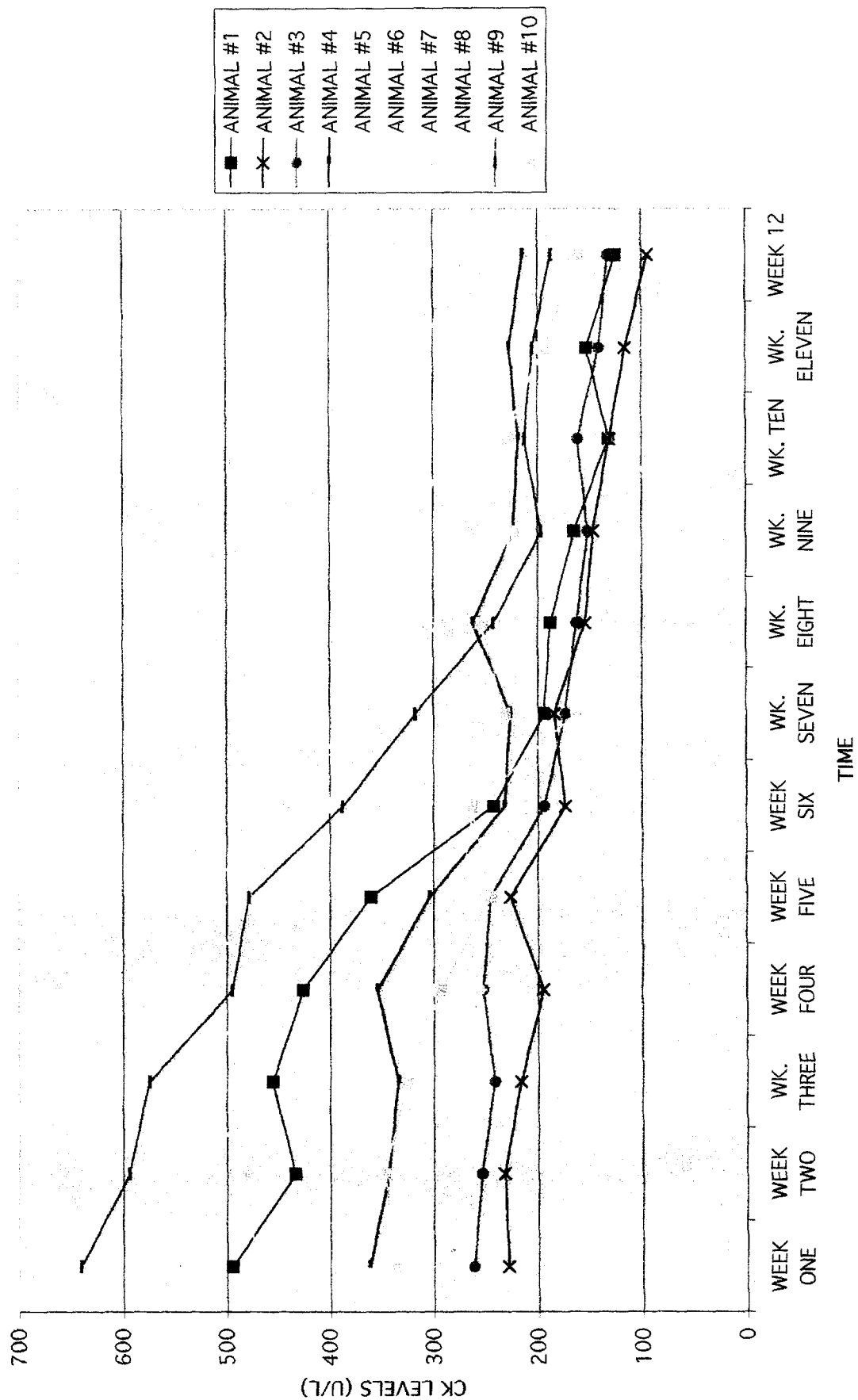


# CREATINE KINASE (CK) LEVELS WITHIN GROUP TWO (U/L)

ANIMAL	WEEK ONE	WEEK TWO	WK. THREE	WEEK FOUR	WEEK FIVE	WEEK SIX	WK. SEVEN	WK. EIGHT	WK. NINE	WK. TEN	WK. ELEVEN	WEEK 12
1	495	434	456	426	361	243	194	188	165	132	153	126
2	228	232	216	194	226	173	184	154	146	131	115	94
3	262	254	242	253	246	194	174	163	152	162	141	133
4	362	343	334	354	304	232	226	262	223	218	227	214
5	294	287	276	256	274	262	164	133	127	87	94	74
6	586	564	542	464	445	403	364	343	317	285	268	242
7	472	482	524	528	473	443	367	294	263	228	194	168
8	573	578	545	526.00	534	424	387	362	374	328	311	267
9	640	593	574	494	478	387	317	242	196	212	204	187
10	338	347	326	294	246	264	232	254	224	232	194	162

NORMAL RANGE FOR THE EQUINE IS 60 - 330 U/L

# CREATINE KINASE (CK) LEVELS WITHIN GROUP TWO



## **TRAINING TIMES GROUP TWO**

The training times within group two didn't start to fall until the fourth through the sixth week after the administration of Alavis MSM. This group received ten grams orally each day. After the sixth week, the improvement in training times was dramatic. These findings correlated with the changes within the thermal gradients of this group and the AST and CK levels. This group improved their training times by an average of 2.09 seconds over the twelve week period.

# TRAINING TIMES FOR GROUP TWO

ANIMAL	WEEK ONE	WEEK TWO	WK. THREE	WEEK FOUR	WEEK FIVE	WEEK SIX	WK. SEVEN	WK. EIGHT	WK. NINE	WK. TEN	WK. ELEVEN	WEEK 12	DECREASE
1	02:03.4	02:02.6	02:02.4	02:02.4	02:03.2	02:02.6	02:02.4	02:01.4	02:00.2	02:01.4	02:00.2	01:59.4	4.0 SECS
2	02:01.2	02:02.2	02:02.4	02:01.6	02:01.5	02:02.4	02:01.5	02:00.5	01:59.5	02:00.2	01:59.2	01:59.0	2.2 SECS
3	01:57.4	01:58.4	01:58.4	01:57.5	01:59.2	01:59.0	01:58.4	01:57.2	01:57.4	01:57.6	01:57.2	01:56.4	1.0 SEC
4	02:06.2	02:06.4	02:05.2	02:05.6	02:05.0	02:04.2	02:04.0	02:02.2	02:02.0	02:02.6	02:02.4	02:02.0	4.2 SECS
5	01:59.2	01:59.0	02:00.2	02:00.4	01:59.0	01:58.2	01:58.4	01:58.4	1:59	01:57.2	0:01	01:58.2	1.0 SEC
6	01:58.2	01:58.6	01:58.4	01:59.2	01:59.4	01:58.2	01:57.5	01:57.0	01:57.2	01:57.4	01:57.2	01:57.4	.8 SECS
7	02:00.5	02:00.2	02:00.6	02:01.2	02:01.2	02:02.4	02:01.4	02:00.2	02:00.0	01:58.5	01:59.2	01:58.2	2.3 SECS
8	02:02.4	02:00.2	02:01.2	02:06.2	02:04.2	02:02.4	02:03.2	02:02.5	02:02.2	02:02.2	02:01.4	02:01.4	1.0 SEC
9	02:04.2	02:04.2	02:00.2	02:08.2	02:06.0	02:04.2	02:03.4	02:02.2	02:02.4	02:01.5	02:01.2	02:00.5	3.7 SECS
10	01:59.2	02:01.4	02:01.2	01:59.2	01:59.4	01:59.2	02:01.6	02:00.2	01:59.2	01:59.2	01:59.0	01:58.5	.7 SECS

BOLD NUMBERS INDICATE AN INCREASE IN THE TRAINING TIME

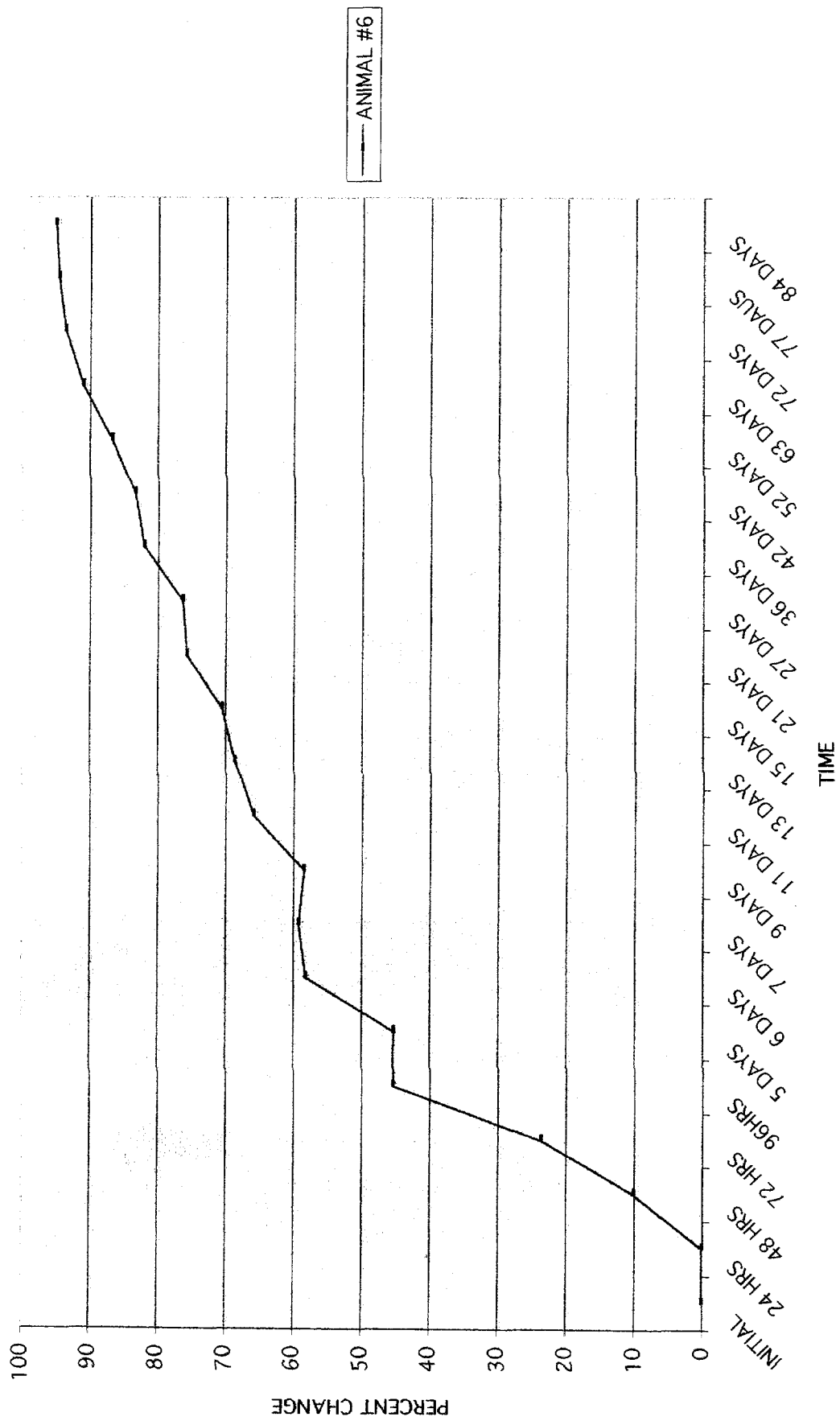
THIS GROUP AVERAGED A DECREASE IN TIME OF 2.09 SECONDS

[illegible]

**GROUP THREE:  
TWENTY GRAMS OF ALAVIS MSM  
ORALLY PER DAY**

**SEQUENTIAL THERMOGRAPHIC EVIDENCE OF  
ANIMAL NUMBER SIX, THE ENTIRE GROUP; AST AND  
CK LEVELS FOR ANIMAL NUMBER SIX AND THE EN-  
TIRE GROUP; TRAINING TIMES**

PERCENT CHANGE IN THERMAL GRADIENTS WHEN COMPARED TO THE INITIAL  
THERMOGRAPH - ANIMAL #6 - GROUP THREE



PERCENT CHANGE IN THERMAL GRADIENTS WHEN COMPARED TO THE INITIAL THERMOGRAPH  
GROUP THREE

ANIMAL	INITIAL	24 HRS.	48 HRS.	72 HRS.	96 HRS.	5 DAYS	6 DAYS	7 DAYS	9 DAYS	11 DAYS	13 DAYS	15 DAYS	21 DAYS	27 DAYS	36 DAYS	42 DAYS	52 DAYS	63 DAYS	72 DAYS	77 DAYS	84 DAYS
1	0	14.2	10.45	16.45	16.05	20.8	32.89	39.7	46.7	58.6	67.45	65.45	70.3	66.7	74.35	78.5	76.4	81.55	79.4	74.6	80.35
2	0	7.6	-8.3	7.4	4.36	-8.2	-10.7	5.4	7.35	8.45	12.4	7.3	14.2	21.7	34.4	32.6	36.75	30.4	38.78	46.5	58.35
3	0	-5.75	-8.75	8.7	8.7	10.45	12.4	16.55	18.75	14.5	16.75	24.3	25.6	34.75	32.65	36.8	41.1	47.8	48.25	51.3	58.9
4	0	0	-6.7	-8.75	-9.45	-10.45	-12.2	-10.45	-11.65	-12.45	-6.75	8.5	7.45	18.75	21.45	24.65	22.8	31.75	28.5	36.4	47.6
5	0	-8.9	-12.45	-15.35	-7.6	5.5	10.75	8.45	15.65	21.5	24.7	26.7	32.4	30.7	38.75	41.4	48.3	54.75	52.2	55.7	62.8
6	0	0	10	23.55	45.3	47.17	55.05	59.08	58.33	55.72	66.47	70.36	75.58	76.27	81.92	83.25	85.62	90.92	93.52	94.55	95
7	0	12.45	10.45	18.74	32.4	37.6	44.7	49.4	59.7	58.4	66.7	74.2	71.5	78.6	77.8	84.7	86.5	83.2	88.7	92.4	91.75
8	0	0	0	6.5	8.75	14.2	18.75	15.3	24.7	26.8	34.7	28.35	39.7	32.45	41.9	48.7	46.75	56.5	62	74.6	79.45
9	0	0	-10.45	-15.45	-7.3	-4.7	10.45	8.75	12.4	7.75	14.3	18.6	21.1	26.7	30.7	28.65	32.78	44.2	54.7	62.2	70.9
10	0	8.25	10.45	7.4	6.45	10.6	12.4	14.75	8.7	14.25	13.9	16.45	15.75	28.45	36.75	34.2	39.75	48.4	56.7	62.4	68.7

AVERAGE DECREASE IN THERMAL GRADIENT FOR GROUP THREE = 71.16%

PERCENT CHANGE

INITIAL 24 HRS. 48 HRS. 72 HRS. 96 HRS. 5 DAYS 6 DAYS 7 DAYS 9 DAYS 11 DAYS 13 DAYS 15 DAYS 21 DAYS 27 DAYS 36 DAYS 42 DAYS 52 DAYS 63 DAYS 72 DAYS 77 DAYS 84 DAYS

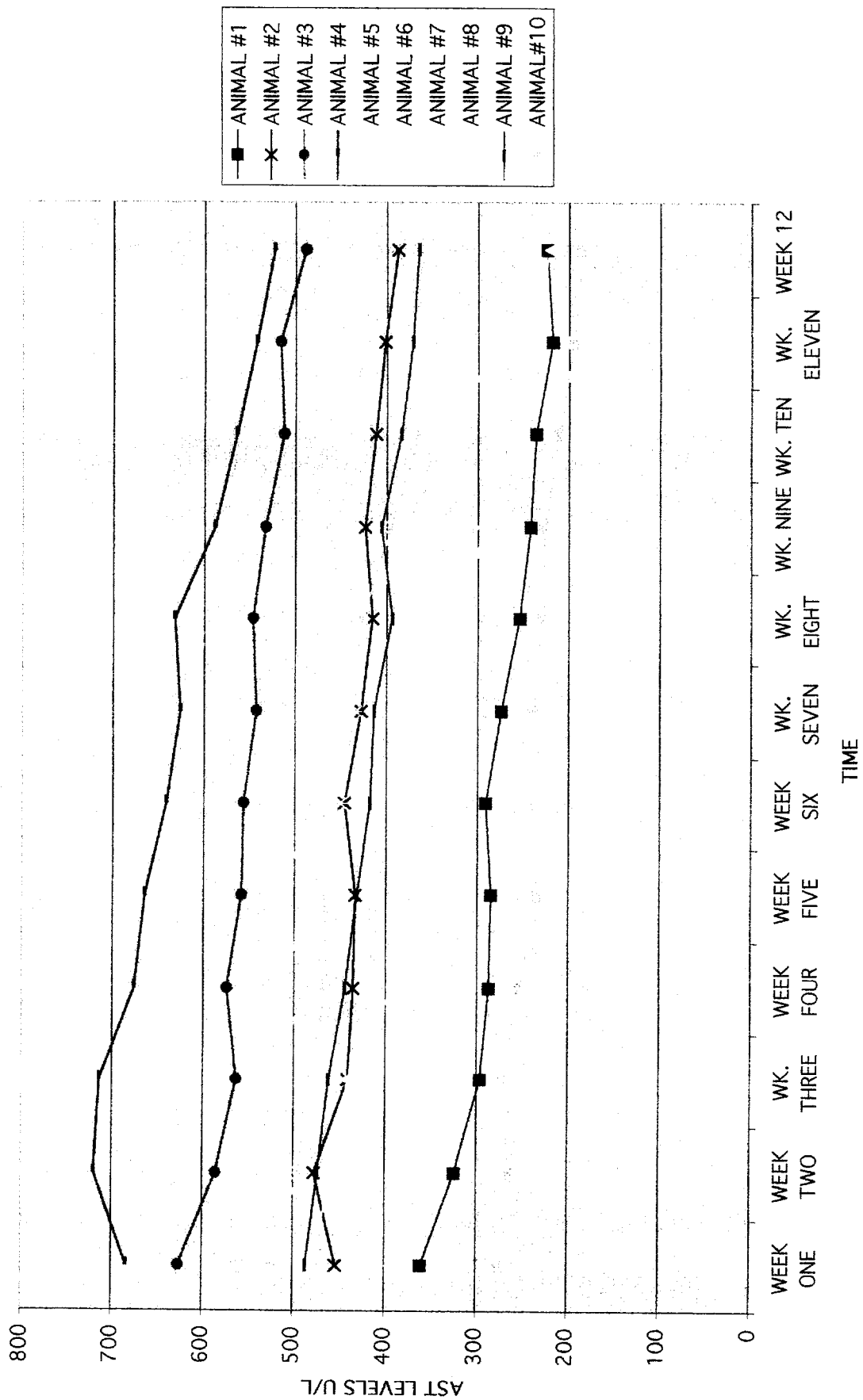
■ ANIMAL #1  
× ANIMAL #2  
● ANIMAL #3  
— ANIMAL #4  
ANIMAL #5  
ANIMAL #6  
ANIMAL #7  
ANIMAL #8  
— ANIMAL #9  
ANIMAL #10

# ASPARTATE AMINOTRANSFERASE LEVELS WITHIN GROUP THREE

ANIMAL	WEEK ONE	WEEK TWO	WK. THREE	WEEK FOUR	WEEK FIVE	WEEK SIX	WK. SEVEN	WK. EIGHT	WK. NINE	WK. TEN	WK. ELEVEN	WEEK 12
1	360	324	296	287	285	291	274	254	242	236	218	224
2	454	478	442	436	434	446	428	416	424	412	402	388
3	626	585	563	574	558	556	542	546	532	512	516	488
4	684	720	714	676	664	641	626	632	588	564	542	523
5	564	542	518	490	512	484	472	452	463	438	426	408
6	484	456	442	392	364	342	336	312	295	274	248	220
7	524	494	484	464	466	451	434	427	394	363	341	328
8	394	376	382	377.00	348	332	341	326	324	318	288	292
9	487	474	462	445	432	418	414	394	406	384	372	365
10	276	264	272	254	234	240	238	228	226	210	194	185

NORMAL RANGE FOR THE EQUINE IS 160 - 412 U/L

# ASPARTATE AMINOTRANSFERASE LEVELS WITHIN GROUP THREE



# CREATINE KINASE (CK) LEVELS WITHIN GROUP THREE (U/L)

ANIMAL	WEEK ONE	WEEK TWO	WK. THREE	WEEK FOUR	WEEK FIVE	WEEK SIX	WK. SEVEN	WK. EIGHT	WK. NINE	WK. TEN	WK. ELEVEN	WEEK 12
1	321	274	242	236	217	194	188	162	151	146	132	124
2	486	324	327	294	287	274	282	246	227	194	183	162
3	662	474	461	454	397	372	386	364	352	348	346	341
4	742	640	622	543	524	462	438	371	364	342	318	296
5	596	486	441	417	396	362	352	332	288	242	216	197
6	510	374	378	294	274	250	238	242	232	224	188	164
7	540	432	324	318	287	274	234	242	210	196	164	143
8	286	224	232	212.00	204	194	172	187	164	142	128	115
9	474	326	334	296	274	251	232	224	194	174	168	142
10	168	124	118	112	107	101	97	104	97	98	94	92

NORMAL RANGE FOR THE EQUINE IS 60 - 330 U/L

## 4



## **TRAINING TIMES GROUP THREE**

The training times within group three started to fall within the first two weeks after the administration of Alavis MSM. This is the group that received twenty grams orally each day. As the animal progresses through the racing season and becomes more physically fit, some drop in time is expected but a drop of 2.62 seconds is remarkable. The animals that changed the least on the thermal gradients and had the best AST and CK levels also trained the best. This was to be expected. Those animals that had the greatest decrease within the thermal gradients, AST and CK levels exhibited the most improvement in training times.

### TRAINING TIMES FOR GROUP THREE

ANIMAL	WEEK ONE	WEEK TWO	WK. THREE	WEEK FOUR	WEEK FIVE	WEEK SIX	WK. SEVEN	WK. EIGHT	WK. NINE	WK. TEN	WK. ELEVEN	WEEK 12	DECREASE
1	01:58.5	01:58.4	01:57.2	01:57.4	01:57.2	01:57.2	01:58.0	01:57.2	01:56.5	01:56.5	01:56.4	01:56.4	2.1 SECS
2	02:01.2	02:01.4	02:01.5	01:59.2	01:59.6	01:59.4	01:59.0	01:59.4	01:59.5	01:59.2	01:59.2	01:59.0	2.2 SECS
3	02:04.2	02:03.5	02:02.2	02:02.4	02:02.5	02:02.5	02:01.5	02:01.4	02:01.2	02:01.2	02:00.5	02:01.5	2.7 SECS
4	02:04.2	02:04.0	02:03.4	02:03.5	02:03.2	02:02.5	02:02.2	02:02.2	02:02.0	02:02.6	02:02.4	02:02.0	2.2 SECS
5	02:03.2	02:03.0	02:00.2	02:00.4	01:59.0	01:58.2	01:59.4	01:59.4	1:59	01:59.0	1:58	01:59.2	4.0 SECS
6	02:01.2	02:01.5	02:00.4	02:00.5	01:59.4	01:58.2	01:59.2	01:59.5	01:58.2	01:58.4	01:58.5	01:58.4	2.8 SECS
7	02:02.5	02:02.4	02:01.4	02:01.2	02:01.2	02:02.4	02:01.4	02:00.2	02:00.0	01:59.2	01:59.2	02:00.5	2.0 SECS
8	01:59.4	01:59.0	01:58.2	01:58.4	01:58.2	01:58.0	01:57.2	01:57.5	01:57.0	01:56.5	01:57.5	01:57.4	2.0 SECS
9	02:04.2	02:03.2	02:01.2	02:01.2	02:01.5	02:00.4	02:00.4	01:59.2	01:59.5	02:00.2	02:01.2	02:00.0	4.2 SECS
10	01:59.2	02:01.4	01:58.5	01:58.2	01:58.0	01:58.0	01:58.2	01:57.5	01:57.2	01:58.4	01:59.0	01:57.2	2.0 SECS

THESE TIMES ARE EXPRESSED IN MINUTES:SECONDS.TENTHS OF A SECOND

THIS GROUP AVERAGED A DECREASE IN TIME OF 2.62 SECONDS