WEIGHTED LEG CUFFS versus WEIGHTED VESTS as Tools of Loaded Resistance Exercise for Canines.

Dr. Ravi R. Iyer, MD, Certified Canine Athlete Specialist
Chairman & CEO, ActivPower Inc.
Member, Blitzburg Hundesport Club, USCA
Member, South Metro Atlanta Schutzhund Club, GSDCA
Member, DVG

AUTHOR BACKGROUND & CONFLICT OF INTEREST DISCLOSURE

The author is a practicing physician, actively competes in competive IGP dogsport, holds a multiple country patent on a version of canine weighted leg cuffs and also manufactures and sells weighted leg cuffs to competitive dog handlers world-wide.

The goal of creating a simple universal tool to achieve canine physical conditioning and fitness has been pursued for many years. Weighted leg cuffs have been used by veterinary rehab centers in Europe and Sweden for the structured recovery of power and mobility in dogs after TPLO and other orthopedic surgery with great success. In the US both weighted leg cuffs and weighted vests have grown in popularity in recent years.

Weighted leg cuffs have been used in high level competition dogs (the dogs in the US teams competing at the WUSV & FCI have used this; as well as several world class competitive dogs from other countries).

Weighted vests have been used to a larger degree by everyday pet owners and to a large part by non-competitive dog trainers. Both weighted cuffs and weighted vests have ardent supporters and detractors of their use.

By contrast critics of weighted resistance exercise have held to the position that ALL USE of weighted loads as a form of resistance exercise in canines should be avoided (except by highly trained professionals) and have instead focused on the promotion of gravity & body weight based resistance exercise as methods of canine conditioning. The arguments presented by these critics are based on the need for some degree of training and skill to safely exercise a high drive canine with wearable weights and the very low prevalence of skilled dog handling or training expertise in the general population even after training is given. Other arguments include observations of poor owner compliance with instructions and anthropomorphized notions of animal care and handling that lend to owner behaviors where dogs are treated not as canines but as “fur babies” and mini humans.

Reliable studies on weighted vests as well as weighted leg cuffs have also been lacking so far, therefore the arguments of both camps have not been coherently examined. This paper is a review of recent literature that brings up new data to clarify ambiguities in this area of public value and importance.

According to the manufacturer of one type of weighted leg cuff (ActoBands, ActivPower Inc.), the use of weighted leg cuffs by non-professionals is reserved for dogs and use scenarios that must meet the following criteria:

1) Dog should have no obesity
2) Dog should have no injury or joint dysplasia
3) Dog should have no Cardio-pulmonary disease
4) Exercise should be restricted to leashed walk only
5) Exercise should be restricted to duration of 10-15 minutes
6) Weights should not exceed 1-3 grams per kilogram body weight per leg
7) Veterinary approval of training program is recommended
8) Escalation of exercise intensity and loads is distributed in 2-3 week increments over 12-16 weeks

As mentioned earlier, there is a dearth of well-designed studies examining the use of weighted leg cuffs as a resistance training tool in dogs. Weighted leg cuffs however has been used by veterinary rehabilitation professionals in Sweden and Europe for the recovery and strength building of canines with muscle mass loss after prolonged immobilization after orthopedic surgery like TPLO for the repair of CCL rupture. The author reached out to the largest veterinary rehabilitation clinic in Sweden requesting them to provide any data on studies performed by them on the use of this tool. ReDog, Sweden was generous enough to share the manuscript of a paper written by one of their fellows on the use of weighted leg cuffs in healthy dogs. The entire manuscript of this clinical study was translated from the original Swedish language into English and both versions are attached to this document as Appendix 1 & 2 respectively. The following is a synopsis of the study.

REDOG SWEDISH STUDY ON WEIGHTED LEG CUFFS:

Essentially the Swedish study examined the use of weighted leg cuffs in healthy dogs of several breeds, all 1year age or older.
13 dogs of the following breeds were studied:
Dalmatian (1); GSD (9); GSD/Rottweiller mix (1); Siberian Husky (1); Alaskan Malamute (1)

All dogs were large breed dogs. The control dog was Dog#1 (Dalmatian) who wore leg cuffs without any weights, while the remaining 12 dogs were exercised with weights of different amounts and durations. The youngest dog was 1 year old (Dalmatian) and the oldest dog was 8-year-old (GSD). The duration of the study was 30 days and measurements were taken on Day 1, Day 15 and Day 30 as follows:

1) The range of motion (flexion and extension) in the knee joint, the hip joint and the elbow joint checked with a goniometer.
2) Muscle mass was measured with an ordinary tape measure at:
    a. - Thigh muscle (Trochanter major/lateral patella)
    b. - Calf muscle (Distal crest tibia)
    c. - Upper leg muscle (Proximal armpit)
    d. - Lower leg muscle (Pisiform bone/dorsal olecranon)

3) A motion analysis was performed according to a fixed model on all dogs:
    a. – Standing
    b. – Sitting
    c. – Lying
    d. - From the front and rear (walking ordinarily and walking slowly)
    e. - From the side (walking ordinarily and walking slowly)

All 13 dogs were trained with a specific weight and for a specific time. See Appendix 1 in the study. (A control dog (Dog 1) wore empty weight cuffs.). The dogs were be trained/loaded in a controlled manner by keeping the dog on a leash. The dogs were be warmed up for 10 minutes before the cuffs were applied. After the training, the dogs were cooled down for five minutes before stretching the forelegs and hind legs.

The exercise schedule was:
Week 1, dog's weight 1x X kg =1X grams in weight cuffs
Day 1: 5 minutes with weight cuffs, forelegs
Day 2: 5 minutes with weight cuffs, hind legs
Day 3:10 minutes with weight cuffs, forelegs
Day 4: 10 minutes with weight cuffs, hind legs
Day 5:15 minutes with weight cuffs, forelegs
Day 6: 15 minutes with weight cuffs, hind legs
Day 7: Rest
Week 2, dog's weight 2x X kg= 2X grams in weight cuffs
Day 1: 5 minutes with weight cuffs, forelegs
Day 2: 5 minutes with weight cuffs, hind legs
Day 3:10 minutes with weight cuffs, forelegs
Day 4: 10 minutes with weight cuffs, hind legs
Day 5:15 minutes with weight cuffs, forelegs
Day 6: 15 minutes with weight cuffs, hind legs
Day 7: Rest
Week 3, dog's weight 3x X kg= 3X grams in weight cuffs
Day 1: 5 minutes with weight cuffs, forelegs
Day 2: 5 minutes with weight cuffs, hind legs
Day 3:10 minutes with weight cuffs, forelegs
Day 4: 10 minutes with weight cuffs, hind legs
Day 5:15 minutes with weight cuffs, forelegs
Day 6: 15 minutes with weight cuffs, hind legs
Day 7: Rest
Week 4, dog's weight 4x X kg= 4X grams in weight cuffs
Day 1: 5 minutes with weight cuffs, forelegs
Day 2: 5 minutes with weight cuffs, hind legs
Day 3:10 minutes with weight cuffs, forelegs
Day 4: 10 minutes with weight cuffs, hind legs
Day 5:15 minutes with weight cuffs, forelegs
Day 6: 15 minutes with weight cuffs, hind legs

Day 7: Rest

SWEDISH STUDY CONCLUSIONS:

The Swedish study on weighted leg cuffs in healthy dogs showed a clear improvement in the movement pattern with increased range of motion and increased muscle mass in the dogs.

1) The motion analysis showed the dogs to have developed a more deliberate lowering of their paws and have thus improved their movement pattern.
2) The dogs that were amblers have walked normally through the use of weight cuffs.
3) The study also showed that the dogs that were uneven in musculature evened out their muscle mass.
4) There was no great difference in the amount of improvement between the various breeds in the study (all breeds improved uniformly)
5) The dogs that according to their owners were the least active, improved the most in range of motion and muscle mass. The dogs that were more active in winter improved in range of motion but less so in muscle mass.
6) Two dogs (Dogs 7 and 8) did not improved at all in muscle mass but did improve in range of motion. This may be because these dogs were trained the entire winter in (weight) pulling.
7) The control dog (Dog 1) that wore empty weight cuffs improved only in range of motion. This confirms the theory that if the goal is to build muscles in the dog, then the dog should be loaded with weights in the cuffs. If the goal is to improve the movement pattern, then using empty cuffs works.
8) The (training) setup with alternating the training with weight cuffs on front and hind legs (in order) to allow the muscles to recover between the training sessions, produced a very good result. Through the adaptation of the muscles to the training time and to the increased load, (as well as the rest time) the muscles developed in succession.

ADDITIONAL PUBLISHED MENTION OF WEIGHTED CUFFS:

“Leg Weights and Resistance Bands:
The therapist can increase resistance to a particular limb or muscle group using a leg weight or elastic resistance band (Fig. 14). Many leg weights designed for people do not fit properly. Human leg weights are often far too heavy, too large, and difficult to maintain in the desired position. Placement of the weight on the limb should also be considered. The stress on the limb is less when the weight is placed closer to the affected limb segment. A general rule of thumb is to use a weight that ranges between 1% and 3% of body weight, depending on limb strength and the stage of recovery. Leg weights are most effective in strengthening flexor muscles, which can be difficult to target with most active exercises.” Principles and Applications of Therapeutic Exercises for Small Animals. Marti G. Drum, DVM, PhD, Denis J. Marcellin-Little, DEDV, Michael S. Davis, DVM, PhD

DATA REGARDING VEST:

Background:

Weighted vests have been marketed as a convenient exercise tool for all dogs regardless of breed or size or fitness level. These weighted vests have been promoted as an effective solution to canine obesity. Owners were not required to undergo any learning other than that they had to snap on these vests and go for a hike, which presented the advantage of easy conflict free acceptance of the tool by the owners. Based on social media posts by owners of weighted vests, these vests have been used for extended hikes spanning hours over all forms of terrain in dogs of all ages ranging from skeletally immature dogs of 6 months age to senior dogs of 9 years age.

Veterinary Expert Opinion:

Veterinary experts board certified in veterinary rehab and/or veterinary orthopedics have however maintained that loading weighted vests onto the back of a canine is damaging for the following reasons:

1) Alteration of the load bearing characteristics of the canine spine.
2) Alteration of and interference with the natural flex and extend of the canine spine that allows the transmission of the thrust forces generated by the rear limbs towards the forward propulsion
3) Increased impact stresses of the weights on the large joints of the shoulders, elbows, hips and knees of the dog....

EVIDENCE OF ALTERATION OF GAIT AND TRUNCAL MOVEMENT BY NON-WEIGHTED VESTS

PAPER 1: Dr.'s Timothy L. Foutz PhD & Steven C. Budsberg DVM, MS (School of Environmental, Civil, Agricultural and Mechanical Engineering, College of Engineering (Foutz), and the Department of Small Animal Medicine and Surgery, College of Veterinary Medicine (Budsberg), University of Georgia, Athens, GA 30602. Address correspondence to Dr. Budsberg : Budsberg@uga.edu) …. in a study titled "Impact of wearing a service vest on three-dimensional truncal motion in dogs" published a well-designed and executed study that addressed Item 1 & 2 of the 3 limitations that have been cited by Board Certified Rehab Vets and Veterinary Orthopedicians as negatives of the use of vests.

The full paper may be downloaded from the link below: https://drive.google.com/file/d/1ikH8OK-X5ITS9SuzWo8TU-YcwAz9dLr6/view?fbclid=IwAR3o7Ke6SgZMJ8-QLM4fZ8BvnUPvytctZiXS9sMF_UzQbXZaJwMZNA_LILE

Essentially Foutz and Budsberg demonstrated significant alteration and restriction in gait, limb movement and truncal movement with either a service dog vest OR the military style tactical vest even when there were no additional weights added to these vests.

DATA REGARDING THE EFFECT OF HIGHER IMPACT LOADS ON CANINE LARGE BONE JOINTS: DAMAGING EFFECT OF EXCESS WEIGHT ON CANINE JOINTS

PAPER 2: Several research studies have documented that excess weight in dogs due to obesity results in accelerated arthritis and degenerative damage to large joints of shoulder, elbows, hips and knees.... there are many studies in this area, but I will cite an authoritative review that establishes both the direct link between excess weight and arthritis but also how the reduction of excess weight results in improvement in arthritic symptoms even in established cases of canine arthritis.... https://www.thieme-connect.com/products/ejournals/abstract/10.3415/VCOT-08-08-0069

PAPER 3: Advances in the Canine Cranial Cruciate Ligament edited by Peter Muir.... A book in the Advances in Veterinary Surgery series which presents a state-of-the-art summary of current knowledge on cruciate rupture, and written by leading specialists, edited by a highly respected veterinary orthopedic surgeon and researcher, has a chapter on the medical management of canine arthritis involving the stifle (knee) wherein Dr's Jaeger & Budsberg write: "The importance of weight management in the prevention and treatment of OA (osteoarthritis) cannot be overestimated."
https://books.google.com/books?hl=en&lr=&id=7KORE3PX-XYC&oi=fnd&pg=PA241&dq=obesity+and+canine+arthritis&ots=_DmW_hYDW-&sig=TgkyY5cHmhqi4BDW628XO_Zi7Vs#v=onepage&q=obesity%20and%20canine%20arthritis&f=false

PAPER 4: ***OWNERS REGULARLY BELIEVE THEIR DOGS ARE NOT OVERWEIGHT EVEN WHEN SPECIFICALLY TOLD SO BY VETS:*** Ordinary pet owners have been shown to have unrealistic and erroneous notions about the level of fitness possessed by their dogs and evidence has repeatedly shown cognitive resistance to recognizing the limitations of their dogs physical capacity.

Canine obesity: is there a difference between veterinarian and owner perception?
https://onlinelibrary.wiley.com/doi/abs/10.1111/j.1748-5827.2011.01138.x

PAPER 5: ***EXCESS NUTRITION RATHER THAN INSUFFICIENT EXERCISE IS THE DOMINANT CAUSE OF OBESITY AND OVERWEIGHT:*** Proponents of canine weighted vests have claimed that the use of weighted vests is valuable in the fight against canine obesity by promoting exercise. However, examination of evidence shows that excess nutrition and quality of nutrition are the major drivers in canine obesity rather than primary lack of exercise. While veterinary experts agree that limited exercise does plays a role in both obesity and exercise, the evidence clearly points to the major contribution of nutrition as the driver for both obesity and arthritis and that it is not possible to effect elimination of obesity by exercise alone without addressing excess nutrition.

https://www.sciencedirect.com/science/article/pii/S0167587709002402

PAPER 6: ***INCREASED WEIGHT PRODUCES GREATER IMPACT FORCES IN OBESE DOGS AND THE STRIDE LENGTH OF OBESE DOGS IS SHORTER:***

Evaluation of gait-related variables in lean and obese dogs at a trot. Robert B. Brady, MS; Alexis N. Sidiropoulos, MS; Hunter J. Bennett, BS; Patrick M. Rider, MS; Denis J. Marcellin-Little, DEDV; Paul DeVita, PhD from Biomechanics Laboratory, Department of Kinesiology, College of Health & Human Performance, East Carolina University, Greenville, NC 27858. (Brady, Sidiropoulos, Bennett, Rider, DeVita); Department of Clinical Sciences, College of Veterinary Medicine, North Carolina State University, Raleigh, NC 27607. (Marcellin-Little). Presented in part at East Carolina University Research and Creative Achievement Week, Greenville, NC, March 2012, and at the Annual Meeting of the American Society of Biomechanics, Gainesville, Fla, August 2012. Address correspondence to Dr. Marcellin-Little (denis_marcellin@ncsu.edu).

Here the authors demonstrate that…

1) Mean stride lengths for forelimbs and hind limbs at both velocities were shorter in obese than in lean dogs.
2) Obese dogs exerted greater peak vertical and horizontal ground reaction forces than did lean dogs.

The authors conclude that …. Greater ROM detected during the stance phase and greater ground reaction forces in the gait of obese dogs, compared with lean dogs, may cause greater compressive forces within joints and could influence the development of osteoarthritis.

https://avmajournals.avma.org/doi/abs/10.2460/ajvr.74.5.757

The findings of PAPER 6 is significant when taken from another perspective. As already shown by Foutz & Budsford in Paper 1, non-weighted military style tactical and off the shelf service vests produce significant restrictions in limb and truncal movement and gait alterations. In Paper 6, Brady et al show that obesity itself produces shortening of the gait excursion. The data of Paper 1 and Paper 6 taken together suggests that putting a weighted vest on a non-obese canine may create the same conditions of limited gait excursion and higher peak vertical and horizontal ground reaction forces, and may cause greater compressive forces within joints….. in effect creating the same conditions that exist from a kinesiologic principle as obesity.

TOTAL WEIGHT LOADS USED IN WEIGHTED CUFFS AND WEIGHTED VESTS:

The Swedish study demonstrated favorable results at 1gram to 3 grams per kilogram of body weight per leg. This formula would mean that a 40-kilogram German Shepherd (88 lbs.) would be loaded with anywhere between 40 grams to 120 grams of weights in each leg cuff. This load translates into 0.1% to 0.3% of total body mass in each leg and a total combined 4-leg load of 0.4% to 1.2% of total body mass on the dog.

By contrast the manufacturer of weighted vests states in the FAQ on their website that the vests are designed to add 7-10% of the total body mass onto the dog's spine and shoulders. This loading

formula would mean that a 40-kilogram German Shepherd (88 lbs.) would carry a load of anywhere between 2.8 kilograms (6.16 lbs.) to 4 kilograms (8.8 lbs.) on their backs. The manufacturer also notes that some users have loaded the vests with weights up to 5 times the above loads (35-50% of total body mass). The manufacturer's website does not indicate whether these higher loads are undesirable neither does it carry any further guidance on any regimen of how these loads are to used or whether any activities are to be restricted.

Based on the documented posts of users of weighted vests in social media, it appears that dogs are wearing loaded vests for durations of hikes spanning 1-2 hours over varied terrain as well as running and jumping over obstacles of varied heights (Social media accounts, pictures and videos).

All of this is not to state that weighted vests are absolutely damaging in all cases. There is a role for the carefully selected and carefully supervised use of weighted vests at much lower loads (not exceeding 2-3% of total body mass) in dogs that have already been trained to high levels of physical fitness, and even in those cases the use is highly restricted by top canine competitors to short periods(1-5 minutes) of tightly controlled activity. However, there is a huge difference in the loads of 0.1-0.3% of body mass per leg (0.4-1.2% total body mass) used in weighted leg cuffs for controlled leash walks of 10-15 minutes duration as reported in the Swedish study, compared to the loads of 7% to 50% total body mass reported by the users of weighted vests at uncontrolled pace of activity for extended durations of time. By all measures of data collection, it appears that the current use of weighted vest in the public is unrestricted, unselected, poorly supervised, and that actual use case scenarios contravene established evidence showing the damaging effects of these kind of loads on the canine musculoskeletal architecture.

In conclusion, there is an abundance of evidence that the present manner by which weighted vests are being used runs counter to establish evidence for the safe performance of canine resistance activity, by contract the available evidence for weighted cuffs demonstrate the use of fractional loads for controlled short durations of time at paces that are low impact and similarly controlled along with evidence of measurable increments in muscle mass and limb excursion without compromise of animal health or safety.

APPENDIX

ReDog Sweden Study

WEIGHT CUFFS

2011 PROJECT WORK

By: Britta Agardh

TABLE OF CONTENTS

BACKGROUND:

Weight cuffs are used in both rehabilitation and preventive health care to strengthen a dog's leg movements and musculature. The training also results in stable movement and increased muscle activity.

Weight cuffs are also used on dogs with a neurologically-impaired placement ability, as they provide the dog increased movement control. Training with weight cuffs results in increased leg strength, for example with hip joint problems and weak leg musculature.

Weights are applied in sewn-in side pockets.

When training the musculature in the dog's hind legs, the leg cuffs are placed above the hock joint with the pockets facing out from the dog. When training the dog's forelegs, the leg cuffs are placed above the dog's wrist. In order for the dog to control its training in a balanced way, leg cuffs are used in pairs between the legs.

DISCUSSION OF PROBLEM:

Problems arose when the dogs were to be loaded with greater weights, as the weights did not fit in the weight cuffs. This was solved by using lead weights that were weighed on an ordinary kitchen scale.
One dog met the inclusion criteria but could not be handled for measurement of the range of motion. The dog was included in this study and displayed very fine results in muscle mass and in the motion analysis.

The margin of error in the measurement with the goniometer and with the tape measure was minimized by my measuring all the dogs.

Unfortunately, German Shepherd Dogs were overrepresented in the study, as these are the most common working dogs (for police/military/SAR). Because of a lack of time and work schedule, these dogs were included in the study.

PURPOSE:

The purpose of this study is to learn how dogs are affected by training with weight cuffs for 30 days. I have chosen to study weight cuffs as a complement to preventive health care on healthy dogs. I want to know what happens with the muscle mass, range of motion and motion pattern on the dogs.

HYPOTHESIS:

All dogs will develop greater range of motion and improve musculature, as well as improving their motion pattern, through training with weight cuffs. By increasing the weight in the cuffs and the load time, quick results will be obtained.

EXCLUSION CRITERIA:

Undiagnosed dogs with motion disorders. Dogs under 12 months of age.

METHOD:

I will study dogs of various breeds and ages for a total of 30 days. I will make three measurements: Day 1, Day 15 and Day 30.
With these measurements, the range of motion (flexion and extension) in the knee joint, the hip joint and the elbow joint will be checked with a goniometer.

Muscle mass is measured with an ordinary tape measure at:

- Thigh muscle (Trochanter major/lateral patella)
- Calf muscle (Distal crest tibia)
- Upper leg muscle (Proximal armpit)
- Lower leg muscle (Pisiform bone/dorsal olecranon)

A motion analysis will be performed according to a fixed model on all dogs:

- Standing
- Sitting
- Lying
- From the front and rear (walking ordinarily and walking slowly)
- From the side (walking ordinarily and walking slowly)

All 13 dogs will be trained with a specific weight and for a specific time. See Appendix 1.
(A control dog (Dog 1) will wear empty weight cuffs.)

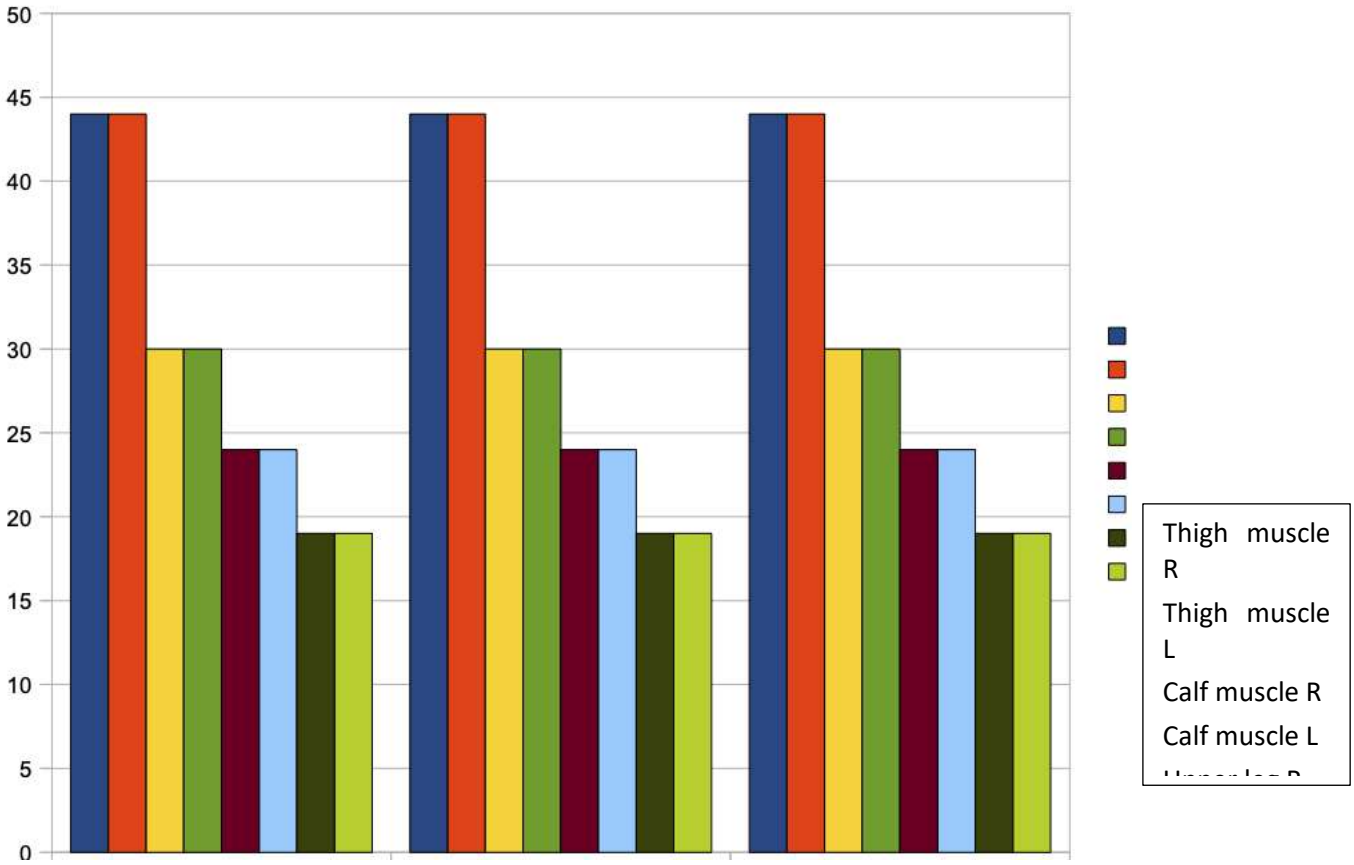
The dogs will be trained/loaded in a controlled manner by keeping the dog on a leash. The dogs will be warmed up for 10 minutes before the cuffs are applied. After the training, the dogs will be cooled down for five minutes before stretching the forelegs and hind legs. These exercises are shown to the dog owner at the first measurement.
The dog owners were given information regarding assessing the dog after rest and immediately interrupting the training of the dog in the event of abnormalities in the dog.

RESULTS

Name: Maddox
Breed: Dalmatian
Age: 1 year
Dog 1 - Control dog

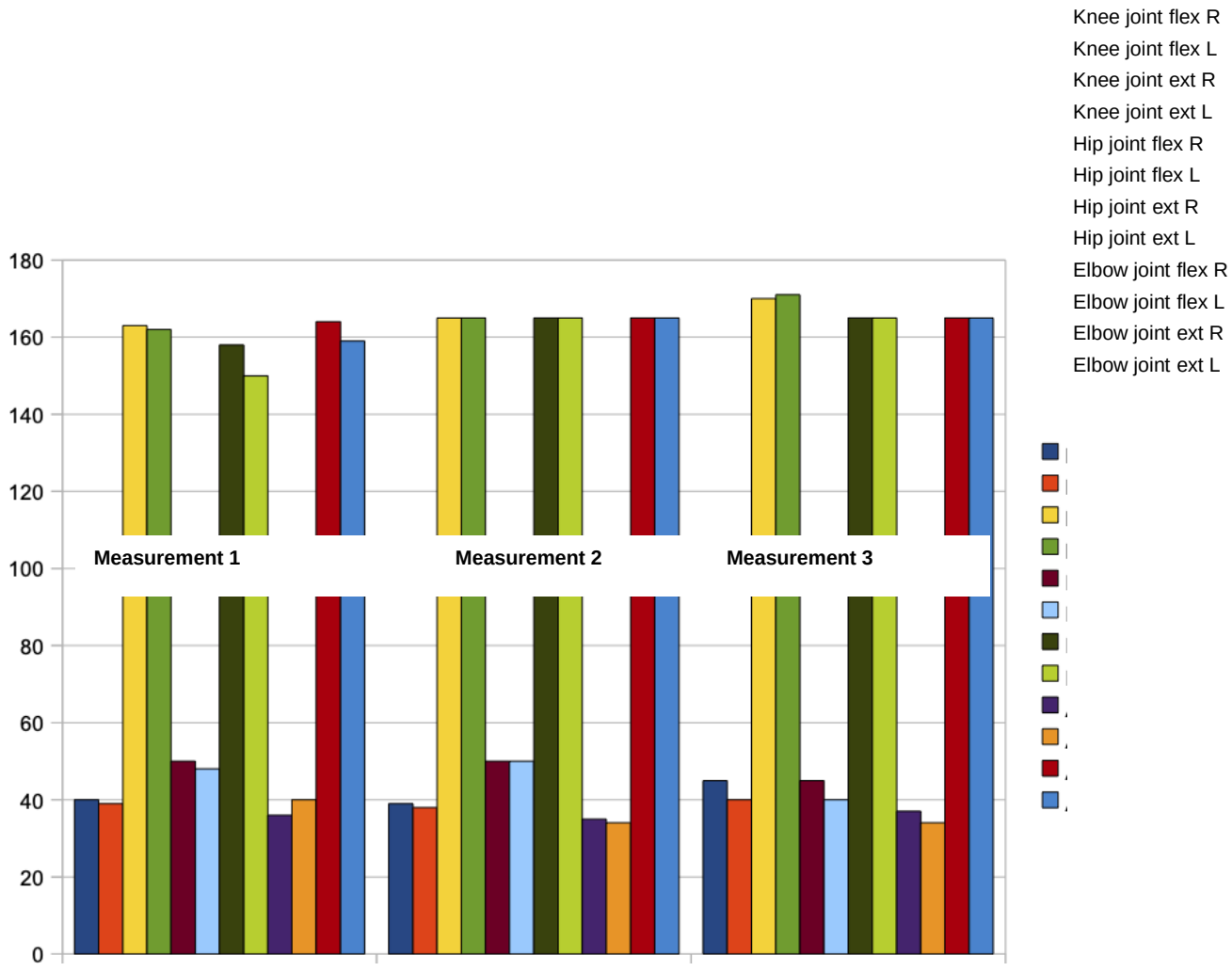
MUSCLE MASS

Date	3/14/2011	-------	3/25/2011	------	4/11/2011	------
	Right	Left	Right	Left	Right	Left
Thigh muscle	44	44	44	44	44	44
Calf muscle	24	24	24	24	24	24
Upper leg muscle	30	30	30	30	30	30
Lower leg muscle	19	19	19	19	19	19



Measurement 1 **Measurement 2** **Measurement 3**

Date	3/14/2011	-------	3/25/2011	-------	4/11/2011	-------
	Left	Right	Left	Right	Left	Right
Knee joint flexion	39	40	38	39	45	40
Knee joint extension	162	163	165	165	170	171
Hip joint flexion	48	50	50	50	45	50
Hip joint extension	150	158	165	165	165	165
Elbow joint flexion	40	36	34	35	37	34
Elbow joint extension	159	164	165	165	165	165


Knee joint flex R
Knee joint flex L
Knee joint ext R
Knee joint ext L
Hip joint flex R
Hip joint flex L
Hip joint ext R
Hip joint ext L
Elbow joint flex R
Elbow joint flex L
Elbow joint ext R
Elbow joint ext L
180
160
140
120
100
80
60
40
20
0
Measurement 1
Measurement 2
Measurement 3

MOTION ANALYSIS

Stationary:

	3/14/2011	3/25/2011	4/11/2011
Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Normal	Normal	Normal

Sitting:

Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Normal	Normal	Normal
Sitting position	Normal	Normal	Normal

Lying:

Symmetrical leg position between extremities	Normal	Normal	Normal
Elbow position	Normal	Normal	Normal

Movement from front and rear:

Adduction or abduction of the extremities	Normal	Normal	Normal
Load time for each extremity	Normal	Normal	Normal
Head movement during loading phases.	Normal	Normal	Normal

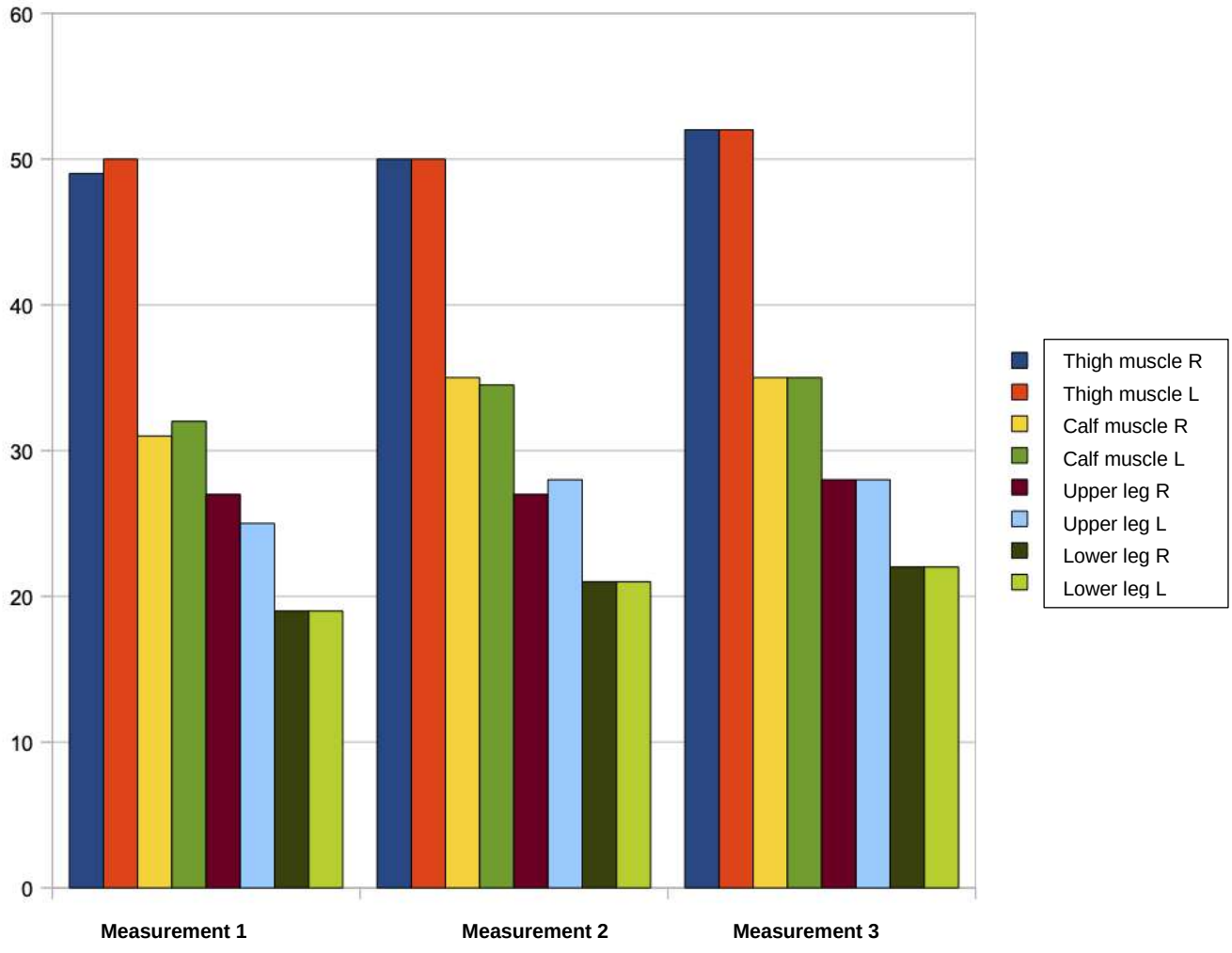
Movement from the side:

Protraction	Normal	Normal	Normal
Retraction	Normal	Normal	Normal
Range of motion in shoulder joint	Excessive	Excessive	Excessive
Range of motion in elbow joint	High steps	High steps somewhat	High steps somewhat
Range of motion in carpal joint	Normal	Normal	Normal
Range of motion in hip joint	Excessive	Somewhat excessive	Somewhat excessive
Range of motion in knee joint	High steps	High steps somewhat	High steps somewhat

Name: Viggo
Breed: German Shepherd Dog
Age: 4 years
Other: Working dog (Police/military/SAR)
Dog 2

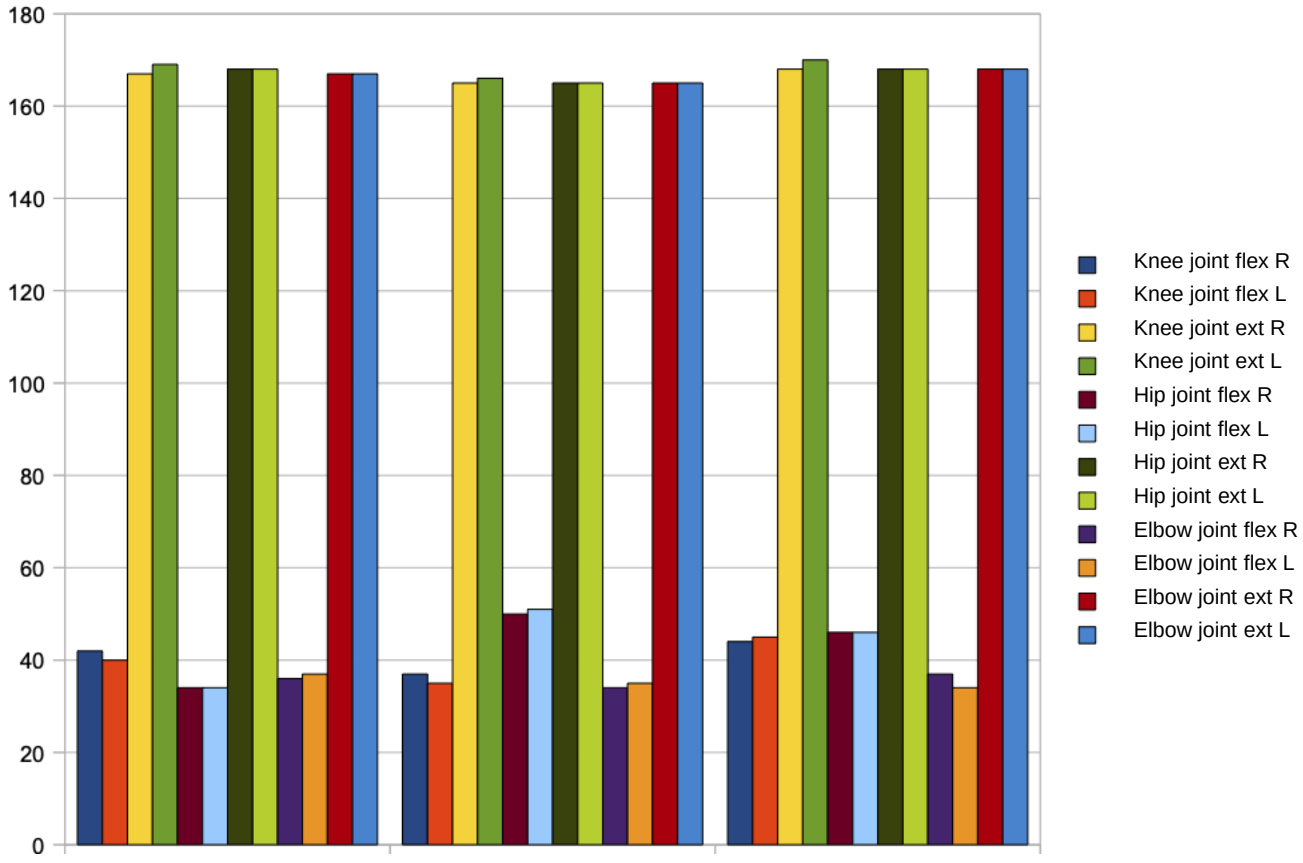
MUSCLE MASS

Date	3/15/2011	-------	3/26/2011	-------	4/14/2011	-----
	Right	Left	Right	Left	Right	Left
Thigh muscle	49	50	50	50	52	52
Calf muscle	34	34	35	35	35	35
Upper leg muscle	27	25	27	27	28	28
Lower leg muscle	19	19	21	21	22	22



RANGE OF MOTION

Date	3/15/2011	------	3/26/2011	------	4/14/2011	------
	Left	Right	Left	Right	Left	Right
Knee joint flexion	40	42	35	37	44	45
Knee joint extension	169	167	166	165	168	170
Hip joint flexion	34	34	51	50	46	46
Hip joint extension	168	168	165	165	168	168
Elbow joint flexion	37	36	35	34	37	34
Elbow joint extension	167	167	165	165	168	168



MOTION ANALYSIS

Stationary:

	3/15/2011	3/26/2011	4/14/2011
Symmetrical loading of extremities	Moves the weight forward. Protraction	Normal	Normal
Symmetrical leg position between extremities	Normal	Normal	Normal

Sitting:

Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Slants left hind leg outward. Pushes the weight backward. Retraction	Slants left hind leg outward. Pushes the weight backward.	Slants left hind leg outward.
Sitting position	Normal		

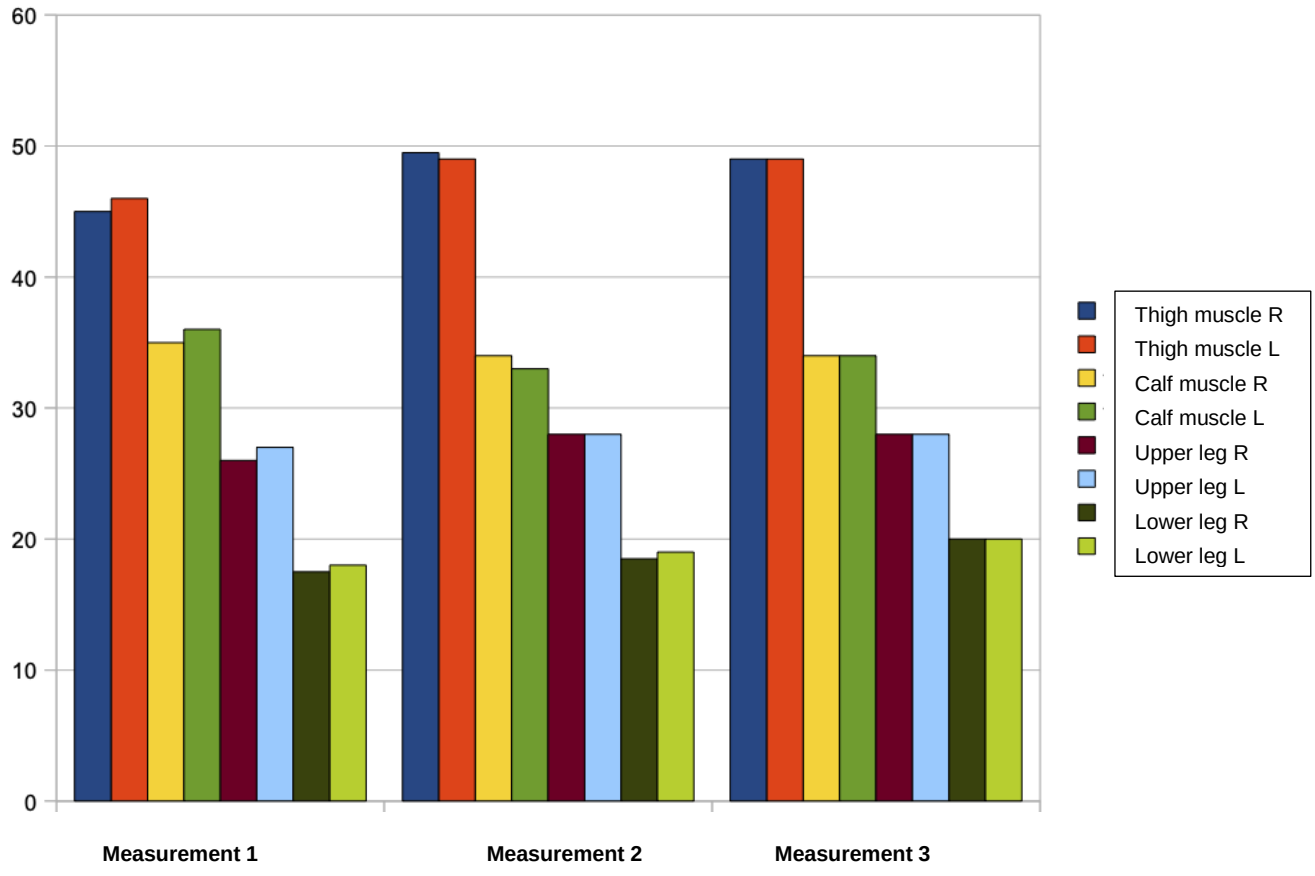
Lying:

Symmetrical leg position between extremities	Normal	Normal	Normal
Elbow position	Normal	Normal	Normal
Movement from front and rear:			
Adduction or abduction of the extremities	Abduction right rear	Abduction right rear	Normal
Load time for each extremity	Normal	Normal	Normal
Head movement during loading phases.	Normal	Normal	Normal
Movement from the side:			
Protraction	Standing	Standing	Normal
Retraction	Sitting	Normal	Normal
Range of motion in shoulder joint	Normal	Great difficulties	Normal
Range of motion in elbow joint	Normal	Normal	Normal
Range of motion in carpal joint	Normal	Inward with right, outward with left	Normal
Range of motion in hip joint	Abduction right rear when trotting	Abduction right rear when trotting	Normal
Range of motion in knee joint	Abduction right rear when trotting	Abduction right rear when trotting	Normal

Name: Cke
Breed: German Shepherd Dog
Age: 5 years
Other: Working dog (Police/military/SAR)
Dog 3

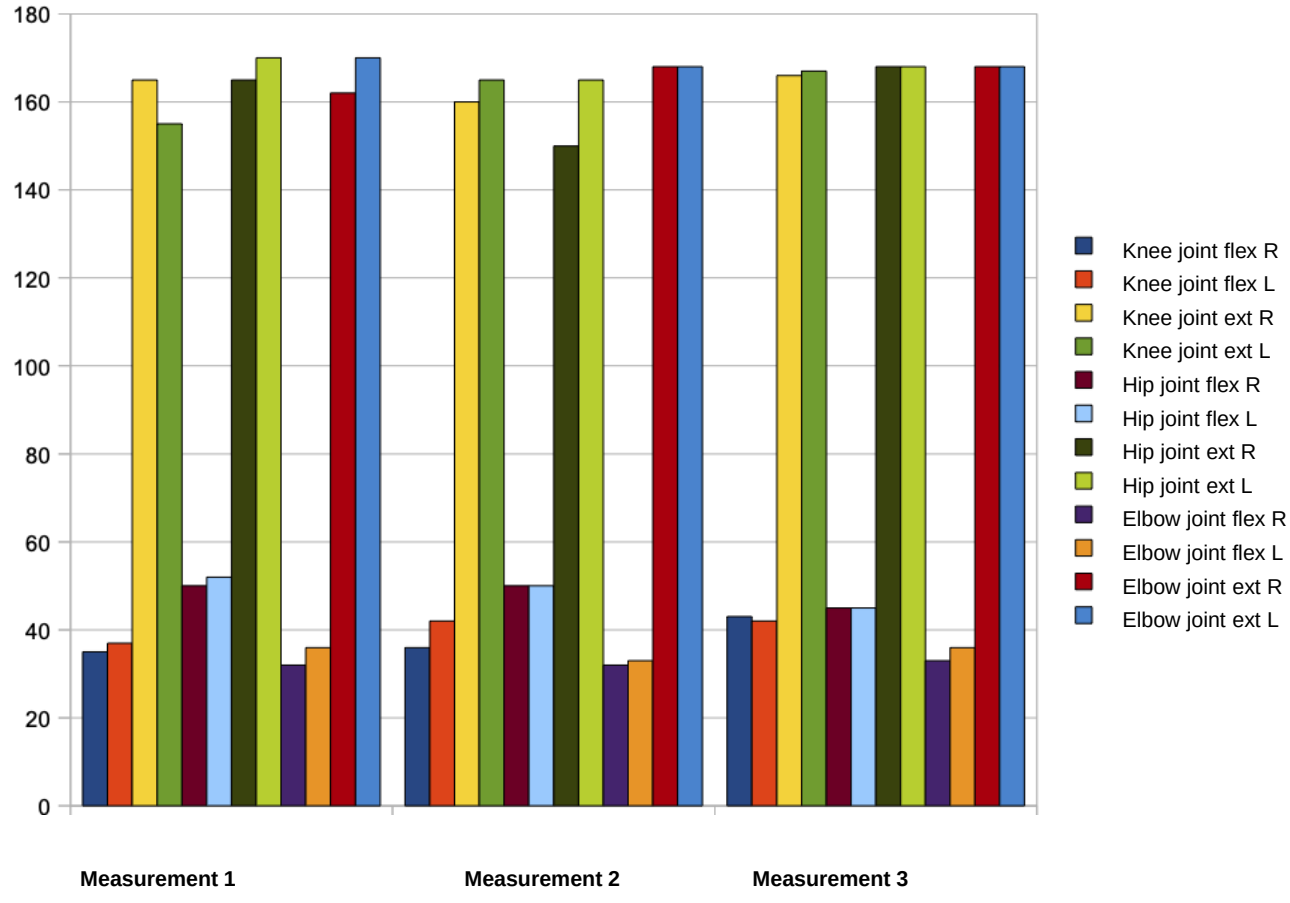
MUSCLE MASS

Date	3/17/2011	-----	4/3/2011	-----	4/14/2011	-----
	Right	Left	Right	Left	Right	Left
Thigh muscle	45	46	49.5	49	49	49
Calf muscle	35	36	34	33	34	34
Upper leg muscle	26	27	28	28	28	28
Lower leg muscle	17.5	18	18.5	19	20	20



RANGE OF MOTION

Date	3/17/2011	------	4/3/2011	------	4/14/2011	------
	Left	Right	Left	Right	Left	Right
Knee joint flexion	35	37	36	42	43	42
Knee joint extension	165	155	160	165	166	167
Hip joint flexion	50	52	50	50	45	45
Hip joint extension	165	170	150	165	168	168
Elbow joint flexion	32	36	32	33	33	36
Elbow joint extension	162	170	168	168	168	168



MOTION ANALYSIS

Stationary:

	3/17/2011	4/3/2011	4/14/2011
Symmetrical loading of extremities	Eases load on left rear.	Eases load on left rear.	Normal
Symmetrical leg position between extremities	Narrow in rear knees.	Narrow in rear knees.	Normal

Sitting:

Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Slants left hind leg out	Slants left hind leg out	Slants left hind leg out
Sitting position	Sitting on tail root.		

Lying:

Symmetrical leg position between extremities	Normal	Normal	Normal
Elbow position	Normal	Normal	Normal

Movement from front and rear:

Adduction or abduction of the extremities	Normal	Normal	Normal
Load time for each extremity	Somewhat with the hind leg. Appears as though he trots with the foreleg but ambles in rear. Short steps, tight instability.	Somewhat with the hind leg. Appears as though he trots with the foreleg but ambles in rear. Short steps, tight instability.	Normal
Head movement during loading phases.	Normal	Normal	Normal

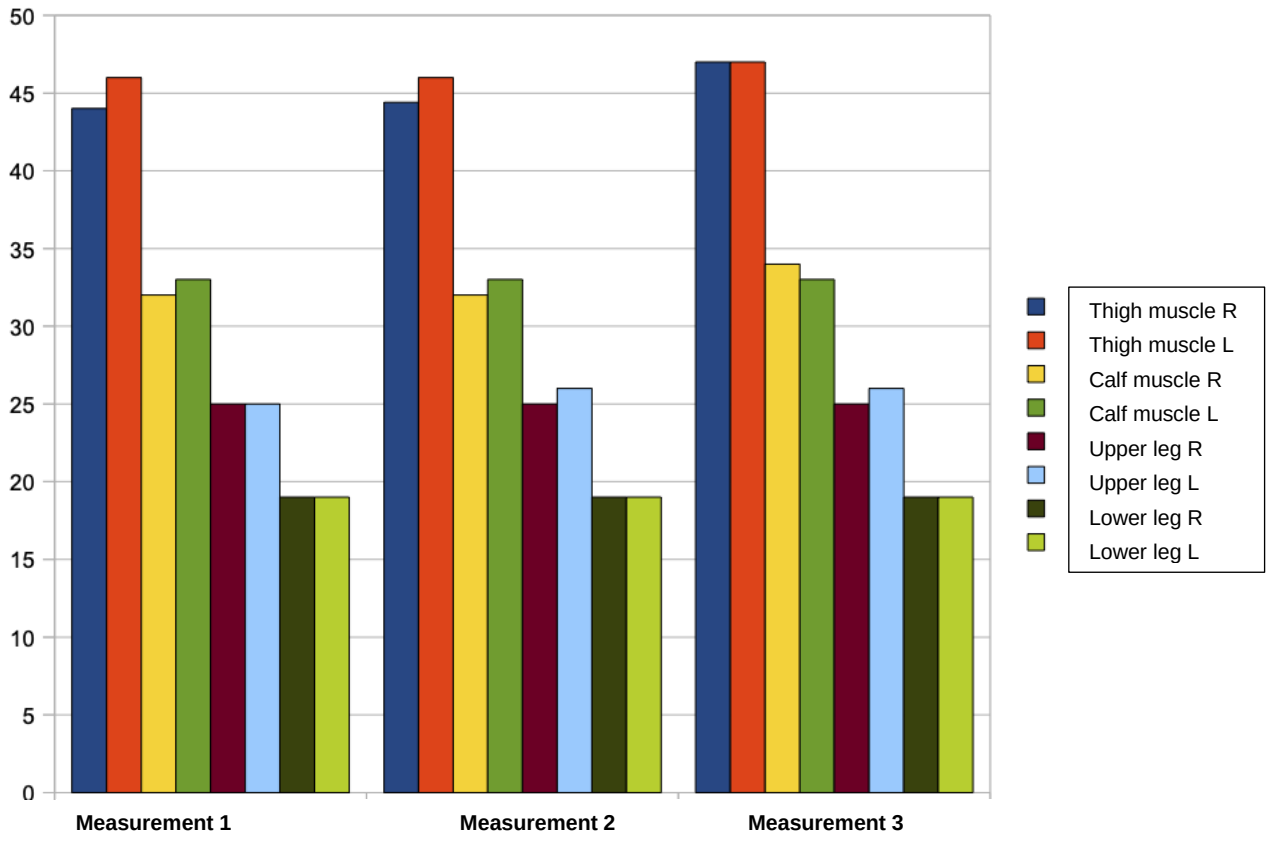
Movement from the side:

Protraction	None	None	Normal
Retraction	Sitting	Sitting	Normal
Range of motion in shoulder joint	Normal	Normal	Normal
Range of motion in elbow joint	Excessive movement when walking and trotting.	Excessive movement when walking and trotting.	Normal
Range of motion in carpal joint	Normal	Normal	Normal
Range of motion in hip joint	Stiff, poor movement. Lumbar region???	Stiff, poor movement. Lumbar region???	Normal
Range of motion in knee joint	Normal	Normal	Normal

Name of dog: KYRO
Age: 8 years
Breed: German Shepherd Dog
Other: Working dog (Police/military/SAR)
Dog 4

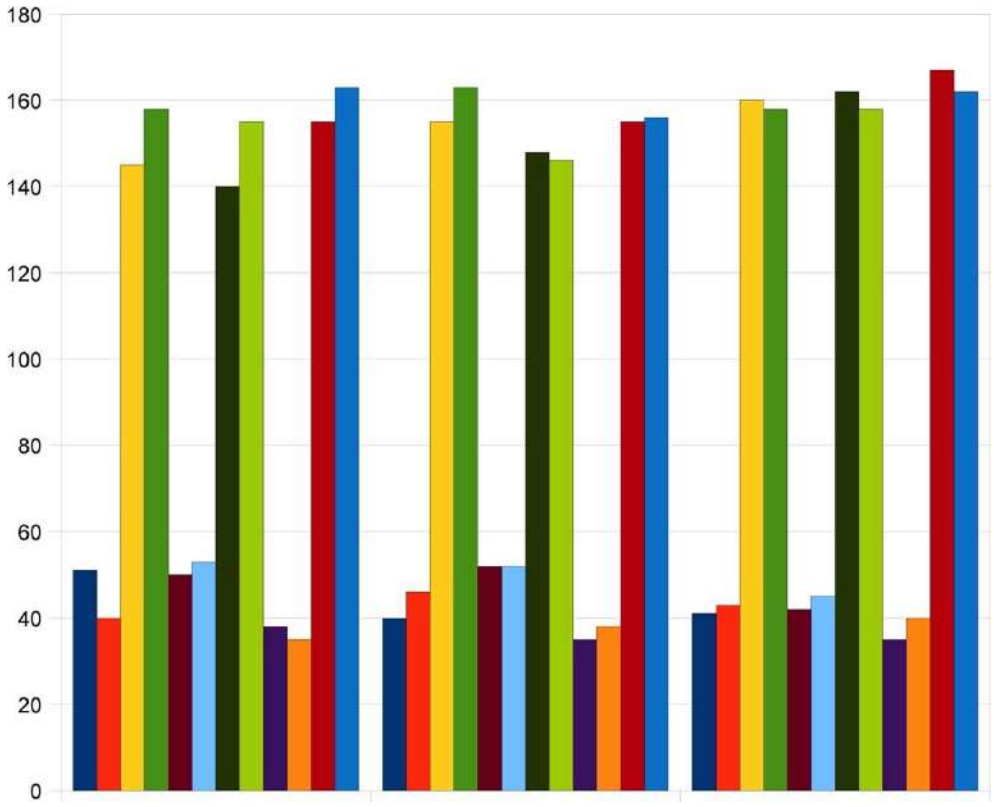
MUSCLE MASS

Date	3/14/2011	------	3/27/2011	------	4/11/2011	------
	Right	Left	Right	Left	Right	Left
Thigh muscle	46	44	46	44.5	47	47
Calf muscle	33	32	33	32	34	33
Upper leg muscle	31	31	25	26	25	25
Lower leg muscle	19	19	19	19	19	19

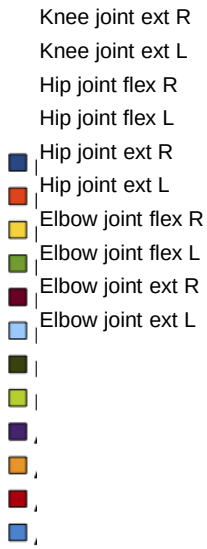


RANGE OF MOTION

Date	3/14/2011	------	3/27/2011	------	4/11/2011	------
	Right	Left	Right	Left	Right	Left
Knee joint flexion	51	40	40	46	41	43
Knee joint extension	145	158	155	163	160	158
Hip joint flexion	50	53	52	52	42	45
Hip joint extension	140	155	148	146	162	158
Elbow joint flexion	38	35	35	38	35	40
Elbow joint extension	155	163	155	156	167	162



Knee joint flex R
Knee joint flex L



Measurement 1 **Measurement 2** **Measurement 3**

MOTION ANALYSIS

Stationary:

	3/25/2011	3/27/2011	4/11/2011
Symmetrical loading of extremities	Stands like an A.	Stands like an A, eases load on left rear.	Much straighter back posture
Symmetrical leg position between extremities	Tight front and rear.	Tight front and rear.	Tight front.

Sitting:

Symmetrical loading of extremities	Protraction. Moves forepaws forward.	Protraction	Eases load on right front. Supination of paws.
Symmetrical leg position between extremities	Wide between the forepaws.	Eases load on right, front.	Normal
Sitting position	Very slow to sit. Otherwise OK.	Normal	Normal

Lying:

Symmetrical leg position between extremities	Folds right forepaw under itself. Puts the weight on left buttock.	Folds right forepaw under itself. Puts the weight on left buttock.	Folds right forepaw under itself. Puts the weight on left buttock.
Elbow position	NO	Moves its back	Folds right forepaw under itself.

Movement from front and rear:

Adduction or abduction of the extremities	Tight in the elbows. Moves its back. Paws in the same line. Slants right forepaw out and rotates it on the ground ...	Tight in the elbows. Moves its back. Paws in the same line, better than before Slants right forepaw out and rotates it on the ground ...	Abduction in the carpal joints
Load time for each extremity			Normal
Head movement during loading phases.	Head lowered	Head lowered.	Normal

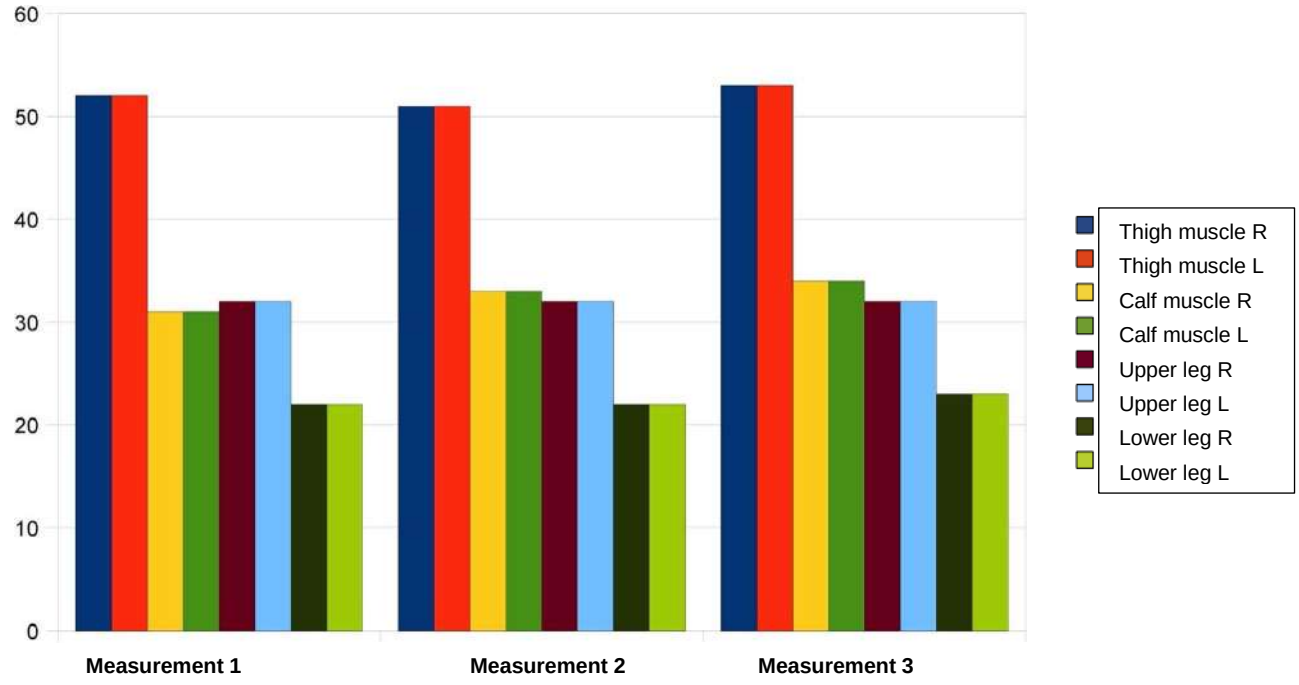
Movement from the side:

Protraction	Sitting	Sitting	
Retraction			
Range of motion in shoulder joint	Normal	Normal	Normal
Range of motion in elbow joint	Normal, but tight inward	Normal, but tight inward	Normal, but tight inward
Range of motion in carpal joint	Abducts on right.	Abducts on right.	Abducts on right.
Range of motion in hip joint	Normal	Normal	Normal
Range of motion in knee joint	Unstable on both.	Unstable on both.	Somewhat unstable on both.

Name: Ozzy
Breed: German Shepherd Dog/Rottweiler
Age: 7 years
Other: Retired working dog (Police/military/SAR)
Dog 5

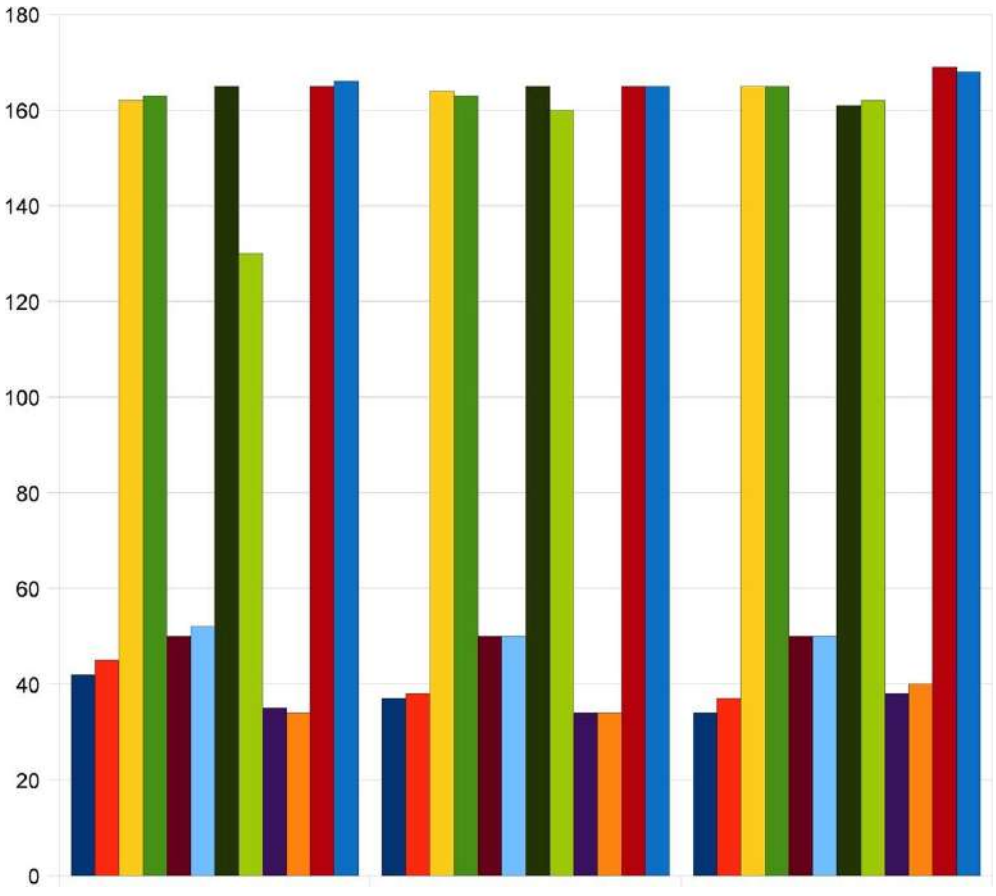
MUSCLE MASS

Date	3/14/2011	------	3/25/2011	------	4/11/2011	------
	Right	Left	Right	Left	Right	Left
Thigh muscle	52	52	51	51	53	53
Calf muscle	31	31	33	33	34	34
Upper leg muscle	32	32	32	32	32	32
Lower leg muscle	22	22	22	22	23	23



RANGE OF MOTION

Date	3/14/2011	------	3/25/2011	------	4/11/2011	------
	Right	Left	Right	Left	Right	Left
Knee joint flexion	42	45	37	38	34	37
Knee joint extension	162	163	164	163	65	65
Hip joint flexion	50	52	50	50	50	50
Hip joint extension	165	130	165	160	161	162
Elbow joint flexion	35	34	34	34	38	40
Elbow joint extension	166	165	165	165	169	168



Measurement 1 **Measurement 2** **Measurement 3**

MOTION ANALYSIS

Stationary:

	3/14/2011	3/25/2011	4/11/2011
Symmetrical loading of extremities	Loading on forward leg.	Normal.	Normal.
Symmetrical leg position between extremities	Normal	Normal	Wide between forelimbs

Sitting:

Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Normal	Normal	Normal
Sitting position	Prefers to lie	Normal	Normal

Lying:

Symmetrical leg position between extremities	Normal	Normal	Normal
Elbow position	Slanted outward	Slanted outward	Slanted outward

Movement from front and rear:

Adduction or abduction of the extremities	Abduction more on left front.	Abduction more on left front.	Normal
Load time for each extremity	Normal	Normal	Normal
Head movement during loading phases.	Normal	Normal	Normal

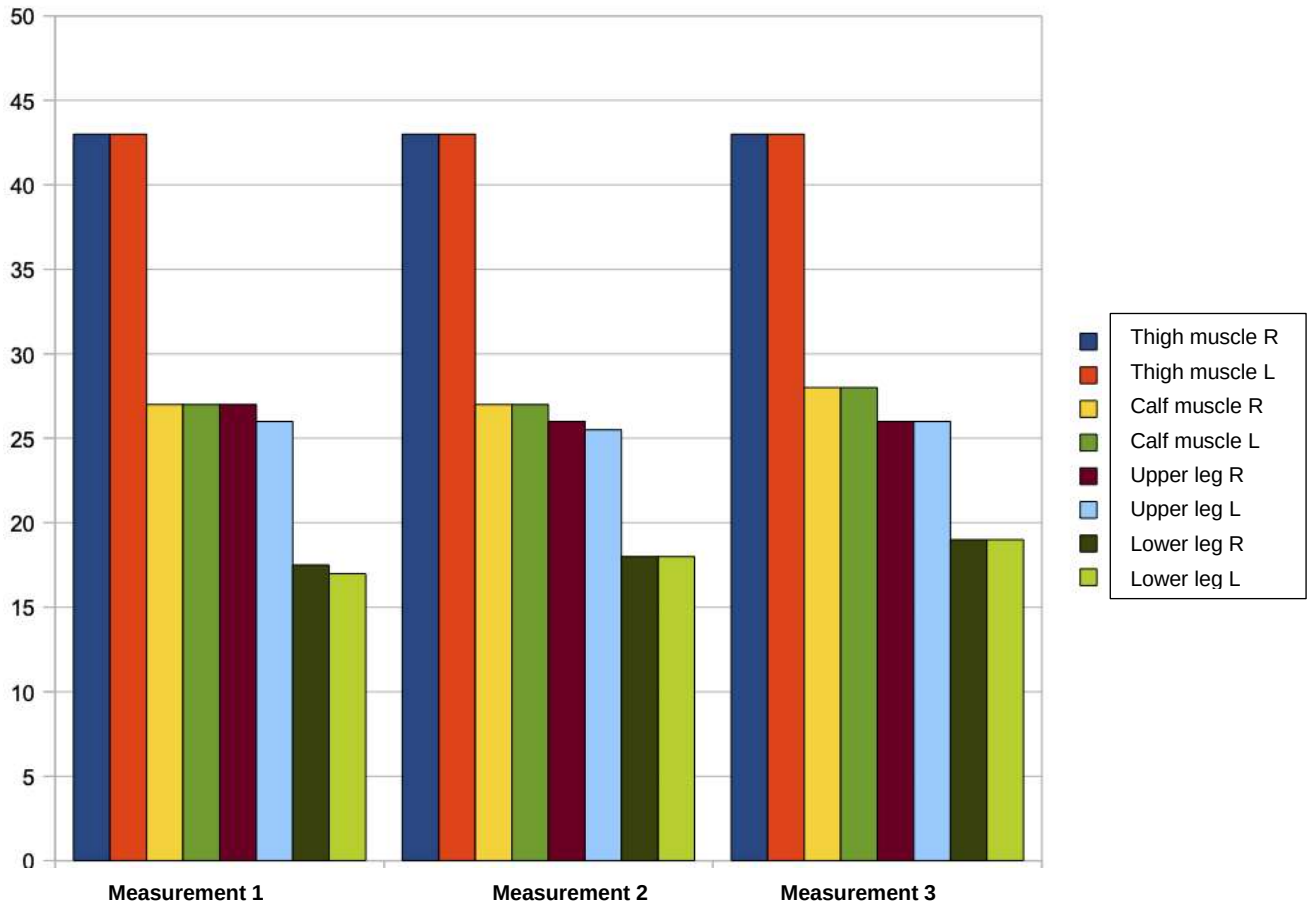
Movement from the side:

Protraction	Sitting and standing	Sitting and standing	Sitting and standing
Retraction			
Range of motion in shoulder joint	Normal	Normal	Normal
Range of motion in elbow joint	Excessive	Excessive	Excessive
Range of motion in carpal joint	Normal	Normal	Normal
Range of motion in hip joint	Stiff	Limited	Limited
Range of motion in knee joint	Normal	Normal	Normal

Name: Trixa
Breed: German Shepherd Dog
Age: 4 years
Other: Working dog (Police/military/SAR)
Dog 6

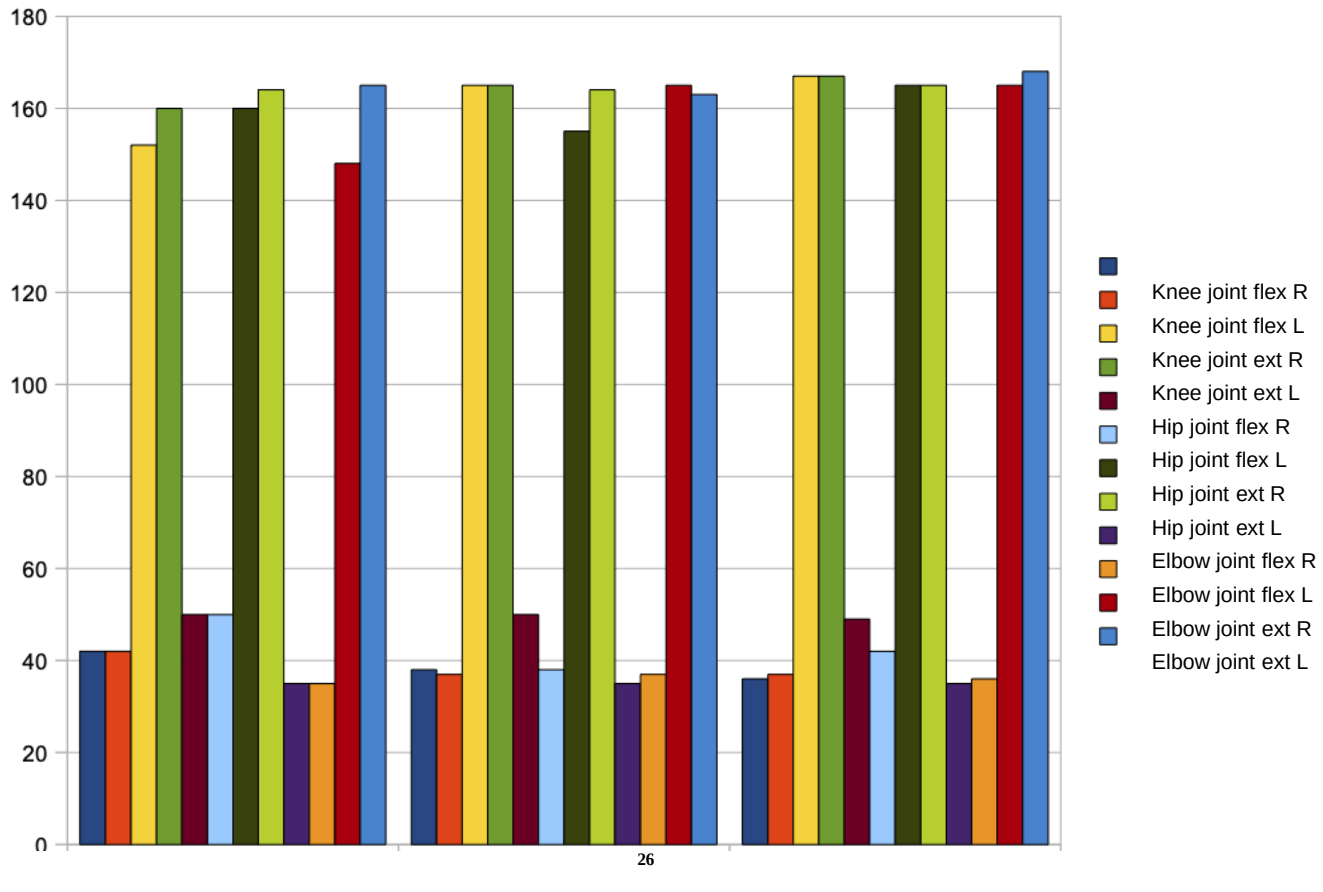
MUSCLE MASS

Date	3/16/2011		3/27/2011		4/11/2011	
	Right	Left	Right	Left	Right	Left
Thigh muscle	43	43	43	43	43	43
Calf muscle	27	27	27	27	28	28
Upper leg muscle	27	26	26	26	26	26
Lower leg muscle	17.5	17	18	18	19	19



RANGE OF MOTION

Date	3/16/2011	------	3/27/2011	------	4/11/2011	------
	Left	Right	Left	Right	Left	Right
Knee joint flexion	42	42	37	38	36	37
Knee joint extension	160	152	165	165	167	167
Hip joint flexion	50	50	50	50	49	42
Hip joint extension	160	160	164	155	165	165
Elbow joint flexion	35	35	37	35	35	36
Elbow joint extension	165	148	163	165	165	168



MOTION ANALYSIS

Stationary:

3/16/2011 3/27/2011 4/11/2011

Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Wide between hind legs, narrow in front	Eases load on left front.	Wide between forelimbs. Eases load on left rear.

Sitting:

Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Normal	Normal	Loads left rear.
Sitting position	Normal	Normal	Normal

Lying:

Symmetrical leg position between extremities	Puts the weight on left	Left paw is slanted in, loads left	Left paw is slanted in, loads left
Elbow position	Normal	Normal	Normal

Movement from front and rear:

Adduction or abduction of the extremities	Abducts elbow and knee	Elbows	Elbows both somewhat
Load time for each extremity	Normal	Normal	Normal
Head movement during loading phases.	Normal	Normal	Normal

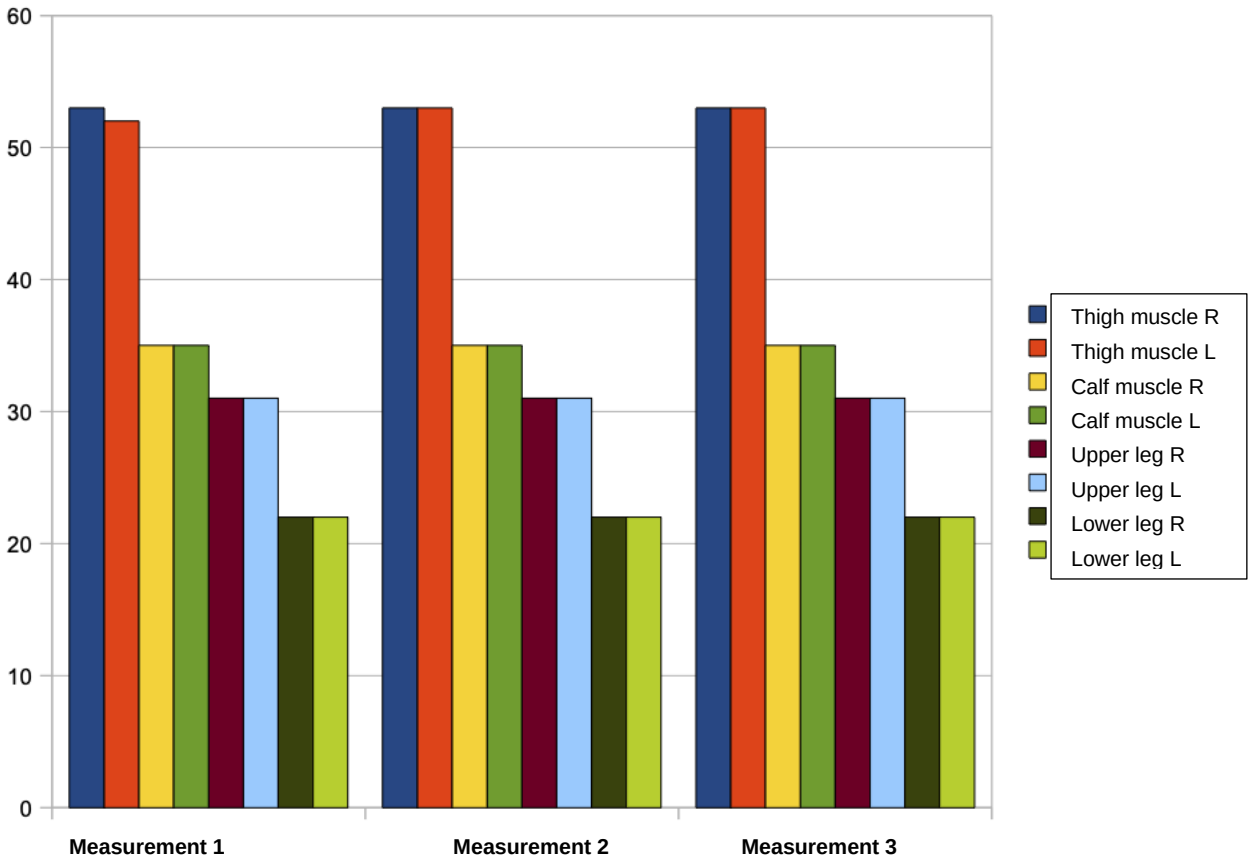
Movement from the side:

Protraction		Standing	
Retraction	Sitting		
Range of motion in shoulder joint	Normal	Normal	Normal
Range of motion in elbow joint	Wide in elbow. Excessive	Wide in elbow. Excessive	Wide in elbow. Excessive
Range of motion in carpal joint	Outward rotating rear paws, bowlegged in front	Outward rotating rear paws, bowlegged in front	Outward rotating rear paws, bowlegged in front
Range of motion in hip joint	Normal	Normal	Normal
Range of motion in knee joint	Excessive.	Excessive.	Excessive

Name: Ymer
Age: 3 years
Breed: German Shepherd Dog
Other: Working dog (Police/military/SAR)
Dog 7

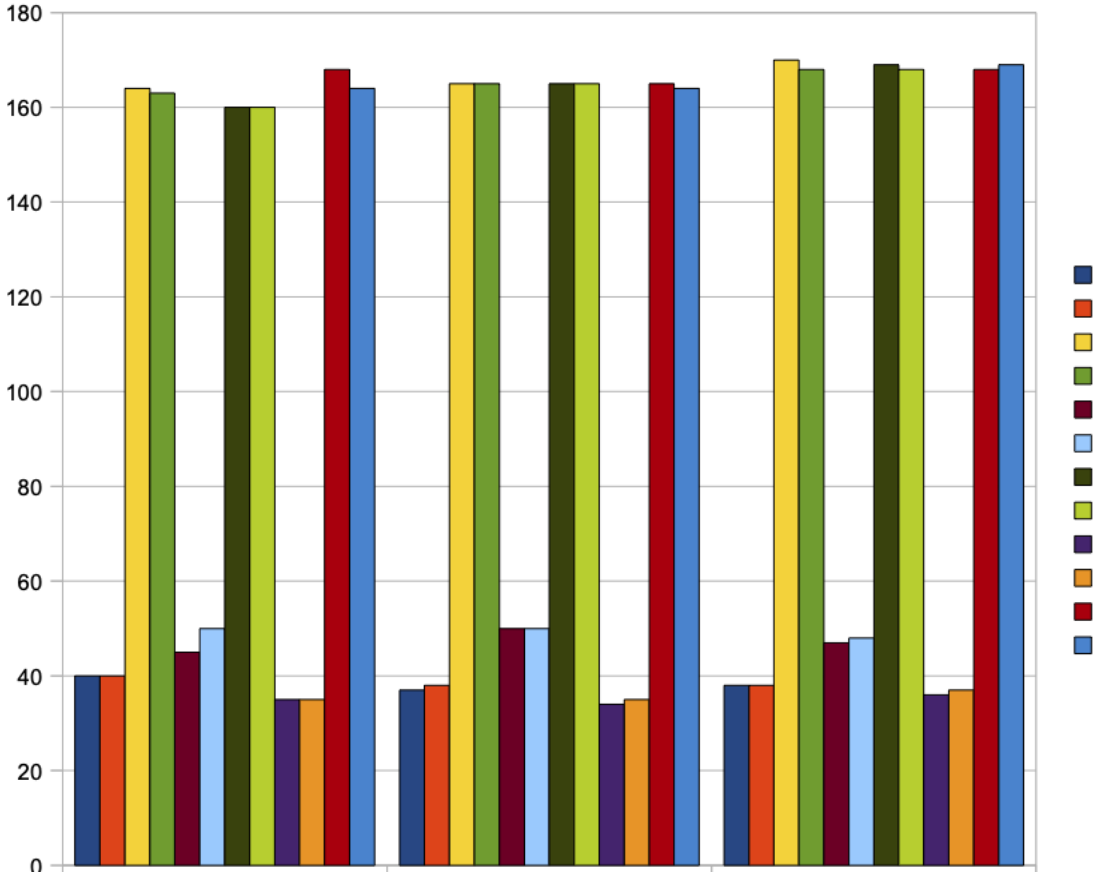
MUSCLE MASS

Date	3/14/2011	------	3/25/2011	------	4/11/2011	------
	Right	Left	Right	Left	Right	Left
Thigh muscle	53	52	53	53	53	53
Calf muscle	35	35	35	35	35	35
Upper leg muscle	31	31	31	31	31	31
Lower leg muscle	22	22	22	22	22	22



RANGE OF MOTION

Date	3/14/2011	------	3/25/2011	------	4/11/2011	------
	Left	Right	Left	Right	Left	Right
Knee joint flexion	40	40	38	37	38	38
Knee joint extension	163	164	165	165	170	168
Hip joint flexion	50	45	50	50	47	48
Hip joint extension	160	160	165	165	169	168
Elbow joint flexion	35	35	35	34	36	37
Elbow joint extension	164	168	164	165	168	169



			Knee joint flex R
			Knee joint flex L
			Knee joint ext R
			Knee joint ext L
			Hip joint flex R
			Hip joint flex L
			Hip joint ext R
			Hip joint ext L
			Elbow joint flex R
			Elbow joint flex L
Measurement 1	**Measurement 2**	**Measurement 3**	Elbow joint ext R
			Elbow joint ext L

MOTION ANALYSIS

Stationary:

	3/14/2011	3/25/2011	**4/8/2011**
Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Normal	Normal	Normal

Sitting:

Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Forepaws somewhat slanted out	Forepaws somewhat slanted out	Forepaws somewhat slanted out
Sitting position	Normal	Normal	Normal

Lying:

Symmetrical leg position between extremities	Normal	Normal	Normal
Elbow position	Normal	Normal	Normal

Movement from front and rear:

Adduction or abduction of the extremities	Normal	Normal	Normal
Load time for each extremity	Normal	Normal	Normal
Head movement during loading phases.	Normal	Normal	Normal

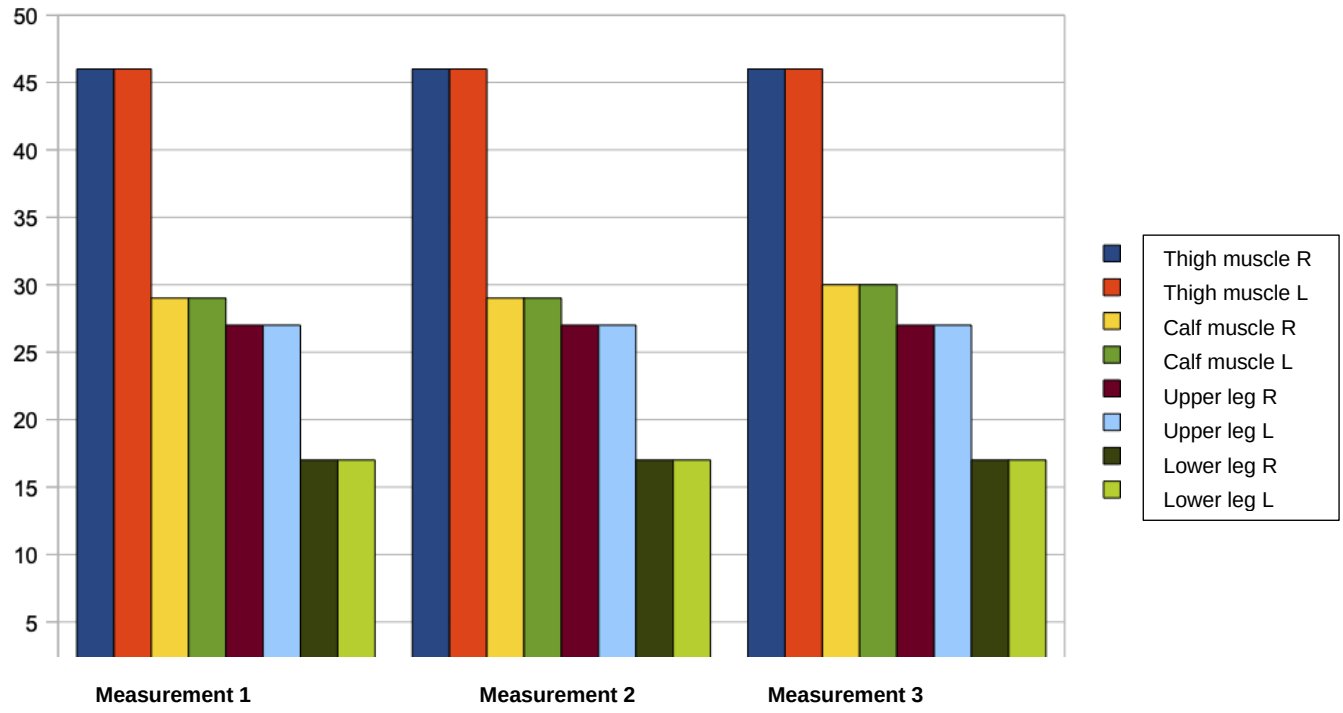
Movement from the side:

Protraction	Normal	Normal	Normal
Retraction	Normal	Normal	Normal
Range of motion in shoulder joint	Normal	Normal	Normal
Range of motion in elbow joint	Normal	Normal	Normal
Range of motion in carpal joint	Somewhat to the outside	Somewhat to the outside	Somewhat to the outside
Range of motion hip joint	Normal	Normal	Normal
Range of motion knee joint	Normal	Normal	Normal

Name: Zack
Breed: Siberian Husky
Age: 2 years
Dog 8

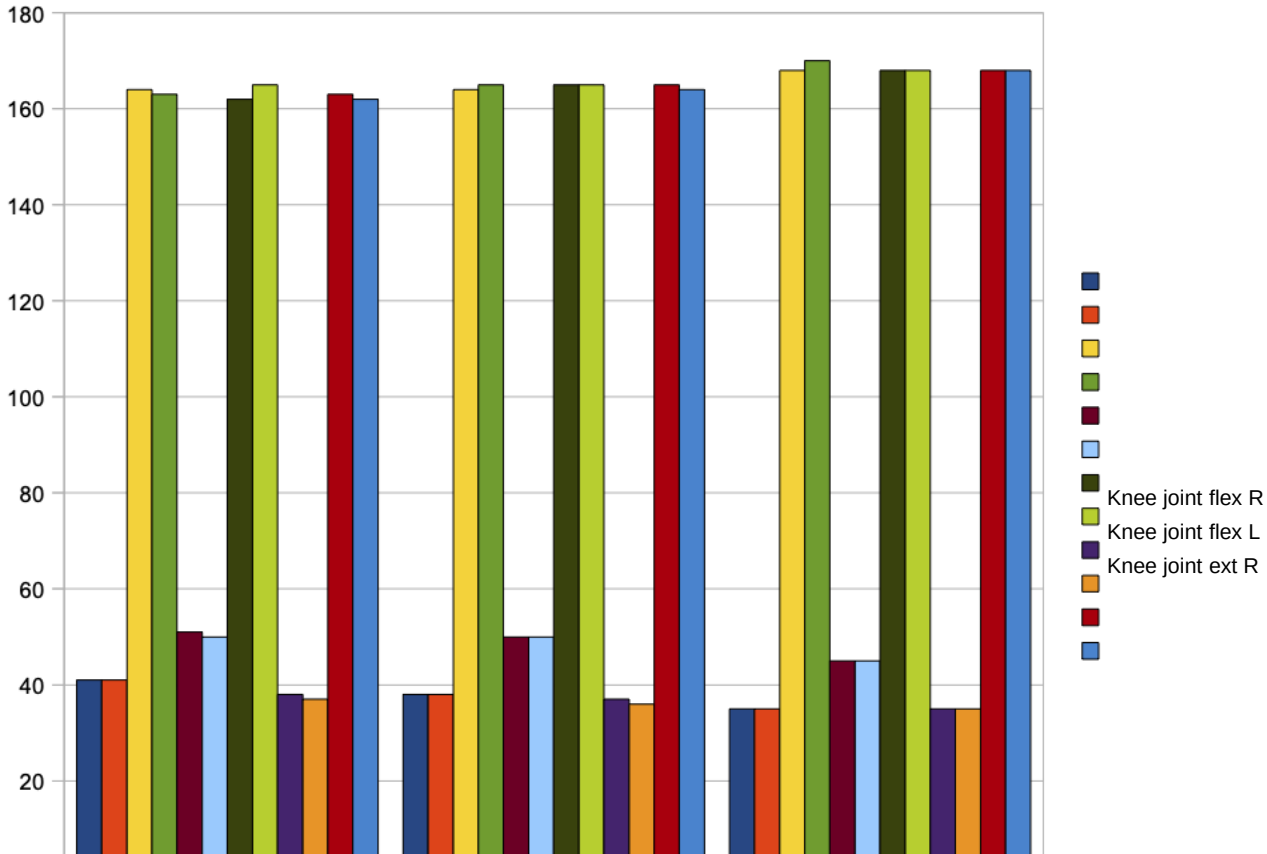
MUSCLE MASS

Date	3/14/2011	------	3/25/2011	------	4/11/2011	------
	Right	Left	Right	Left	Right	Left
Thigh muscle	46	46	46	46	46	46
Calf muscle	29	29	29	29	30	30
Upper leg muscle	27	27	27	27	27	27
Lower leg muscle	17	17	17	17	17	17



RANGE OF MOTION

Date	3/14/2011	------	3/25/2011	------	4/11/2011	------
	Left	Right	Left	Right	Left	Right
Knee joint flexion	41	41	38	38	35	35
Knee joint extension	163	164	165	164	168	170
Hip joint flexion	50	52	50	50	45	45
Hip joint extension	165	162	165	165	168	167
Elbow joint flexion	37	38	36	37	35	35
Elbow joint extension	162	163	164	165	168	168



Knee joint ext L
Hip joint flex R
Hip joint flex L
Hip joint ext R
Hip joint ext L
Elbow joint flex R
Elbow joint flex L
Elbow joint ext R
Elbow joint ext L

Measurement 1	Measurement 2	Measurement 3

MOTION ANALYSIS

Stationary:

	3/14/2011	**3/25/2011**	**4/11/2011**
Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Wide between hind legs. Low position	Wide between hind legs. Low position	Wide between hind legs. Low position

Sitting:

Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Normal	Normal	Normal
Sitting position	Normal	Normal	Normal

Lying:

Symmetrical leg position between extremities	Normal	Normal	Normal
Elbow position	Normal	Normal	Normal

Movement from front and rear:

Adduction or abduction of the extremities	Normal	Normal	Normal
Load time for each extremity	Normal	Normal	Normal
Head movement during loading phases.	Normal	Normal	Normal

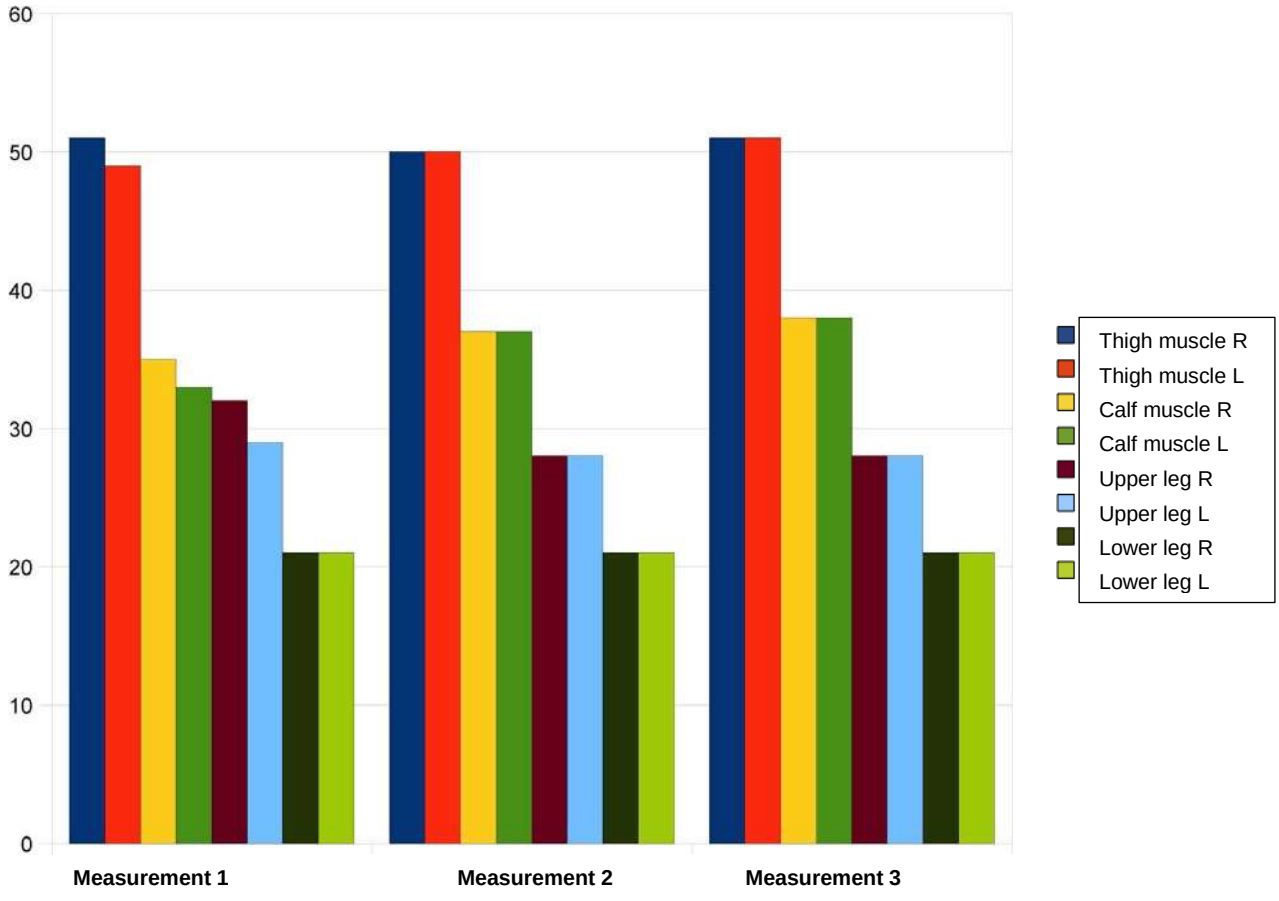
Movement from the side:

Protraction	Normal	Normal	Normal
Retraction	Normal	Normal	Normal
Range of motion in shoulder joint	Normal	Normal	Normal
Range of motion in elbow joint	Normal	Normal	Normal
Range of motion in carpal joint	Normal	Normal	Normal
Range of motion in hip joint	Normal	Normal	Normal
Range of motion in knee joint	Normal	Normal	Normal

Name: Classe
Breed: German Shepherd Dog
Age: 4 years
Other: Working dog (Police/military/SAR)
Dog 9

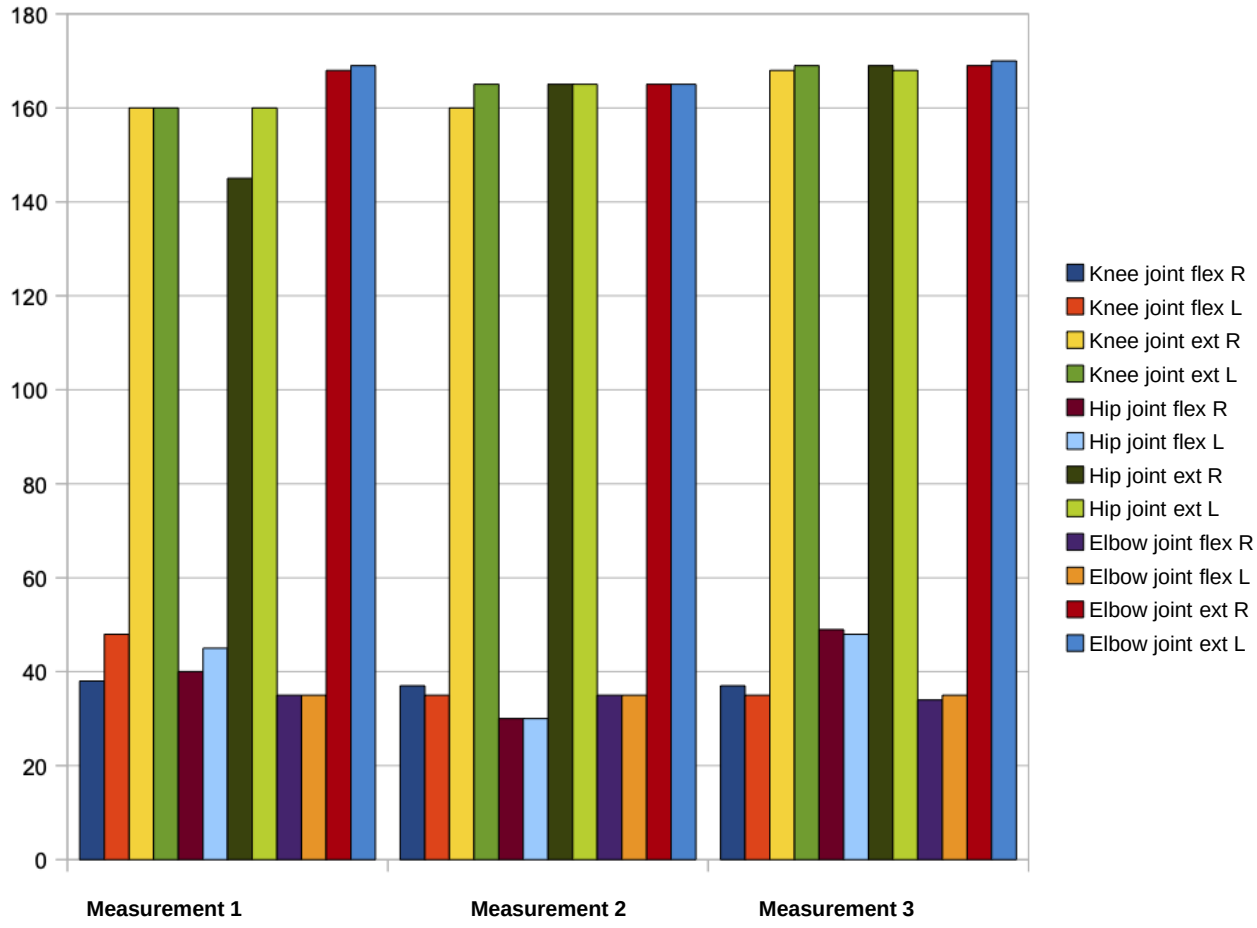
MUSCLE MASS

Date	3/13/2011	------	3/31/2011	------	4/13/2011	------
	Right	Left	Right	Left	Right	Left
Thigh muscle	51	49	50	50	51	51
Calf muscle	35	33	37	37	38	38
Upper leg muscle	32	29	28	28	28	28
Lower leg muscle	21	21	21	21	21	21



RANGE OF MOTION

Date	3/13/2011	------	3/31/2011	------	4/13/2011	------
	Left	Right	Left	Right	Left	Right
Knee joint flexion	38	48	37	35	37	35
Knee joint extension	160	160	160	165	168	169
Hip joint flexion	40	45	50	50	49	48
Hip joint extension	145	160	165	165	169	168
Elbow joint flexion	35	35	35	35	34	35
Elbow joint extension	168	169	165	165	169	170



MOTION ANALYSIS

	3/13/2011	3/31/2011	4/13/2011
Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Normal	Normal	Normal
Sitting:			
Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Normal	Normal	Normal
Sitting position			
Lying:			
Symmetrical leg position between extremities	Normal	Normal	Normal
Elbow position	Normal	Normal	Normal

Movement from front and rear

Adduction or abduction of the extremities	Abducts both elbows.	Abducts both elbows.	Abducts both elbows.
Load time for each extremity	Normal	Normal	Normal
Head movement during loading phases.	Normal	Normal	Normal

Movement from the side:

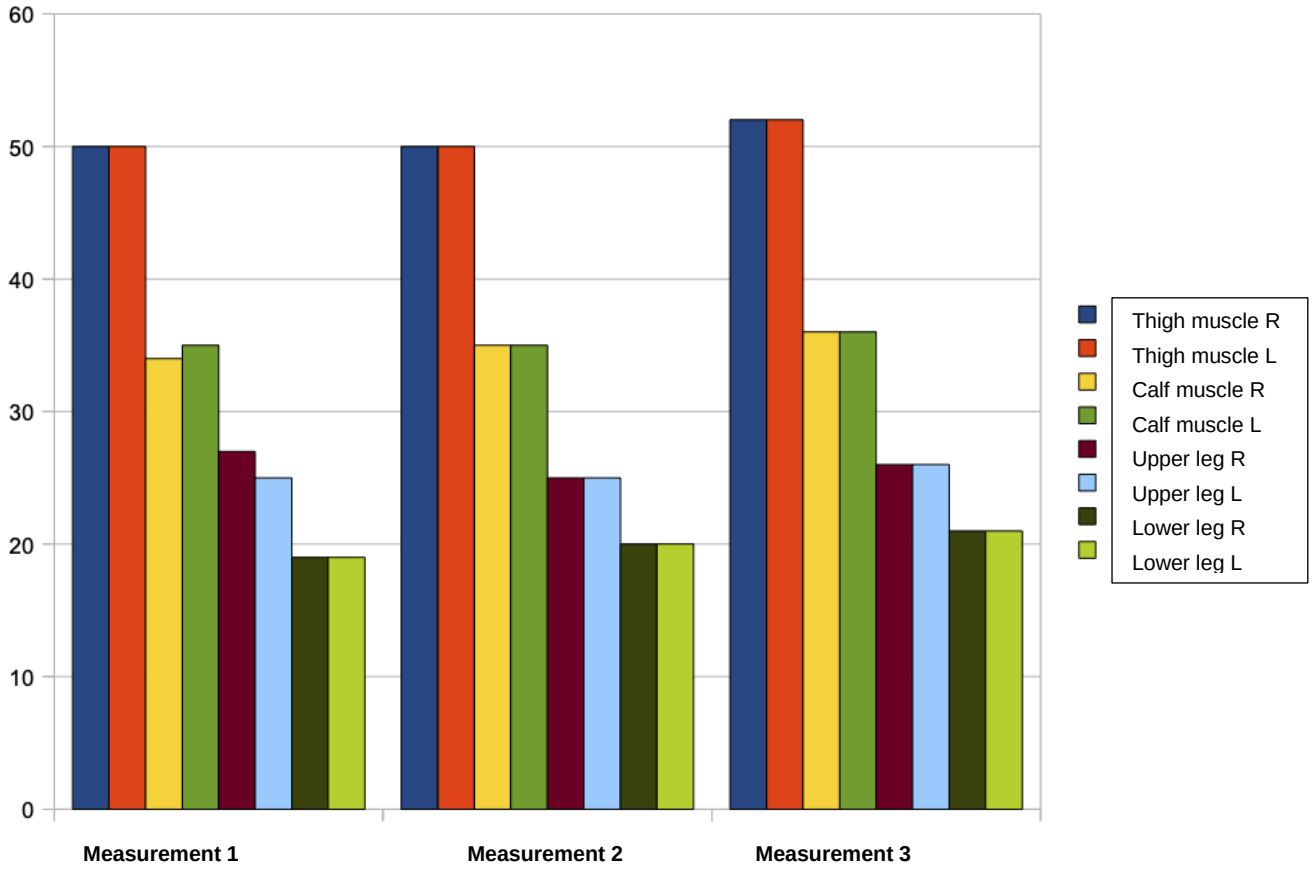
Protraction			
Retraction			
Range of motion in shoulder joint	Normal	Normal	Normal
Range of motion in elbow joint	Excessive	Excessive	Excessive
Range of motion in carpal joint	Excessive	Excessive	Excessive
Range of motion in hip joint	Normal	Normal	Normal
Range of motion in knee joint	Normal	Normal	Normal

Name: Gino
Breed: German Shepherd Dog
Age: 5 years
Other: Working dog (Police/military/SAR)
Dog 10

MUSCLE MASS

Date	3/17/2011	------	3/26/2011	------	4/12/2011	------
	Right	Left	Right	Left	Right	Left
Thigh muscle	50	50	50	50	52	52
Calf muscle	34	35	35	35	36	36
Upper leg muscle	27	25	25	25	26	26
Lower leg muscle	19	19	20	20	21	21

□



RANGE OF MOTION

NOT PERFORMED. THE DOG CANNOT BE HANDLED!

Date	3/17/2011	------	3/26/2011	------	4/12/2011	------
	Left	Right	Left	Right	Left	Right
Knee joint flexion						
Knee joint extension						
Hip joint flexion						
Hip joint extension						
Elbow joint flexion						
Elbow joint extension						

MOTION ANALYSIS

Stationary:

	3/17/2011	3/26/2011	4/12/2011
Symmetrical loading of extremities	Eases load on left.	Normal	Normal
Symmetrical leg position between extremities	Right hind leg angled out.	Wide leg position in rear. Angled out in front.	Normal

Sitting:

Symmetrical loading of extremities	Loads right foreleg.	Normal	Normal
Symmetrical leg position between extremities	Slants right rear paw out	Normal	Slants right rear paw out
Sitting position	Normal	Slow to sit.	Normal

Lying:

Symmetrical leg position between extremities	Normal	Normal	Normal
Elbow position	Normal	Normal	Normal

Movement from front and rear:

Adduction or abduction of the extremities	Abducts in front	Abducts in left front. Left rear paw directed outward.	Abducts left front somewhat. Left rear paw directed outward.
Load time for each extremity	Ambles at trot and walk.	Normal	Normal
Head movement during loading phases.	Normal	Normal	Normal

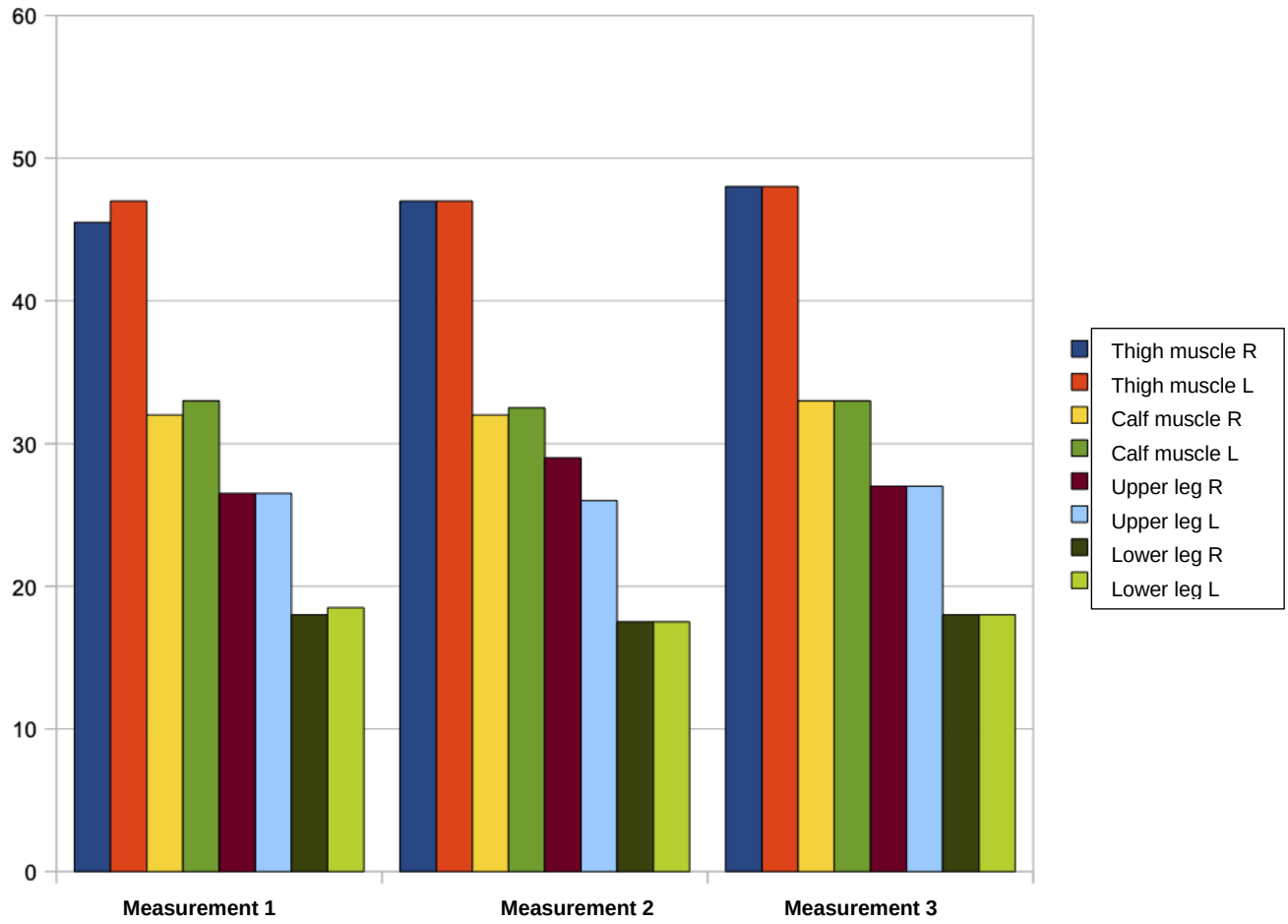
Movement from the side:

Protraction	Normal	Normal	Normal
Retraction	Normal	Normal	Normal
Range of motion in shoulder joint	Normal	Normal	Normal
Range of motion in elbow joint	Excessive/loose in both	Excessive in both in front.	Excessive in both in front.
Range of motion in carpal joint	Normal	Excessive. Directed outward.	Excessive. Directed outward.
Range of motion in hip joint	Normal	Normal	Normal
Range of motion in knee joint	Normal	Unstable right knee.	Somewhat unstable right knee.

Name: Benina
Breed: German Shepherd Dog
Age: 6 years
Other: Retired working dog (Police/military/SAR)
Dog 11

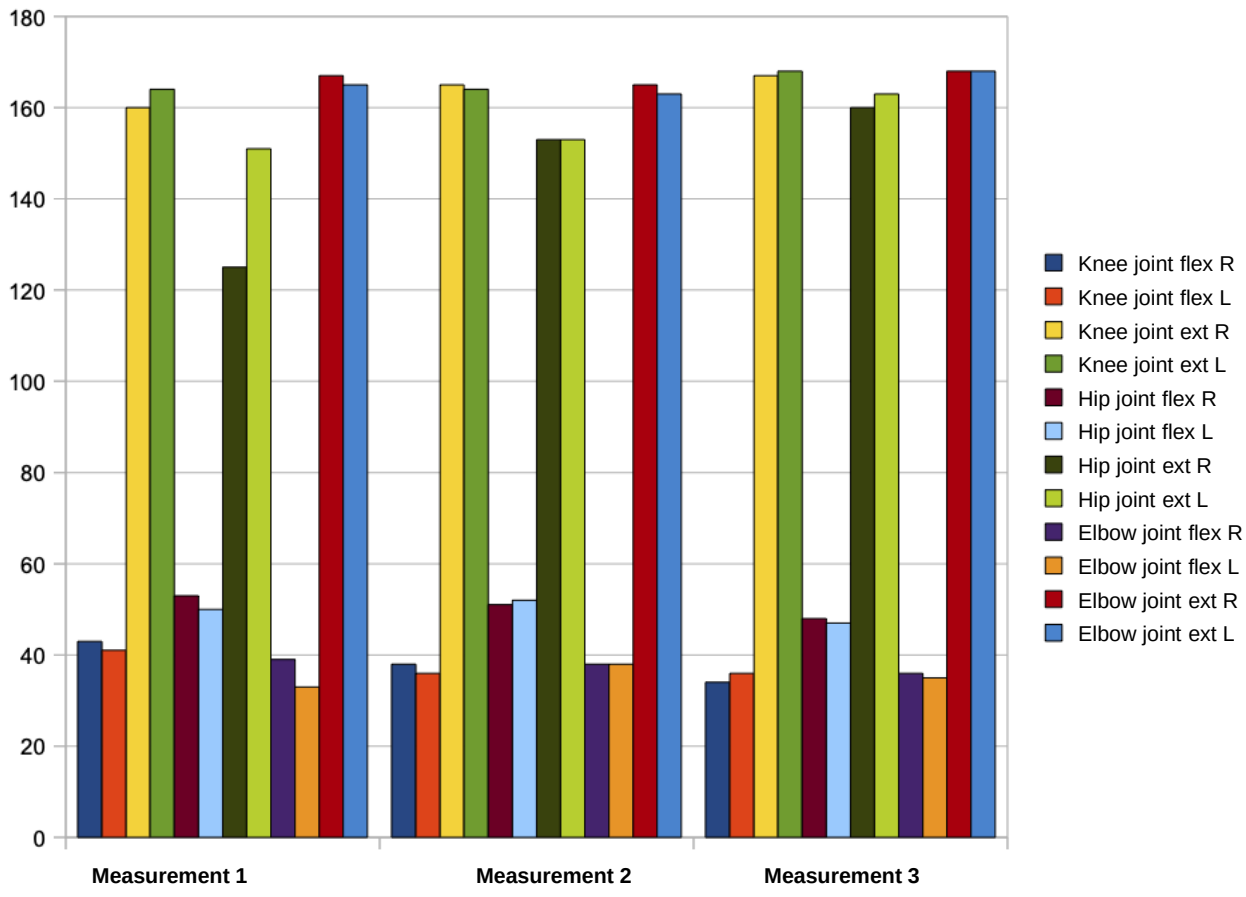
MUSCLE MASS

Date	3/15/2011	-----	3/26/2011	------	4/14/2011	------
	Left	Right	Left	Right	Left	Right
Thigh muscle	47	45.5	47	47	48	48
Calf muscle	33	32	32	32	33	33
Upper leg muscle	26	26.5	27	26	27	27
Lower leg muscle	17.5	17	17.5	17.5	18	18



RANGE OF MOTION

Date	3/15/2011	------	3/26/2011	------	4/14/2011	------
	Left	Right	Left	Right	Left	Right
Knee joint flexion	41	43	36	38	34	36
Knee joint extension	164	160	164	165	167	168
Carpal joint flexion	33	38	37	35	48	47
Carpal joint extension	197	209	205	205	160	163
Elbow joint flexion	33	39	38	38	36	35
Elbow joint extension	165	167	163	165	168	168



MOTION ANALYSIS

Stationary:

	3/15/2011	3/26/2011	4/14/2011
Symmetrical loading of extremities	Slants left hind leg inward. Left foreleg is placed somewhat forward. Loads right front.	Eases load on left front.	Eases load on left front.
Symmetrical leg position between extremities	Widens the forelegs.	Widens the hind legs	Widens the hind legs

Sitting:

Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	The hip is placed outside.	Normal	Normal
Sitting position	Normal	Normal	Normal

Lying:

Symmetrical leg position between extremities	Normal	Puts the rear on the right side.	Puts the rear on the right side.
Elbow position	Placed under the dog.	Normal	Normal

Movement from front and rear:

Adduction or abduction of the extremities	Abducting movement left front.	Normal	Normal
Load time for each extremity	Normal	Normal	Normal
Head movement during loading phases.	Normal	Normal	Normal

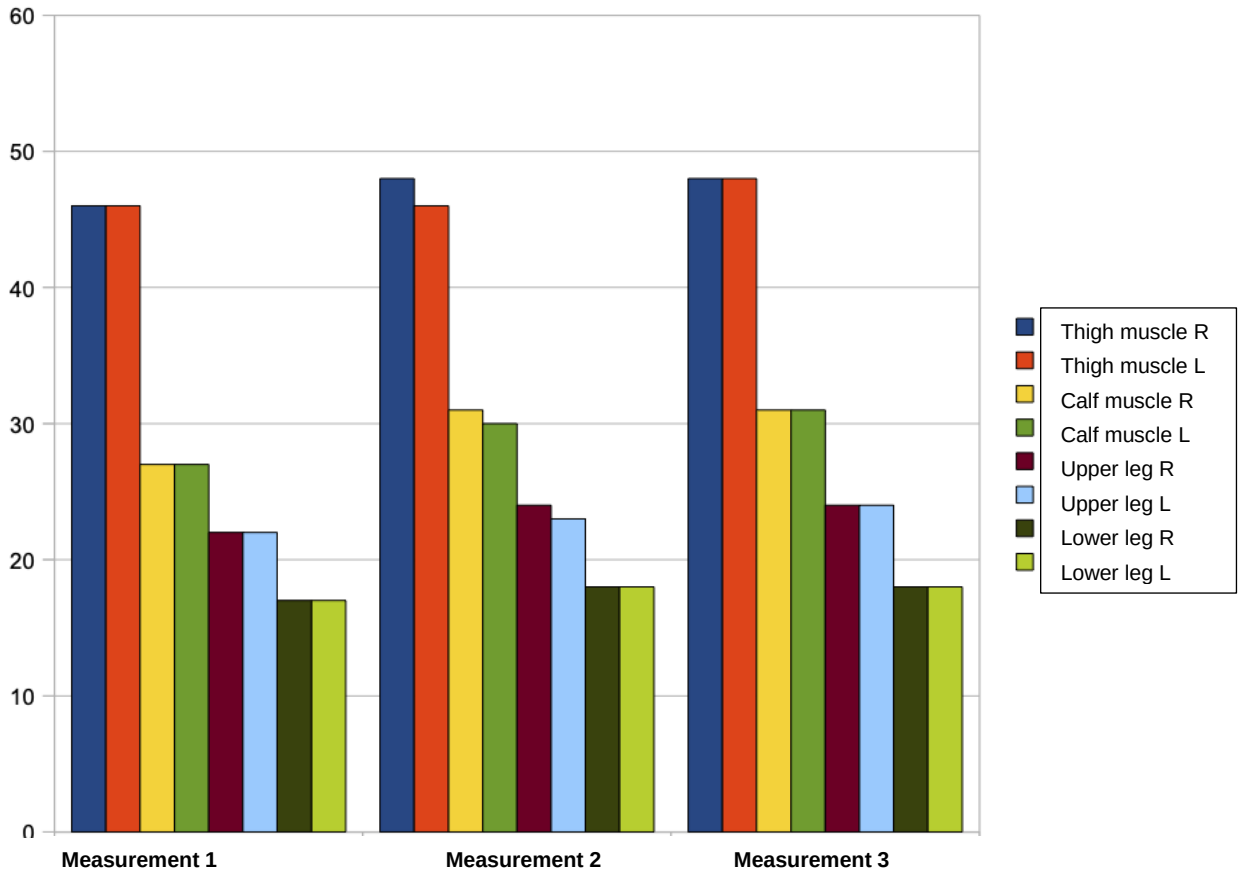
Movement from the side:

Protraction	Normal	Sitting	Sitting
Retraction	Normal	Normal	Normal
Range of motion in shoulder joint	Normal	Normal	Normal
Range of motion in elbow joint	Somewhat loose in movement at trot. Left elbow somewhat out.	Left elbow somewhat out.	Left elbow somewhat out.
Range of motion in carpal joint	Normal	Normal	Normal
Range of motion in hip joint	Supination when walking and trotting. Wider movement when trotting.	Supination when walking and trotting. Wider movement when trotting.	Supination when walking and trotting. Wider movement when trotting.
Range of motion in knee joint	Normal	Normal	Normal

Name: Sandi
Breed: German Shepherd Dog
Age: 4 years
Other: Working dog (Police/military/SAR)
Dog 12

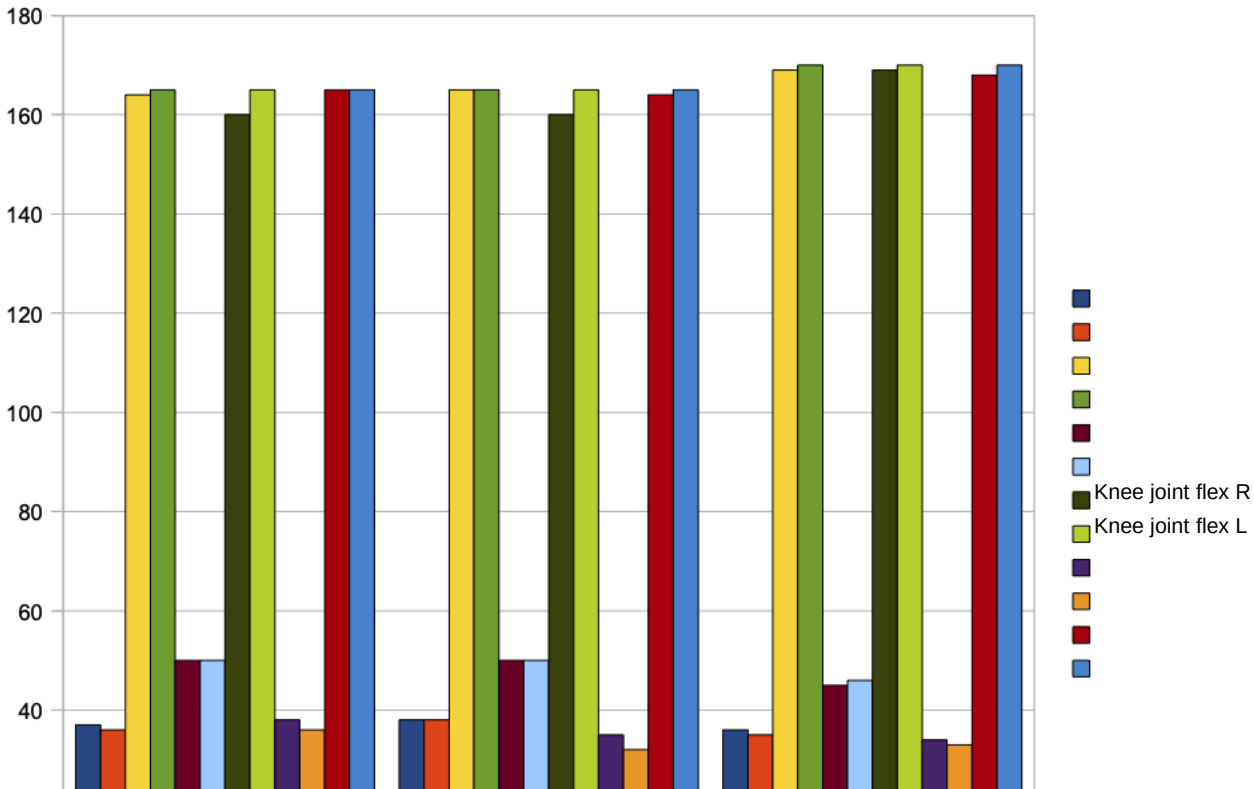
MUSCLE MASS

Date	3/17/2011	------	3/26/2011	------	4/14/2011	------
	Right	Left	Right	Left	Right	Left
Thigh muscle	46	46	48	46	48	48
Calf muscle	27	27	31	30	31	31
Upper leg muscle	22	22	24	23	24	24
Lower leg muscle	17	17	18	18	18	18



RANGE OF MOTION

Date	3/17/2011	------	3/26/2011	------	4/14/2011	------
	Left	Right	Left	Right	Left	Right
Knee joint flexion	36	37	38	38	36	35
Knee joint extension	165	164	165	165	169	170
Hip joint flexion	50	50	50	50	45	46
Hip joint extension	165	160	165	160	169	170
Elbow joint flexion	36	38	32	35	34	33
Elbow joint extension	165	165	165	164	168	170



Knee joint ext R
Knee joint ext L
Hip joint flex R
Hip joint flex L
Hip joint ext R
Hip joint ext L
Elbow joint flex R
Elbow joint flex L
Elbow joint ext R
Elbow joint ext L

Measurement 1	Measurement 2	Measurement 3

MOTION ANALYSIS

Stationary:

3/17/2011 3/26/2011 4/14/2011

Symmetrical loading of extremities	**Normal**	**Normal**	**Normal**
Symmetrical leg position between extremities	**Normal**	**Normal**	**Normal**
Abnormal leg position	**Normal**	**Normal**	**Normal**

Sitting:

Symmetrical loading of extremities	**Normal**	**Normal**	**Normal**
Symmetrical leg position between extremities	**Normal**	**Normal**	**Normal**
Sitting position	**Normal**	**Normal**	**Normal**

Lying:

Symmetrical leg position between extremities	**Normal**	**Normal**	**Normal**
Elbow position	**Normal**	**Normal**	**Normal**

Movement from front and rear:

Adduction or abduction of the extremities	**Normal**	**Normal**	**Normal**
Load time for each extremity	**Normal**	**Normal**	**Normal**
Head movement during loading phases.	**Normal**	**Normal**	**Normal**

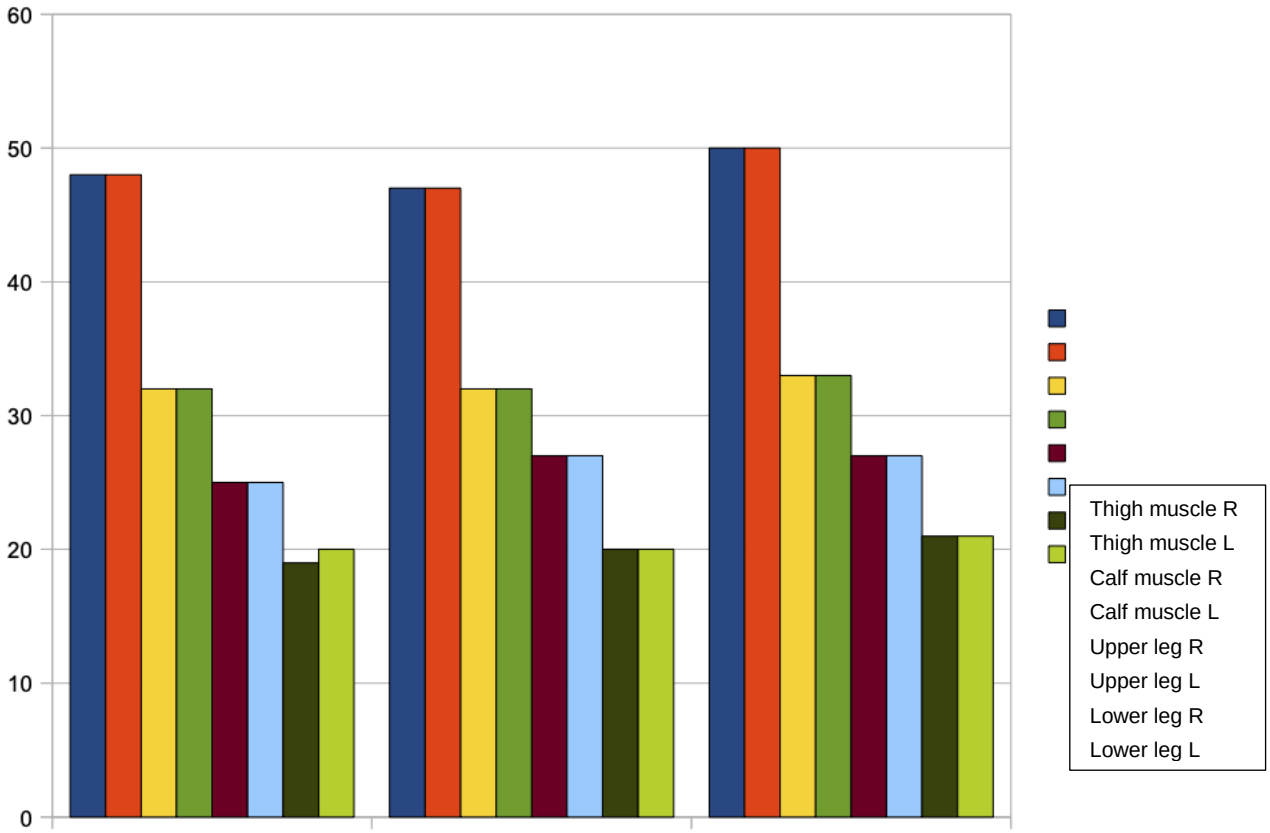
Movement from the side:

Protraction	**Normal**	**Normal**	**Normal**
Retraction	**Normal**	**Normal**	**Normal**
Range of motion in shoulder joint	**Normal**	**Normal**	**Normal**
Range of motion in elbow joint	**Normal**	**Normal**	**Normal**
Range of motion in carpal joint	**Normal**	**Supination right front.**	**Supination right front.**
Range of motion in hip joint	**Normal**	**Normal**	**Normal**
Range of motion in knee joint	**Normal**	**Normal**	**Normal**

Name: Rappy
Breed: Malamute
Age: 4 years
Dog 13

MUSCLE MASS

Date	3/15/2011	------	3/26/2011	------	4/13/2011	------
	Right	Left	Right	Left	Right	Left
Thigh muscle	48	48	47	47	50	50
Calf muscle	32	32	32	32	33	33
Upper leg muscle	25	25	27	27	27	27
Lower leg muscle	19	20	20	20	21	21



Measurement 1	Measurement 2	Measurement 3

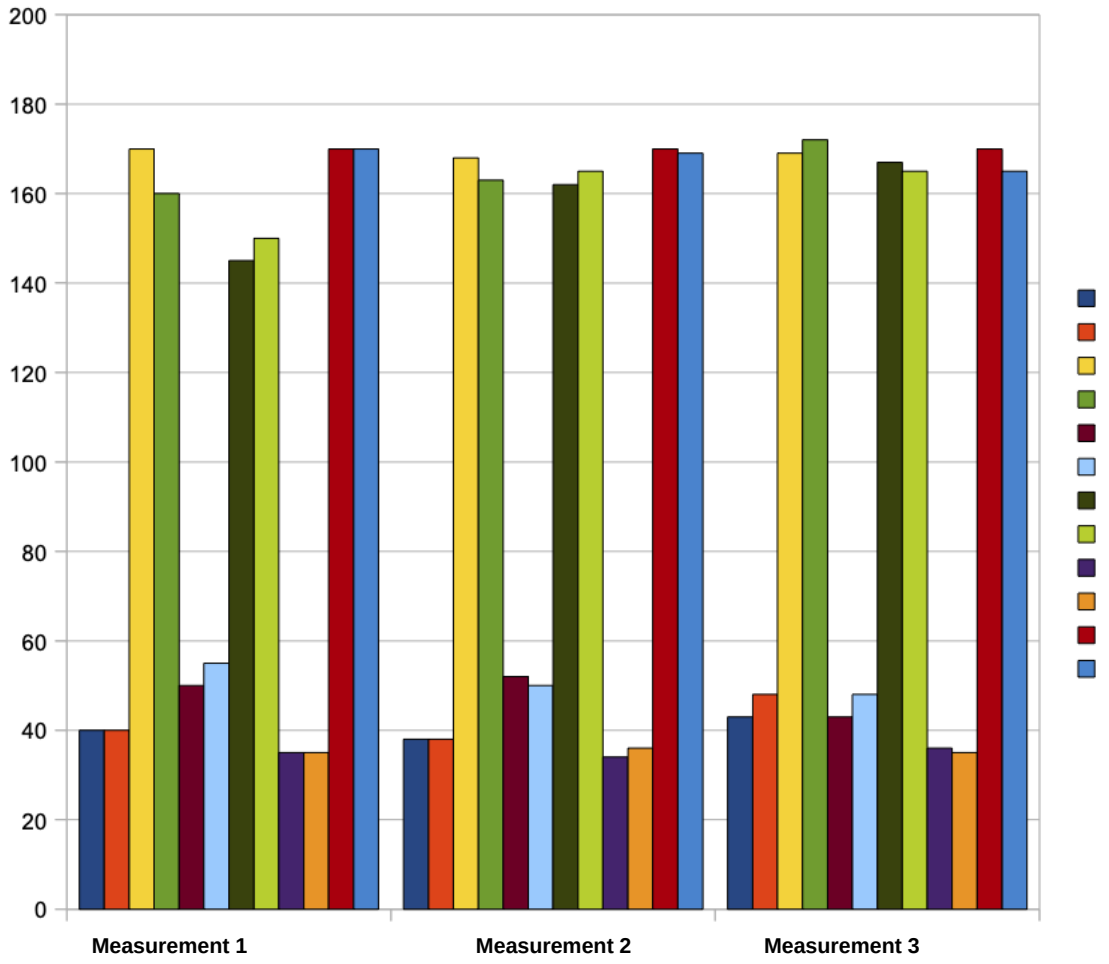
RANGE OF MOTION

Knee joint flex R

Knee joint flex L

Knee joint ext R

Date	3/15/2011	------	3/26/2011	------	4/13/2011	------
	Left	Right	Left	Right	Left	Right
Knee joint flexion	40	40	38	38	43	48
Knee joint extension	160	170	163	168	169	172
Hip joint flexion	55	50	50	52	43	48
Hip joint extension	150	145	165	162	167	165
Elbow joint flexion	35	35	36	34	36	35
Elbow joint extension	170	170	169	170	170	168



MOTION ANALYSIS

Stationary:

	3/15/2011	3/26/2011	4/13/2011
Symmetrical loading of extremities	Normal	Normal	Normal
Symmetrical leg position between extremities	Wide leg position in rear, normal in front.	Wide leg position in rear, normal in front.	Wide leg position in rear, normal in front.

Sitting:

Symmetrical loading of extremities	Slants right hip out, sits on left buttock.	Slants right hip out, sits on left buttock.	Slants rear paws out
Symmetrical leg position between extremities	Normal	Normal	Normal
Sitting position	Normal	Normal	Normal

Lying:

Symmetrical leg position between extremities	Normal	Normal	Slants rear paws out
Elbow position	Normal	Normal	Normal

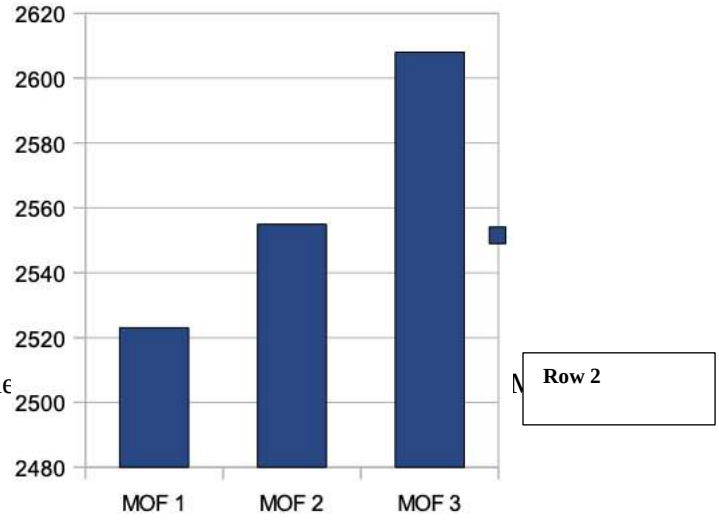
Movement from front and rear:

Adduction or abduction of the extremities	Normal	Normal	Normal
Load time for each extremity	Normal, amble	Normal, amble	Normal, amble
Head movement during loading phases.	Normal	Normal	Normal

Movement from the side:

Protraction			
Retraction			
Range of motion in shoulder joint	Normal	Normal	Normal
Range of motion in elbow joint	Normal	Normal	Normal
Range of motion in carpal joint	Normal	Normal	Normal
Range of motion in hip joint	Normal	Normal	Normal
Range of motion in knee joint	Bowlegged	Bowlegged	Bowlegged

	Total (cm)
Measurement 1	2523
Measurement 2	2555
Measurement 3	2608



Total compilation of muscle

CONCLUSIONS

The study showed a clear improvement in the movement pattern with increased range of motion and increased muscle mass in the dogs.
The motion analysis shows the dogs have developed a more deliberate lowering of their paws and have thus improved their movement pattern.
The dogs that were amblers have walked normally through the use of weight cuffs.
The study also showed that the dogs that were uneven in musculature have evened out their muscle mass.
I could not see any great difference in the improvement of the various breeds in the study.
1 Dalmatian
1 Siberian Husky
1 Malamute
1 German Shepherd Dog/Rottweiler
9 German Shepherd Dog
The dogs that according to their owners have been the least active have improved the most in range of motion and muscle mass. The dogs that were more active in winter have improved in range of motion but less in muscle mass.
Two dogs (Dogs 7 and 8) have not improved at all in muscle mass but did improve in range of motion. This may be because these dogs were trained the entire winter in pulling.

As two dogs did not improve in muscle mass, my hypothesis cannot be confirmed. All dogs did **not** improve in muscle mass and range of motion.
The control dog (Dog 1) that wore empty weight cuffs improved only in range of motion. This confirms the theory that if the goal is to build muscles in the dog, then the dog should be loaded with weights in the cuffs. If the goal is to improve the movement pattern, then using empty cuffs works.

Despite this, the setup with alternating the training with weight cuffs on front and hind legs was to allow the muscles to recover between the training sessions, and this produced a very good result. Through the adaptation of the muscles to the training time and to the increased load, the muscles developed in succession. I have begun a new 90-day study in which the differences are a smaller load (2X) and a longer load time (10-30 minutes), and nearly all dogs that participated in this 30-day study will assist in that one.
I have also begun a study of working dogs, also 90 days in length. These dogs will be trained with weight cuffs only during the sessions when they are working. The reason for this is that these dogs usually are not trained while they work but only when they have days off. The objective with training the dogs with weight cuffs on the job is to even out the training and thus train in a way that prevents injuries.

When the dogs were measured, the owners were very pleased with the result. Most of them will continue to make use of weight cuffs after the conclusion of the study.

Appendix 1

Week 1, dog's weight 1x X kg =1X grams in weight cuffs

Day 1: 5 minutes with weight cuffs, forelegs
Day 2: 5 minutes with weight cuffs, hind legs
Day 3:10 minutes with weight cuffs, forelegs
Day 4: 10 minutes with weight cuffs, hind legs
Day 5:15 minutes with weight cuffs, forelegs
Day 6: 15 minutes with weight cuffs, hind legs
Day 7: Rest

Week 2, dog's weight 2x X kg= 2X grams in weight cuffs

Day 1: 5 minutes with weight cuffs, forelegs
Day 2: 5 minutes with weight cuffs, hind legs
Day 3:10 minutes with weight cuffs, forelegs
Day 4: 10 minutes with weight cuffs, hind legs
Day 5:15 minutes with weight cuffs, forelegs
Day 6: 15 minutes with weight cuffs, hind legs
Day 7: Rest

Week 3, dog's weight 3x X kg= 3X grams in weight cuffs
Day 1: 5 minutes with weight cuffs, forelegs
Day 2: 5 minutes with weight cuffs, hind legs
Day 3:10 minutes with weight cuffs, forelegs
Day 4: 10 minutes with weight cuffs, hind legs
Day 5:15 minutes with weight cuffs, forelegs
Day 6: 15 minutes with weight cuffs, hind legs
Day 7: Rest

Week 4, dog's weight 4x X kg= 4X grams in weight cuffs

Day 1: 5 minutes with weight cuffs, forelegs
Day 2: 5 minutes with weight cuffs, hind legs
Day 3:10 minutes with weight cuffs, forelegs
Day 4: 10 minutes with weight cuffs, hind legs
Day 5:15 minutes with weight cuffs, forelegs
Day 6: 15 minutes with weight cuffs, hind legs
Day 7: Rest