

Vitamin C and HD – Revisited

By Sy Guth

An article ran in the December 2008 / January 2009 issue of NZ Dog World, entitled *Reducing the Risk of Hip Dysplasia in Large Breed Dogs*. For those who are interested as to how my mini-study has progressed and how the puppies since December 2008 have scored on HD, the following is a review of the on-going mini-study along with some lessons learned. I'm not pioneering new theories or trials, just proving for myself, the results achieved by other veterinarians and breeders that ran similar studies over the past half-century.

The Original Mini-Study of Seven Golden Retriever Puppies

Being on a pension is very restrictive to trying to run a study of this nature, so the results are slow to come. However, I have persevered and steered in the direction that the study showed to be most promising in terms of lowering the hip scores. Some of you who read the article, will remember that the puppies who did the best in the study was one puppy kept on a raw diet that resulted in hip scores of (1:1=2) and two girls kept on the Lorgair Step-Down Protein Diet with Dr Kruger Joint & Muscle and 450 mg daily of GNLD Vitamin C who scored (1:2=3) and (4:1=5). Both the latter girls had been Penn-Hip tested at 16 weeks and both girls scored an estimated 11 points lower than expected at a year old.

The study indicated that the puppies kept on lower doses of GNLD Vitamin C or not kept on it past 6 months of age, scored higher on their hips. Those kept on either a raw diet or 450 mg daily to the time of scoring resulted in hip scores of total 5 or below. Across the board, the 6 Lorgair puppies that were given GNLD Vitamin C from 3 weeks of age up to **at least** 8 weeks of age, scored an average of 7.33. This is well below most country averages for Golden Retrievers.

A New Direction in Diet

During the following year, I changed the adult dogs to a raw / grain-free hybrid diet composed of raw foods and commercially available grain-free dry kibble with the added supplements of GNLD Vitamin C, ProVet Vitamin E, and Dr Kruger Joint & Muscle formula daily. After 6-months, I took note of the effect of the diet on the adult dogs and then started weaning puppies on a grain-free diet.

For the puppies, I started introducing raw foods around 4 weeks of age and the commercial grain-free kibble around 5 weeks of age. The puppies continued to be started on the GNLD Vitamin C from 3 weeks of age, increasing slowly from 23 mg / per day for a large breed puppy to 450 mg by 5 weeks of age. I have now weaned 5 litters on the diet and about 95% of the puppy owners have followed one of my 5 recommended diets.

Puppies Scored on the New Diet

The first puppy on the new raw / grain-free hybrid diet with 900 mg daily of the GNLD Vitamin C, was old enough to officially hip score this last November. One of my breeding lines is extremely active and agile. In the past, these puppies have continually bounced up and down on their rear legs and not fared well on their hip scores – having scored in the high teens or low twenties. This puppy was one of the bouncers and I had considered writing him off and not even having him scored. But

in the end, I figured I had invested a year in the new diet and I owed it to myself to see what the results were – good or bad. Well, as a testament to the diet, he did well – he scored a 1:0=1. The parent's scores were between 4 and 8.

Another breeder who breeds German Shepherds tried the 900 mg of GNLD Vitamin C up to scoring time and fed a commercial grain-based dog food on a girl she kept from a litter. Her girl scored a 3:1=4. What makes this case study particularly interesting is that two other puppies from the litter were also scored. The litter was given 500 mg of GNLD Vitamin C up until the time the puppies left for their new homes. Some of the new owners bought a container of the GNLD Vitamin C and kept their puppies on it until they were 14 weeks of age, but none of the other puppies are known to have been kept on the vitamin C past 14 weeks of age. One other girl scored a total 14 and a boy in the litter scored a total 77. The parent's hip scores were between 6 and 8.



X-rays taken by Total Vets, Christchurch, NZ

Anomalies in Hip Scores

The example of the scores from the litter of German Shepherds confirms what I found in the statistics on Golden Retrievers that I wrote about in December 2009/January 2010 issue – *Hip Dysplasia Stats – What Are They Really Telling Us?* The parents do not always have a bearing on the hip results of the off-spring. The article points out many anomalies in the results of over 4,000 off-spring that had been scored from 165 sires over a 10 year period.

Some people questioned the data because only the sire's hip scores were given in the data. The data is not set up to be able to compare all the dams put to a sire easily and it is time consuming to work through the data. However, I returned to the stats from Standfastdata, produced by Mrs Eileen Casiley, and researched each of the dams mated to one of the males with high hip scores and the individual puppies that were scored in 14 of his litters.

The anomalies were even more startling. The dams with hip scores between 11 and 21 that were put to the sire with a hip score of 25, produced off-spring with litter averages between 7 to 13. The highest dam, mated to this sire with 25 hips, had a total hip score of 21. There were 4 puppies in this litter and only 1 puppy was scored resulting in a total score of 11. Two dams with the single digit hip scores of 6 and 9, produced litters with the highest litter hip score mean averages of 41.67 and 28 respectively. A total of 5 puppies were scored out of these two litters. Although all the puppies were not scored in each litter – far from it – there is a sampling from 14 litters with a total of 26 puppies scored from this sire who’s hip score is 13:12=25. The mean average for his prodigy is 15.3 -- 10 points lower than his own score.

Between 1992 and 2005, over 1,000 Golden Retrievers a year were HD scored by the BVA (British Veterinary Association), the average ranged from 16 to 20.3. The current BVA average is 18. The 5-year mean average is 15. This indicates that not a great deal of progress has been made in lowering HD scores after several decades of breeders scoring their dogs.

Off-spring hip scores for 14 litters from same sire					
Sire -Hips 13:12=25	Puppies in the litter	Number of puppies scored	Mean avg for the litter	Puppies COI - RC	
				COI	RC
Litter 1 Dam hips 5:6=11	7	2	7.00	27.87	43.67
Litter 2 Dam hips 5:6=11	9	3	12.00	27.74	43.13
Litter 3 Dam hips 6:3=9	8	1	8.00	25.22	39.50
Litter 4 Dam hips 8:5=13	6	1	10.00	25.18	39.34
Litter 5 Dam hips 3:6=9	8	1	12.00	26.93	41.98
Litter 6 Dam hips 7:6=13	8	1	10.00	27.79	42.85
Litter 7 Dam hips 11:10=21	4	1	11.00	27.22	41.20
Litter 8 Dam hips 8:9=17	9	3	10.00	24.85	38.75
Litter 9 Dam hips 3:4=7	9	2	10.00	28.26	42.54
Litter 10 Dam hips 7:10=17	9	2	10.00	27.40	42.64
Litter 11 Dam 6:5=11	5	3	13.00	29.18	44.66
Litter 12 Dam 8:6=14	7	1	8.00	34.98	54.01
Litter 13 Dam 3:3=6	8	3	41.67	35.53	54.21
Litter 14 Dam 5:4=9	4	2	28.00	32.34	50.18
Totals		26 pups	15.35		

Not All Forms of Vitamin C Are Created Equal

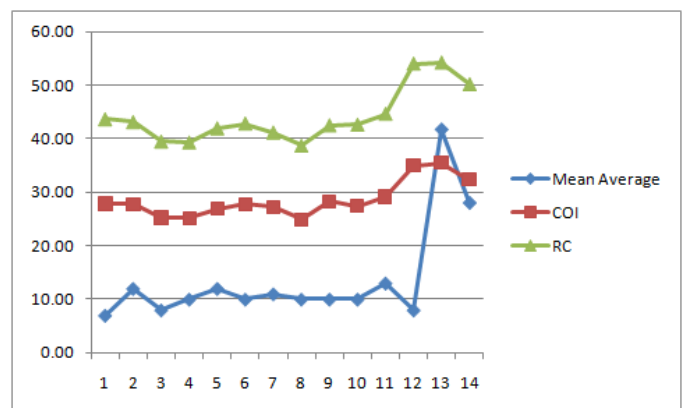
The question asked most frequently after the first article appeared was from people wanting to know if they could use a different type of Vitamin C than what I used. I chose to use the GNLD Vitamin C because it is molecularly natural. I had been guided by Sylvia Hammarstrom’s article, *Vitamin C and HD*, and she stated in her article that the vitamin C needed to be natural. I spent a month looking for another form of natural vitamin C other than GNLD. I didn’t find any.

Roach in Switzerland made a natural vitamin C back in the 90s. Roach no longer produces this natural form of vitamin C. GNLD continues to be the only molecularly natural vitamin C that I have found on the worldwide market. By molecularly natural, they mean the molecular structure is the same as you find in nature, say in an orange. However, one tablet of GNLD Neo-C that is 230 mg is equal to 4 small oranges.

The vitamin C needs to be in a form that synthesizes in the body to produce collagen II. The only other form of vitamin C that has proved to be effective in forming good joints in dogs is sodium ascorbate.

The forms that have proved in studies NOT to be good and a waste of money are straight ascorbic acid with no additives to make it molecularly natural and calcium ascorbate. Calcium ascorbate is not recommended because the calcium may cause

In the time since I started my mini-study, 5 puppies have been kept on 450 mg or more of the GNLD Vitamin C to scoring age and the average for the 5 pups is 7.8. Of these 5 puppies the scores of two of the dams have been 16 and 20 both mated to single figure partners. This is a remarkable improvement from the 2002 litter, prior to my adjusting nutrition in the diet, where 3 pups scored an average of 18.67 with a set of parents that were 19 and 7. I have not stopped mating parents where one has a double-digit total hip score. What I have done is adjust the diet to ensure the puppies grow in proportion. The early step down diet reduced the hip scores to a rolling average of 11.47 between 2002 and early 2007. Since 2007, following Dr Belfield’s studies of adding vitamin C to the diet of both the pregnant dam and the puppies from 3 weeks of age -- the average score for all the puppies put on the GNLD Vitamin C, regardless of strength or length of time has resulted in an average of 8.33. This is a strong indication to me that vitamin C is a missing link in forming good hip joints.



Data from Standfastdata

kidney stones as well as not improving the hip joints. Ester-C is a form of calcium ascorbate.

The bad rap on vitamin C not working to improve hip joints has come from studies that did not use a form of the vitamin C known to work. Many people have a difficult time understanding that not all vitamin C is the same.

Why Do Certain Types of Vitamin C Prevent HD?

There are two parts to the answer of this question. The first has to do with what happens to the dog to cause HD and the second part is how vitamin C helps protect the dog. The following is a very truncated version of what happens.

Physical Aspects of HD

The hip joint consists of a long thighbone, the femur that is shaped like a ball at the top end. This is meant to fit snugly into the concave hip socket known as the acetabulum. The joint is held in place by a short, elastic, round ligament supported by adjoining muscles. There is fluid between the ball and socket known as synovial fluid. This fluid provides the lubrication and mobility for the joint. On the inner side of each rear leg is a tendon like muscle known as the pectineus. The pectineus connects the end of the thighbone to the pelvis.

How Vitamin C Helps

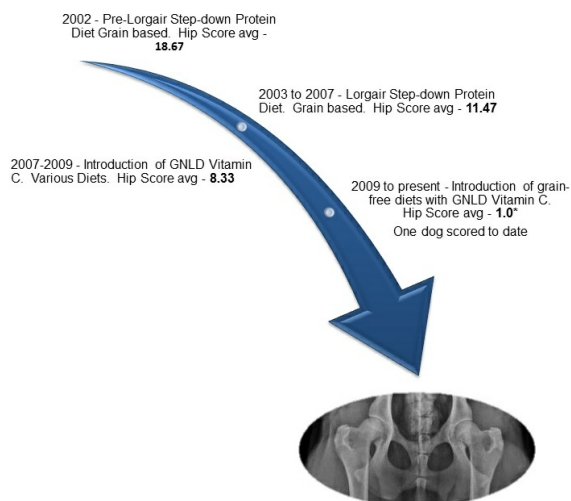
The body requires collagen to strengthen tendons and ligaments and bind tissue together. It keeps the tendons and ligaments more elastic. It also forms a honeycomb into which nutrients are deposited to help form good bone.

Stress depletes the body of water soluble vitamins – this includes vitamins C and B complex. Puppy's lives are stressful. Stress in a puppy's life includes going to their new home and being separated from their mum and littermates; being vaccinated; worming; teething; physical growing; meeting all the new people and dogs in their world; training; running; and just being a normal puppy. All this stress uses large quantities of vitamin C. Given that the dog is at the low end of manufacturing their own natural vitamin C compared to other animals in nature, this leaves the puppy at risk of not having enough vitamin C to synthesize into enough collagen needed to keep those tendons and ligaments strong and, more importantly, supple and elastic. All too frequently, large breed dogs will develop a limp between the most aggressive growing spurt ages of 5 months to 7 months. But the limping can occur all the way up to 18-months-old.

When there is not enough collagen the pectineus muscle becomes extremely taut as the bones grow larger. The dog jumps for a Frisbee and lands on one hip – landing off balance the weight is put on one leg. One big strain on the leg and the taut pectineus muscle pulls the ball away from the socket. A small gap is created known as congenital coxofemoral subluxation. Without the fluid to refill the joint, the joint starts to grate and becomes uneven. An inflammation occurs and the dog starts limping. With time the scar tissue and ossification build up to fill the gap. This produces an osteoarthritic condition that continues to push the femur ball out and doesn't stop until the puppy has stopped growing or the gap has been filled.

Supplementing with a vitamin C that will properly synthesize in the body into collagen, and provided it is given in large enough quantities, it will help prevent the problem. The collagen lubricates the tendons and muscles and when the active dog comes down on the rear legs the ball is not as likely to pull away from the socket. The dog's joints are protected resulting in no damage to the joint and no limping. Plus the nutrients, including the vitamin C form strong healthy bones that are less likely to have hairline fractures.

Lowering the Risk of HD Through Nutrition



What Lessons Have Been Learned?

I have learned a great deal more since I wrote the article back in December 2008.

Using Ample Dosages

The most important lesson I learned about using vitamin C to improve the hip joints is that you have to use dosages that are large enough to be effective. I started out with 230 mg daily on some puppies and 450 mg on others. The 230 mg showed little, if any improvement. The 450 mg showed improvement in the puppies in the original study, but not in a puppy that came later. I revised the amount upward to 900 mg daily and continue to monitor this amount to ensure it is enough.

In his 25-year-study, Dr Belfield used the sodium ascorbate. His studies used a considerably higher dosage of the sodium ascorbate than my studies with the GNLD Vitamin C. He also started the puppies on a liquid paediatric human infant version of vitamin C from 3-hours-old. Puppies do not start to manufacture their own vitamin C until around 3-weeks of age. Another study done by researchers in 1991 in Anaheim, California showed the same results – sodium ascorbate worked, whereas, the other forms did not.

In my early and continuing studies, the pregnant bitches were supplemented with the vitamin C. The bones of the foetus start forming around 5-weeks of age in the womb. In large breed dogs, you may also find that it reduces the whelping time.

The other important lesson learned, is that the vitamin C supplementation must be carried on from pregnancy with the dam through until the puppies reach 18-months-of-age when the rear plates close down. I continue the vitamin C on after 18-months of age at a reduced amount of 450 mg daily until the dogs get older, and then increase it again to 900 mg daily around age 8 to 10-years. Older dogs do not produce as much vitamin C as younger dogs. The GNLD Threshold Vitamin C is a slow release formula and stays in the body for 6 to 8 hours. I believe this is why I need a lesser amount than the studies done with the sodium ascorbate.

High Protein Diet

I had concerns about using a high protein diet on puppies before starting the raw / grain-free hybrid diet because of all the warnings that high protein might not be good for growing puppies. Meats naturally have good amounts of protein and the protein in the Orijen Large Breed Puppy is around 32%. Having used a protein step-down diet with grain-based commercial dry foods to keep puppies growing in proportion, I was nervous about the switch to high protein.

It appears that the way the dogs digest and use grain-based and grain-free diets is different. I have learned that the high protein diet I'm using is working very well to keep the puppies growing in proportion. The first puppy on the diet had a very brief growing spurt at 3 months. Increasing his exercise quickly brought him back into proportion. None of the other puppies I'm rearing have had growing spurts. I continually monitor my puppy owners to ensure they are feeding the right amounts and not over feeding to avoid the growth spurts. The amount of food and the amount of exercise must equal each other on the high protein diet to avoid growth spurts.

Orijen de-bones their fresh meats to lower the calcium and phosphorous levels in the food. This is an interesting point.

Supplements

The Dr Kruger supplements have stayed the same in the diet to ensure the puppies get all the needed nutrients to build their young immune systems and maintain them in optimum health. Between 3-months and 6-months the puppies are switched from the Puppy formula to the Joint & Muscle formula providing Glucosamine Sulphate (170mg) and Chondroitin Sulphate (125mg) plus three anti-inflammatory herbs. The Glucosamine and Chondroitin along with vitamin C work to keep the joints cushioned.

Exercise

On the current diet, exercise has been increased from a younger age. Because the grain-free foods appear to build stronger bones and muscles, I have not worried about letting the young puppies run more freely and for longer periods of time. I have found the puppies to be faster and more sure-footed than in the past. There has been no limping with the puppies I have raised. I continue to warn puppy owners not to let their puppies jump for Frisbees and balls in the air; or not walk them on soft-sand beaches; or allow them to jump in and out of cars and off sofas; or rough play with larger dogs. Common sense does need to be employed with large breed puppies when their bones are soft and growing.

General Health

General health of the puppies has been great. No illnesses in any of the puppies. Four of my breeding bitches have been tested for T4 thyroid levels since feeding the raw / hybrid diet and all have been found to have normal thyroid levels. I test during the girl's heat when reportedly their thyroid level is meant to be at its lowest. I do this because this is exactly the time I want to know that the thyroid indicators are in the normal range. If below normal, there is a chance that the hormones will not release normally. The Luteinizing Hormone (LH) normally surges for 3 days just prior to ovulation. It is during the LH surge that the progesterone begins to rise. The thyroid, being one of the governors of hormones, it is important to me to know that the thyroid is functioning properly. If either of these hormones do not release properly, the chances of a successful mating can be diminished by not being able to predict the best days for mating without continual blood progesterone testing.

Warnings That Slowed the Studies

Looking back over the past decade of research and trials in reducing the risk of HD in large breed dogs there have been non-factual statements that have slowed the progress. It has always been my mental apprehensions in believing these non-substantiated claims that delayed the start of a particular phase of the study. Once I let go of these unsubstantiated claims, I was able to progress well.

The first of the unsubstantiated claims is that vitamin C will create kidney stones. This has never been substantiated in any medical journal – human or animal. In fact, Linus Pauling showed just the opposite that calcium causes the stones and vitamin C actually helps break them up.

The warning that large amounts of vitamin C is not good for dogs. Using the molecularly natural vitamin C has not had any negative effect on the dogs and in fact has strengthened their immune system and provided a good anti-oxidant. I'm not alone in my findings. Sylvia Hammarstrom has bred over 1,000 champion giant and large breed dogs in California over her 50 years as a breeder. She has used the GNLD Vitamin C for the past 20 years and not had any ill effects. Dr Belfield used large doses of sodium ascorbate and never had any negative effects over a 25 year study. It is important to note that all three of us used a safe form of vitamin C. Again it is important not to use either the pure ascorbic acid without other properties to make it a natural formula or to use the calcium ascorbate form which has calcium in it.

The third claim that was ingrained in my thinking and needed to be let go of was that commercial dog foods are 100% complete and balanced and nothing else could be as good for dogs. This created the fear that if I went to raw feeding, my dogs would not be as healthy as feeding the commercial foods. Once I realised that this was nothing more than excellent PR on the part of commercial dog food companies, I was free to try the raw feeding. My dogs are healthier and happier and look forward to their meals because they are different and to them more delicious – not to mention biologically appropriate. By using a good well-

balanced supplement formula, I have no worries that my dogs are missing any important nutrients.

Common sense and good hygiene practices with fresh raw foods, has not resulted in any illness to my dogs. Noteworthy is that it takes a good three months to change a dog over from a grain-based diet to raw feeding before the dogs gut and enzymes work naturally the way nature intended them to work. Once this has been accomplished successfully, then the dog's natural enzymes, meant to deal with dead and decaying flesh, will prevent the dog from becoming ill. It is only when grain-based diets and raw diets are mixed, that the enzymes are suppressed and do not work as they should and increase the risk of illness to the dog from nasties like e-coli.

Conclusion

In the first article, I speculated that dogs didn't make as much natural vitamin C as they needed to prevent HD. I also speculated that some dogs inherited the ability to make more vitamin C naturally than others. Vitamin C is made naturally in the dog's liver. This speculation was confirmed when I discovered a couple of studies.

The first study was on the individual measurement of vitamin C in the blood of 104 dogs. The study showed the amounts varied from .02 milligrams up to .82 milligrams for each 100 centimetres of blood.¹

The second study provided the level of vitamin C found in some animals:

TABLE I: DAILY PRODUCTION OF ASCORBATE IN ANIMALS

	Animal Ascorbate Production Milligrams/Kg Body Wgt / per day ²
Snake	10
Tortoise	7
Mouse	275
Rabbit	226
Goat	190
Rat	150
Dog	40
Cat	40
Monkeys, Apes, Man	0

So the study continues and the results with the added vitamin C continue to bring positive results. Some other breeders will have some dogs that have been kept on the vitamin C coming up for scoring this year. My next puppy will be scored in about 4 to 5 months and another one later in the year. To date all is positive and the supplementation of vitamin C is continuing to lower my puppy's HD scores.

Foot notes 1, 2, J.V. Lacroix et al., "Ascorbic Acid Blood Levels in the Dog," North American Veterinarian, May 1942, page 329

Sy Guth's latest book is *Grain-Free Dog Diets and How to Wean Puppies Grain-Free*. Available through www.homespunpress.com