A Summary of Anatomical and Biomechanical Consequences of differing jump heights in Dog Agility

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Introduction

This paper is an attempt to collate and summarise existing knowledge, data and expert opinion about the impact of jump height on an agility dog’s performance.

The anatomy and mechanics of jumping is well understood and documented, yet little research has been done and therefore little data exists to demonstrate the long term effects of jumping on dogs that regularly partake in agility.

In an article published on Agilitynet (www.agilitynet.com), Veterinarian and Agility competitor Peter van Dongen says “Quite a few people I know - many with many years of experience - have very strong opinions about what is right and what is wrong relating to the issue of jump heights in agility. I believe that these views are based on personal experiences as handlers or trainers rather than hard scientific evidence of injuries in agility dogs and their causes. Having been trained in a scientific way, however. I prefer to see some facts rather than opinion, ideas, hearsay or other. This, however, made me look for these facts and unfortunately these are very rare indeed. There is, to my knowledge, and I have checked with various sources within my field of expertise, no actual scientific report on injuries in agility dogs in high enough numbers to make any conclusions statistically relevant.”

With this in mind, other source documents in related fields have also been reviewed for this paper.

There has been (understandably) a belief that it is possible to directly compare jumping in canines with horses. It is true that a comparison between two quadrupeds is more valid than between quadrupeds and bipeds – comparisons with jumping in humans is not as useful for example. However, care must be taken to take account of the differences – dogs have greater limb angulation, which allows a greater stride length relative to body size, giving them a greater running speed for their size. Typically a dog moves at 0.62mph/lb, whereas a horse moves at 0.04mph/lb. In addition the canine spine is much more flexible than a horse, and the front leg has a separate radius and ulna, allowing the leg to rotate along its axis and therefore help the dog make fast turns. In contrast, a horse cannot arch it’s spine to help propulsion and the fusion of the radius and ulna in the foreleg impedes the horse’s ability to make sharp turns.( Zink & Daniels, Jumping from A to Z, 2005). Information taken from studies of horse kinematics should therefore be reviewed with these differences in mind.

However, in an article published in the Journal of Experimental Biology, an examination of how the musculoskeletal spring system operates at different speeds and in animals of different sizes concludes that mammals of different sizes move in a dynamically similar manner at physiologically equivalent speeds. Animals studied were horses, dogs, goats, wallabies, kangaroos and rats, with the results for dogs and goats being closely aligned. (Farley, Glasheen & McMahon 1993).
The Anatomy of a Dog and How it Jumps

a) Sequence of Events

When a dog jumps, the rear assembly (hindquarters) provides the propulsion whilst the front assembly (shoulder, elbow, leg etc) provides the degree of lift and absorbs much of the impact on landing. Regardless of breed or size, all dogs jump using the same sequence of movements.

As a dog approaches a jump, the front feet are placed, one slightly ahead of the other, at a take off spot. This point is determined by a number of factors – speed, height of jump, weight:height ratio of dog, ground conditions, experience and confidence of the dog and dog’s general strength and well being.

As the front feet are planted, the head is lowered and the front legs are slightly flexed. Then the spine is flexed as the rear legs are brought forward and planted slightly ahead of the front feet.

The front legs are extended, pushing the front body upwards and raising the head to help with upward thrust. The rear legs are then extended to propel the dog upward and forward. Once the dog is in the air, the head is lowered closer to the outstretched front legs to help with forward thrust and to reduce drag.

At the apex of the arc, the dog should lower his head and lift his tail to help rotate the body forward and downward.

After the outstretched front legs have hit the ground – one leg slightly ahead of the other, the rear legs are drawn forward under the body to absorb some of the impact of landing and to continue with the forward running gait on landing. (Zink & Daniels, Jumping from A to Z, 2005)

b) Centre of Gravity

Any movement in animals is a consequence of the shifting of the body’s centre of gravity. Different animals do this in different ways. In the majority of dogs, the centre of gravity is just behind the shoulders, about one third of the way up the body. This varies slightly with the length and weight of head and neck, length of legs and weight and structure of torso. When the centre of gravity is moved out of position without changing the base beneath it, movement results.

In all movement, the centre of gravity transcribes an arc with the low point at the starting position, moving upward and downward with each cycle of activity. Upward movement requires muscular effort but does not contribute to forward movement. Therefore, the flatter the arc is, the less energy is wasted in upward movement. (Case; 2005, The Dog Its Behavior, Nutrition & Health).

In order to jump successfully, a dog needs to raise its centre of gravity high enough for all of its body to clear the height and width of the jump. The ability to raise the centre of gravity is determined by conformation, confidence and experience. The hardest working part of the dog is the front assembly, it is responsible for supporting more than half of the dog’s weight. It is also mostly responsible for shifting the centre of gravity and therefore providing lift.
c) Dynamics of Movement

One of the most useful sources of information on the mechanics of movement comes from studies undertaken to assist in the development of robotics. The following extract is taken from www.oricomtech.com

**Dynamic Leg Operations**

- in dynamic objects, energy can be stored and recovered using both potential [gravitational] and kinetic means, as well as in elastic devices.
- moving bodies naturally store energy kinetically, but if they are also rising and falling, then potential energy stores are also available.
- living creatures also store energy in their musculoskeletal structures - by storing energy in their muscles and tendons during ground impact, and releasing it back during subsequent propulsion.

The first two figures show the arc of travel of the front (at left) and rear (at right) legs of a dog under light impact conditions. The 3 positions are ground impact, bend during weighting and force absorption, and push off to the next step. Note how the shortening and lengthening, in conjunction with the angular movement, tends to keep the top of the legs at the same height above the ground. This helps to keep the animal's COG on an even plane during stepping.
**Heel & Toe.** For every gait from walk to run, the heel of the extended foot hits the ground first, and so must take up the shock of impact, while the toes are the last to leave the ground at the start of each suspension, and so should add some extension and spring to the step for maximum effect. For these reasons, the feet of dogs and cats and humans have padded heels for softening impacts, and all animals have a series of tendons and leverages in the feet and lower legs for pushing off.

**Hard Striding.** As the various pictures show, however, the rear legs of dogs have a decided crook which comes down at an angle during hard striding, and in conjunction with the knee joint, the rear legs scissor and absorb the shock of impact.

**Pounding.** The scissoring of the rear leg helps absorb impact shock, but the front legs have a more difficult time. The front knee bends only backwards, so the front leg extended forward comes down straight at impact. We speculate that the front knee-elbow arrangement do not scissor at impact like the back leg, since body inertia into it would probably cause the front leg to collapse the dog into the ground. Therefore, the leg is held straight and ankle joints (plus pads on the dog) register the major shock.

However, as the figure at the right shows, if the forward angle of the leg is correct, given the stride, then the force of impact will be lessened. If the leg comes down too soon at too steep an angle, then the foot "pounds" into the ground, increasing the force of impact. And if the leg comes down at too shallow an angle, the dog will lose grip and skid.

d) **Landing**

Whilst the front assembly therefore is shown to be extremely important in lift, the ability to land successfully is a consequence of the absorption of energy on impact and the follow through of the rear legs into a running gait.

Professor R McNeill Alexander is one of the foremost authorities on the mechanics, physics and energetics of locomotion. He has published at least a dozen books and many papers on aspects of this subject, of which the publication *The mechanics of jumping by a dog (canis familiaris)* is referenced by just about every research article subsequently written on the subject of canine locomotion.

His research field is the mechanics of human and animal movement, especially of running and jumping. His group's research showed the importance of tendons as energy-saving springs in running mammals, including humans. Their mechanical tests on body parts have demonstrated the spring in the arch of the human foot, and the
phenomenon of tendon fatigue. He and his collaborators have devised mathematical models which predict optimum patterns of human and animal movement, explaining many of the details of walking and running gaits, and of the jumping techniques of animals and athletes. He has investigated the strengths of animal leg bones in relation to the stresses that they have to withstand in life, and the consequences of size differences for the design of animals. He has also investigated the movements of jellyfish, fish, frogs, birds, dogs, horses, antelopes and elephants. Reading through the works of Alexander will underline the complexity of this subject, as well as raising the importance of the need to fully understand the theory of the “spring system”.

Vertebrate animals exploit the elastic properties of their tendons in several different ways. Firstly, metabolic energy can be saved in locomotion if tendons stretch and then recoil, storing and returning elastic strain energy, as the animal loses and regains kinetic energy. Leg tendons save energy in this way when birds and mammals run, and an aponeurosis in the back is also important in galloping mammals. Secondly, tendons can recoil elastically much faster than muscles can shorten, enabling animals to jump further than they otherwise could. Thirdly, tendon elasticity affects the control of muscles, enhancing force control at the expense of position control. (RM Alexander; Tendon Elasticity and Muscle Function; 2002)

Yet again the front assembly is key, being a dog’s main shock absorber. When a dog jumps, the front paws are the first to hit the ground. The upper arm absorbs the main jolt of this impact as the elbow travels backwards. An analogy to this would be a shock absorber on a car. An important aspect to some shock absorbers is their stroke length. In other words, what is the distance it can be compressed before it bottoms out? The same thing holds true for the upper arm. The longer the path is that the elbow travels, the greater its length to be compressed. (Steven Robinson; The Importance of the Upper Arm)

Continuing with the analogy of shock absorption, a dog with greater angulation can also absorb the impact of landing better than a dog with a straighter front assembly. This is because the greater angulation allows the dog an imperceptibly longer period of time for the muscles to slow the impact, whilst the bones and tendons behave like springs, folding up then straightening out again. (Lanting F. Front and Rear Angulation in the Working Dog 2008).

Swarte.,Mouwen & Mouwen suggest that speed not height of jump is a key factor when calculating landing impact. The impact on landing can be calculated from measuring the kinetic energy and the kinetic energy of an object is directly proportional to the square of its speed. Therefore, at twice the speed, kinetic energy increases by a factor of four. But then the ability to absorb this energy needs to be taken into account, and this is governed mostly by the construction of the front assembly and the “spring system” described by Alexander et al.

e) A Size, Shape and Jumping Styles

One of the key measures that determines a dog’s suitability for agility is the body weight to height ratio. The heavier a dog is in relation to height, the more effort is
needed during locomotion and the more demands made on the anatomy structures. It is fairly obvious that the lower this ratio, the easier it is for a dog to jump. In a table of weight:height ratios by breed, Zink shows that weight increases at a faster rate than height.

<table>
<thead>
<tr>
<th>Breed (typical measurements)</th>
<th>Weight (lbs)</th>
<th>Height (ins)</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australian Shepherd</td>
<td>42</td>
<td>20</td>
<td>2.1</td>
</tr>
<tr>
<td>Basset Hound</td>
<td>45</td>
<td>11</td>
<td>4.1</td>
</tr>
<tr>
<td>Border Collie</td>
<td>37</td>
<td>20</td>
<td>1.9</td>
</tr>
<tr>
<td>Doberman</td>
<td>78</td>
<td>26</td>
<td>3.0</td>
</tr>
<tr>
<td>GSD</td>
<td>74</td>
<td>25</td>
<td>3.0</td>
</tr>
<tr>
<td>Golden Retriever</td>
<td>74</td>
<td>24</td>
<td>3.1</td>
</tr>
<tr>
<td>Great Dane</td>
<td>150</td>
<td>31</td>
<td>4.8</td>
</tr>
<tr>
<td>Labrador</td>
<td>64</td>
<td>23</td>
<td>2.8</td>
</tr>
<tr>
<td>Papillon</td>
<td>7</td>
<td>11</td>
<td>0.6</td>
</tr>
<tr>
<td>Pembroke Corgi</td>
<td>30</td>
<td>12</td>
<td>2.5</td>
</tr>
<tr>
<td>Sheltie</td>
<td>22</td>
<td>15</td>
<td>1.5</td>
</tr>
</tbody>
</table>

Yet jump height categories are determined by the dog’s height only, using a straight line relationship. As this is accepted practice, Zink concludes that dogs with a weight height ratio of greater than 4 are in the danger zone for jumping and should be trained with great care, those in the 2.5 to 4 range are not stressing their bodies as much but are less likely to have a long jumping career, whilst those with a ratio of less than 2.5 are likely to be the most successful.

Another structural factor is body length in relation to height. Dogs that are significantly longer than they are tall bear more weight on their front legs and are therefore disadvantaged.

Finally we must consider leg length. A dog whose legs are greater in length from the ground to the elbow as a percentage of the dog’s height at withers has the advantage of a higher centre of gravity. During jumping, the majority of the lengthening of the leg takes place above the elbow, with this joint acting as the fulcrum from which the leg extends. It is an advantage in jumping to have that height as high as possible in relation to the height of the jump.

During jumping, the major amount of bending is in the elbow joint to get the front legs to clear the hurdle. At the right, the upper leg (ie, humerus) is barely forward of vertical, while the lower leg segments are horizontal. The dog at left has its front legs pulled up even farther, due to the height of the jump.
When a dog jumps, the trajectory around the centre of gravity does not alter once the dog is in flight. What can be altered is the dog’s body position around the centre of gravity. Raising or lowering the head, kicking out back legs or moving the tail will influence the dog’s ability to clear the jump, but also will affect how the dog lands. For example, if the dog raises his head shortly after the apex of the trajectory, the centre of gravity will shift backwards, causing the rear legs to land at the same time or shortly after the front legs. Dogs with less angulated front assemblies often jump in this style – Terriers in particular.

Landing on all four feet minimises the impact on the front end, but it is not all good news. If a dog lands on all four feet at once, the force of impact travels up both front and back legs and opposing forces meet in the spinal column as well as making it difficult for the dog to absorb and transfer energy by moving smoothly into a running gait.

Dogs can be taught to jump successfully and will often improve their performance with confidence and experience. In agility, consideration is given to this through a grading structure, which increases degree of difficulty once a dog can demonstrate success at any given grade. The grading structure takes no account of jump height. It is therefore important that account is taken by course designers of other stresses on the dog’s anatomy – distance between jumps to allow for adequate take off distance, tightness of turns increasing rotational force on the dog’s body, etc.

f) Dog’s Height v Jump Height – extracts & opinions

In most medium-size and ancestral-type breeds, the distance below the underline of the chest will be practically the same as for the distance from point of elbow to ground. That is, the top of the elbow’s olecranon process with be very close to being in the same plane as the part of the sternum between the legs...... Sighthounds are typically built with even a greater leg-length-to height ratio than the gundog, guardian, and herding breeds. Their more upright shoulders and croups serve them better for the double-suspension gallop in which they “fold up” and extend to a greater amount than other breeds do, and the more vertical foreassembly results in a little more space between the olecranon and the underline. The shorter the breed and the dog, the lower will be the leg-length-to-height ratio. Think of most Toys, Cockers and Corgis, but also Brittanys and smaller dogs.( A Matter of Proportions, Function, and Breed Standards: Leg-Length Ratios, Using the Vizsla and the German Shepherd Dog as Examples by Fred Lanting)

One physical characteristic worthy of consideration is length of leg. The length of a dog’s leg from the ground to the elbow should be longer rather than shorter. Adequate length of leg greatly aids a jumping dog. However, moderation should be considered here as a dog excessively high on leg has a higher center of gravity and can tend to be less stable. A dog moderately high on leg would be ideal.
The problem with inadequate leg length is twofold. First, small/short legs contribute to a less than desirable weight to height ratio. Second, small/short legs are much less efficient and have to work very hard to propel the body over jumps, through weave poles and over A-frames. (Plail Nina; Structure As It Relates To The Performance Dog  www.sheltieranch.com)

A small sample dogs of differing breeds were measured to calculate the ground to elbow v height at withers lengths.

Dogs that jump Large Height (650 mm) measure over 430 mm
Dogs that jump Medium Height (450 mm) measure over 350 mm, less than 430 mm
Dogs that jump Small Height (350 mm) measure under 350 mm

<table>
<thead>
<tr>
<th>Breed</th>
<th>Ground to Elbow</th>
<th>Height at Withers</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Collie X</td>
<td>360</td>
<td>550</td>
<td>190</td>
</tr>
<tr>
<td>Labrador</td>
<td>312</td>
<td>510</td>
<td>198</td>
</tr>
<tr>
<td>BC</td>
<td>258</td>
<td>497</td>
<td>239</td>
</tr>
<tr>
<td>Sprollie</td>
<td>270</td>
<td>470</td>
<td>200</td>
</tr>
<tr>
<td>Border Terrier</td>
<td>221</td>
<td>377</td>
<td>156</td>
</tr>
<tr>
<td>Cocker Spaniel</td>
<td>225</td>
<td>349</td>
<td>124</td>
</tr>
<tr>
<td>Border Terrier</td>
<td>200</td>
<td>349</td>
<td>149</td>
</tr>
</tbody>
</table>

Without undertaking many more measurements, there is no point in reaching conclusions here, but it is perhaps interesting to note that the 2 dogs with proportionally shorter legs that are currently at Large height would fall into the 4th height category

**Injury Risks and Prevention**

Safety and prevention of injury in relation to jump height in agility is influenced by a huge number of factors – dog’s conformation, weight, fitness, training, experience, confidence, placement of jumps relative to each other and other obstacles, ground conditions, air temperature, skill of handler –and so on.

Agreement is reached that there is an increased risk of orthopaedic injury to dogs that regularly take part in agility, yet there are very few examples of research conducted to either quantify these risks or to propose ways of reducing them.

Extracts from available publications are shown below. It is difficult to draw any statistically valid conclusions concerning jump height from these articles, mostly due to lack of real data or small sample sizes.

a) Shoulder Injury in Agility Dogs; Sherman O. Canapp, Jr., D.V.M., M.S., Diplomate ACVS. Published in Clean Run Articles
The cause of injury in Agility Dogs appears to be related to repeated strain injury. This includes two-on/two-off contacts, landing vertically on the forelimbs from a misjudged jump, overstretching of the muscle, quick turns, and repetitive contractions of the muscle with the shoulder flexed and/or the elbow extended. Injury to the tendon can occur in a number of ways including strain from overloading, degeneration, or disruption. A single less than maximum load may injure some of the fibers without complete failure of the tendon, but the blood supply to the tendon proper is poor, leading to a longer healing time. Repetitive strain injury may initiate actual degeneration of the tendon. As the area continues to be reinjured, the tendon may weaken sufficiently for inflammation and/or microtears (tendinopathies) in the connective tissue in or around other tendons to form, ultimately leading to shoulder joint instability.


Jumping is a common task for working dogs and it is believed that high landing forces make dogs that frequently jump over obstacles prone to orthopaedic problems. The aim of this study was to quantify forces experienced by dogs jumping over obstacles of different height. Five dogs of similar conformation (three Border Collies and two Australian Shepherd Dogs) were made to jump over 40, 50, 60 and (if possible) 75 cm high obstacles. Two different jumping approaches were assessed: the dogs either started from sitting close to the jump or approached the jump at full gallop. Vertical and horizontal ground reaction forces were collected during landing from a force platform embedded in the runway. Simultaneous 3D kinematic data was collected from retroreflective markers attached to the front and hind limbs of the dogs using a multi camera high-speed optical motion capture system. Preliminary data from one Border Collie dog indicate that flight time increased with jump height. Average speed during the flight phase dropped from 5.4m/s to 4.4m/s with increasing jump height in the running jumps but it was a consistent 3.5m/s over all heights of jump initiated from a sitting start. Peak vertical force experienced during landing increased with jump height from 3.4 times bodyweight to 4.6 bodyweights for the combined front limbs and decreased from 3.1 bodyweights to 2.6 bodyweights for the combined hind limbs with the front/hind ratio increasing from 1.1 to 1.8.

c) From an article published in the October 1996 issue of Canine Sports Medicine The Effects of Jumping on Forelimb Injuries; Author Unknown.

When jumping over obstacles, dogs land with significant force applied to their forelimbs. If this is an infrequent event, then the impact is usually of little concern, but repetitive jumping over many years may have significant consequences. Repeated impact loading has been documented to cause some overuse injuries in human athletes. The effects of jumping on chronic injuries in dogs has not been studied extensively. Forelimb injuries such as biceps tendinitis and carpal hyperextension (severe wrist sprain) seem to occur more
frequently in dogs that do a lot of jumping. Chronic, repetitive forms of trauma, including jumping, have been linked to another type of shoulder injury in dogs termed mineralization of the supraspinatus tendon. Both the frequency of jumping and the height jumped may play a role in these injuries. Further concern is stimulated by the results of a scientific paper published in 1992 in Veterinary and Comparative Orthopedics and Traumatology. In a study entitled Measurements of Vertical Ground Reaction Force in Jumping Dogs, the authors found that the forces increased significantly with increasing height. Vertical ground reaction forces are considered to be an accurate indication of the impact placed on the forelegs when a dog jumps. Furthermore, the dog's body weight and breed also influenced the vertical ground reaction forces. Statistical analysis of the effect of weight on force shows that heavier dogs impact with greater force at each jump height.

d) From a report on a Dutch agility website, based on a lecture given by Dr H C Schamhardt, of the Veterinary faculty of Utrecht University. Report compiled by Swarte, Mouwen & Mouwen

Because of the difficulties caused by the article being written in Dutch, the following extracts are taken from the summary by Peter van Dongen.

It is the speed, rather than the weight of the dog, which mainly increases the kinetic energy when landing after a jump. Double the speed leads to a fourfold increase in kinetic energy! Most injuries occur at landing, rather than when taking off, as the time during which the stresses occur is shorter, and they all work on the front legs only.

The height of the jump is a smaller influence on the stresses than the speed at which the jump is taken.
The stresses on joints are much higher if the dog makes a turn while landing after a jump at the same time.
Flexed limbs absorb the stresses put on them much easier, with a smaller chance of injury, than extended limbs. Flexed limbs when landing occur when the jumping height is relatively high and the distance between jumps relatively short. It is the relation between height and distance which is ultimately important.

e) From an article published in The Equine Veterinary Journal in 2001

Forelimb tendon loading during jump landings and the influence of fence heights; Meershoek, Schamhardt, Roepstorff & Johnston

Lameness in athletic horses is often caused by forelimb tendon injuries, especially in the interosseus tendon (TI) and superficial digital flexor tendon (SDF), but also in the accessory ligament (AL) of the deep digital flexor tendon (DDF). In an attempt to explain the aetiology of these injuries, the present study investigated the loading of the tendons during landing after a jump. In jumping horses, the highest forces can be expected in the trailing limb during landing. Therefore, landing kinematics and ground reaction forces of the trailing forelimb were measured from 6 horses jumping single fences with low to medium heights of 0.80, 1.00 and 1.20 m. The tendon forces were calculated
using inverse dynamics and an *in vitro* model of the lower forelimb. Calculated peak forces in the TI, SDF and DDF+AL during landing were 15.8, 13.9 and 11.7 kN respectively. The relative loading of the tendons (landing forces compared with failure forces determined in a separate study) increased from DDF to TI to SDF and was very high in SDF. This explains the low injury incidence of the DDF and the high injury incidence of the SDF. Fence height substantially influenced SDF forces, whereas it hardly influenced TI forces and did not influence AL strain. Reduction of fence height might therefore limit the risks for SDF injuries, but not for TI and AL injuries.

f) From Jumping from A to Z, Ch 2, by Zink and Daniels 2005

Trajectory is the term for the path through the air that an animal takes while jumping. In horse jumping, it is desirable for the trajectory to be that of a bascule (an arc shaped like a semi circle). To achieve this, a horse should leave the ground as far away from the jump as it is high. Dogs have a larger repertoire of jumping styles to choose from because of significant anatomical differences (athletic ability). Dogs that jump with a flatter trajectory experience less deceleration and less vertical impact on landing, and thus suffer less stress to the front end. Over the lifetime of an active dog, the reduced stress on the carpal joints, elbows and shoulders means fewer soft tissue injuries and a reduced incidence and/or severity of arthritis. 

There are circumstances in which it is not ideal for a dog to be moving very fast, and at these times it is neither ideal nor possible for a dog to jump with a very flat trajectory. The canine sports that most often preclude dogs from jumping with a flat trajectory are USDAA agility for dogs that jump 30” and AKC obedience for dogs that jump approx. 26” or more. In both these cases, limitations on the amount of room between jumps or between jumps and other obstacles/ ring barriers, reduce the larger dog’s choice of jumping style. A rounder trajectory is often the safest one in these circumstances. Dogs can be taught to judge the space available to them and to select the most appropriate jumping trajectory for each instance.
Summary

1. Statistically valid research data does not exist for the effect of jump height on an agility dog’s performance

2. Veterinarians and others in the field of agility dog wellbeing accept that there is an increased risk of orthopaedic injury to dogs that regularly take part in agility.

3. There are differences of opinion on the reasons for these injuries, but there is agreement that a dog’s front assembly is the most at risk, that conformation is a key factor and there are several other variables in the mix.

4. Height to weight ratio is a factor in jumping ability. Dogs with a ratio of less than 2.5 are the most capable, between 2.5 to 4 can be equally capable but may expose themselves to greater physical stresses, dogs with a ratio of greater than 4 are in the danger zone for jumping and should be trained with great care.

5. There are some breeds of dog where conformation prevents them from being able to safely & successfully take part in agility – these are the breeds at either end of the scale – the achondroplastic dwarf breeds such as the Bassett Hound and the giant breeds such as the St Bernard

6. An agility dog’s ability to jump successfully can be improved through schooling and as confidence and experience increases.

7. Regardless of conformation, experience, environmental conditions or skill of handler, a dog begins its agility career in KC competition at a jump height determined by its height at withers and continues to jump at that height as long as it remains in full competition. As the dog becomes more successful, degree of difficulty is increased through course design, not through obstacle size.

8. Dogs under 350mm at withers jump at 350mm, between 350 and 430 jump at 450 mm and dogs over 430mm jump at 650mm. Large dogs represent the most numerous category.

9. Ability to shift Centre of Gravity upwards is key to the ability to successfully clear a jump.

10. Dogs with longer front legs in any height category start with the advantage of a higher centre of gravity and those with greater shoulder angulation have greater reach.

11. The ratio between leg length and height at withers is therefore important.
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www.oricomtech.com Dynamic Leg Operations

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