

## Koi Food facts and Nutrition myths

### Duncan Griffiths

The feed Carbohydrate/wheat germ as opposed to protein in the winter argument and the feed lower protein as opposed to lower more staple food winter argument, has raged for ages, and it's a real complex issue and there is no specific answer as we are dealing with captive carp V's wild carp and the requirement or rather what's available to wild carp differs immensely. But when you look at real world nature in wild carp the reverse is true to an extent, however it is a picky subject matter

if you look at it logically in nature and wild carp there are plenty of carbohydrate around in the summer months in the form of vegetation and seeds blowing in off the fields etc. virtually none this exists in the winter as the vegetation dies back and there are no seeds. That does not mean carp go into protein eating overdrive in the winter; because they don't, their metabolism is greatly reduced in the winter and therefore the need for as high energy requirement. But generally it does mean any food they are likely to pick up when the mood suits is more likely to be protein in the winter, slugs etc. (worms are about 80% protein)

Having said that our koi are not wild and have adapted to what we feed due to heating and ways of keeping temps unnaturally higher than normal ambient temperatures in winter (covers etc).

Built into all carp domestic and wild, is the ability to know when not to eat when the temps are really low! In short if they will eat it will do them no harm, if they won't eat it's likely that because of the cold their inbuilt mechanism/senses has kicked in, they would not eat anything no matter how tempting until things improve. So the idea that wheat germ is essential as anything else would be slow to digest and rot in the koi's stomach is ludicrous. I have never ever seen this phenomena and I have never spoke to any one that has seen it. As the digestion slows down with the ever decreasing temperatures all things are slow to digest and carp rely on this inbuilt mechanism that tells them when to feed and when not to. That's how the winter wheat germ and low protein argument came about in the first place so to me it's just another of those long standing koi keeping myths

There are possibly a few points at this stage – as temperatures drop the metabolism does not change – it just slows down. As the metabolism slows down so the appetite decreases. You can therefore over feed a pond but not your koi. When temps get to around 10 – 12C the metabolism is very slow and the need for energy the fuel aspect of the feed, (lipids and carbohydrates) is very limited. Cell replacement is limited etc. Why on earth would you need “easily digestible” high carbohydrate foods when the koi's body hardly needs anything? Warm blooded mammals need high carbohydrate in winter because they generate their own body heat. Fish are cold blooded. One other point at around 10 – 12C the fish is still alive, swimming and breathing so it needs some nutrients

All carbohydrates are broken down in the digestive system into simple and complex sugar molecules and these are a major source of energy which is why athletes eat loads of pasta prior to a race.

True, Koi don't race but they do have immediate and just as important energy requirements. So to an extent Koi Do need carbohydrate. Carbohydrate = fuel

Source references; have stated that carp diets without carbohydrate produce less growth than diets with carbohydrate. Therefore from a nutritional point of view carbohydrate is considered essential in a carp diet.

Their very first energy requirement when a koi is fed is the immediate energy requirement to process what they have just been fed, a kind of catch 22, and that comes from energy derived from carbohydrate and lipids, you cannot get energy from protein fast enough, sudden bursts of energy also require immediate energy ETC,

The reason for the need for immediate energy for digestion is this. The koi has no stomach just a gut around 3.5 times the length of its body so the through put of food is very swift in summer months and slows as colder climates set in. The gut of the koi/Carp cannot absorb Protein in its raw state this is

a physical impossibility. If we waited for this to happen 100% of the protein fed would be expelled out the back of the koi without ever gaining inclusion into the koi's body. The carp has to break protein down into short chain amino acids instead of long chain molecules. At this point it's still a struggle to absorb them to where they are needed for cell generation so these are further broken down into very short chain amino acids individual amino acids and at this point they can be absorbed through the gut membrane into the blood and transported converted back into proteins and utilized. . This process is not a fast enough to give instant on demand energy hence the carbohydrate Lipid element

It's also worth mentioning at this point from a fish's perspective, protein derived from fish breaks down easier into smaller amino acid chains for digestion than does protein derived from animal sources, hence the importance of white fish meal as the main protein source

Generally protein is for building cells and growth, where as carbohydrate and in particular lipids are for energy to drive the engine, vitamins can be viewed as the spark plugs in this process.

Look at it this way the "protein" is the mechanical metal lump of a car engine and all what goes to maintain it. The carbohydrate and lipids are the fuel it burns to make it function. Last but not least vitamins are the spark plugs and injectors that make the whole process take place.

We further have to bear in mind that there are two types of muscle tissue in the koi. One is white and the other red. the white muscle is used for instant sprint speed bursts of speed, where as the red muscle is for the longer enduring slower motor functions such as lazing around the pond at a gentle pace when they get a fright from predator it's the white tissue that fires up and sprints them to the other side of the pond at warp speed. But as you will guess, because it's white there is limited blood flow and therefore takes long to recover. White and red muscle use stored energy. When chased the white muscles uses up the stored energy very rapidly and become exhausted very easily. This stored energy is not replaced instantly it takes time to rebuild

As previously mentioned carbohydrates become glucose which is an immediate source of energy to drive the engine functions of the Koi and supply its needs if glucose continues to rise in the blood stream to excess this is then converted to glycogen which can then in this form be stored in the liver. As the tissue becomes exhausted this glycogen can then be released by the liver as a ready made source of fuel for that tissue. Between meals glucose derived from liver glycogen will be the primary source of blood glucose to be used by the rest of the body for fuel. Hopefully in a **well balanced diet** the liver will give more glycogen out than it stores

So far we have talked about mainly the energy requirement for locomotion; this is not all the koi needs fuel for. The koi has to balance its osmoregulation system some of this is passive and requires and requires no efforts on the koi's part other parts are an active process and does require energy and thus fuel, one such function is the pumping of chloride ions against the concentration gradient and other such elements, without boring the pants off you this action is driven by ATP pumps, these are special cells the pump chloride, calcium etc against its natural diffusion gradient as with all pumps ( just like your pond pump) when they pushing something where it does not naturally want to go it takes energy, the koi does this 24/7/365 no matter if its at rest, active or sick this has to be maintained and this action requires energy = fuel

So as always In life, nutrition is about balance and moderation

I have no idea only a guess as to what that level of carbohydrate requirement %'age would specifically be, but what I can say is if you over cook this carbohydrate requirement fat deposits become evident in the body. You must also bare in mind the maker needs a way of binding the protein into the food to deliver it to the fish< hence carbohydrate> some excess carbohydrate will be converted to glycogen and stored to be converted back to glucose for future requirements for driving the engine so, a lot of the excess carbohydrate and protein is excreted hence viewed excess waste Carbohydrate is essential, to much of this beyond their requirement will result in to much storage and will be converted to fat in and around the hepatic tissue fatty liver disease.

There is no such thing as wheat germ food only food with wheat germ in varying amounts. Wheat germ koi foods with a protein level of around 32 – 34% will have about 12 – 15% wheat germ and the rest fish meal (or chicken feather, blood meal etc as the protein source. There is no such thing as protein food only food with varying amounts of protein and herein lies the major problem with foods for koi, the labeling methods.

Wheat germ in its crude state is 28 – 29% protein and many of the essential amino acids for essential tissue generation ( muscle building and regeneration) are not there or in very low amount. It is known that plant proteins are deficient in amino acids. There is a world wide shortage of fish meal. So many studies have been undertaken to substitute alternative protein sources for the fish meal. There is a cut off point where growth and health are compromised. Below a certain level of fish meal inclusion – about 25% if I remember correctly – then growth suffers.

Crude protein content is getting higher and higher year on year as makers push to make their foods that bit special and attractive to get folks to buy theirs and not the other lower protein content, the latest is 51-55% protein but is it and is it really needed?

the simple fact is, "mature" koi do not need and cannot process/utilize much more than 25-30% protein the rest is pure waste, the excess will mess up your filter and water quality dependant on how frequently and how much you feed, on the other hand, immature fish need as much as they can get and will make very good use of 51-55% protein and higher. Koi fry 50 – 55% protein, adult koi .... 35 – 40% protein. Carp cannot utilize 50% protein. But adult koi can utilize 40% protein. The question arises – if you feed 5 times a day on 25% protein but twice a day on 40% protein how much protein does the fish get in a 24 hour cycle? As we place much emphasis on skin luster and colour quality feeding 36 – 40% is the way to go even for adult koi. Much of the natural food found in mud dams has protein levels much higher than we feed with pellets. Spirulina, and algae, has 63% protein!

As a koi goes from its 3<sup>rd</sup> to 4<sup>th</sup> years of age its need for high protein will be greatly reduced as much of the accelerated growth and early development will have settled down to a steady level need

Most good food makers accept that ponds are mixed with both mature and immature koi, and settle for a happy medium say around 30-40% protein that tends adequately for both needs, and these tend to be the better and the more experienced makers of koi food. Where as many of the new kids on the block go for a perceived BIG BANG and in truth unless you have a pond full of fry or tossia/nissai its not really needed at all. Mark and Lisa of Cuttlebrook koi farm as I see it feeds 51% protein for two basic reasons, 1, they are growing on s very young fish and they can and will utilize this amount of protein. 2 , their brood fish need to be producing lots of eggs for next season and not reabsorbing them from deficient food lower protein food . for the rest of us the lower protein option would be a plus in this scenario (the reabsorbtion in varying degrees of eggs)

I feed 30-35% protein to my mature koi dependant on what's available and 55-60% protein to my fry I find anything higher than this with my mature produces extra waste

But what of the so called 55% protein and higher foods? Yes they probably are 55% protein but under certain marketing strategies you are not being told the whole truth, simply because you can get these high levels of protein by adding chicken meal, feather meal, blood meal etc but the amino acid profile does not always match that needed by koi. You can get the correct amino acid profile using 36 – 40% protein. This has been proven time and again in scientific references. It's not how much you feed but what you feed. Put another way if you feed your child day in day out on junk food as opposed to three square balanced diets, although the amount s can be identical we all know too well what the results will be.

Many makers list the contents and in particular the CRUDE Protein, it may read crude protein 55%, lipids 8% carbohydrate 33% ash 4% usually about this time they slide into the list white fish meal, krill, Soya ETC they then carry the list on, vitamins ETC, but never really tell you how much the white fish meal contributes to the mix

So it's conceivable that a food with lower protein content can be better than one with so called higher protein content, if the amino acid profile matches up with what the fish actually need

what it should say on the pack is

Crude protein 55%. Of which 45% is derived from: fish meal. Krill, anchovy and all other good stuff. then carbohydrate vitamins etc Then you know the other 10% protein is derived largely from the carbohydrate element. but perhaps manufacturers will not tell this as this would be disclosing some key elements of their formulation (relative to costs)the other 10% would be another protein source. Perhaps: chicken meal, feather meal, blood meal – something that sounds really grotty and unromantic which the manufacturer does not want to disclose for marketing purposes.

Toe nail cuttings are protein but you would not want to eat them

In short if you buy a food that says crude protein at 44% and does not tell what this is derived from or at least what the majority is made up from, it's telling you nothing or at least only half of the truth!). It's just telling you that there is 44% protein in there.

On the other hand all Good koi food manufactures tend to list 38% protein derived from white fish meal, hoki, salmon anchovy krill, and other good stuff. As the percentage of protein decreases something else has to be added to the formulation. You still have to get back to the 100% of the mixture you are going to make into pellets. This "something else" is carbohydrate. You are literally diluting the protein source with carbohydrate. Raw fish meal has around 62 – 65% protein. So when you begin a formulation and you aim for 38 – 40% and "dilute" it accordingly. Yes there is a lot more to this than the simplistic approach I have explained here but that is literally what happens. And remember some of the 100% will be moisture

All koi foods which have around 36 - 38% protein will have around 35% carbohydrate. As the level of protein decreases so the level of carbohydrate increases. There are many koi foods which advertise around 38% protein but analyze out at 16 -17% protein. But these foods have around 65% carbohydrate. Now would you feed 65% carbohydrate to your koi ? see chart below

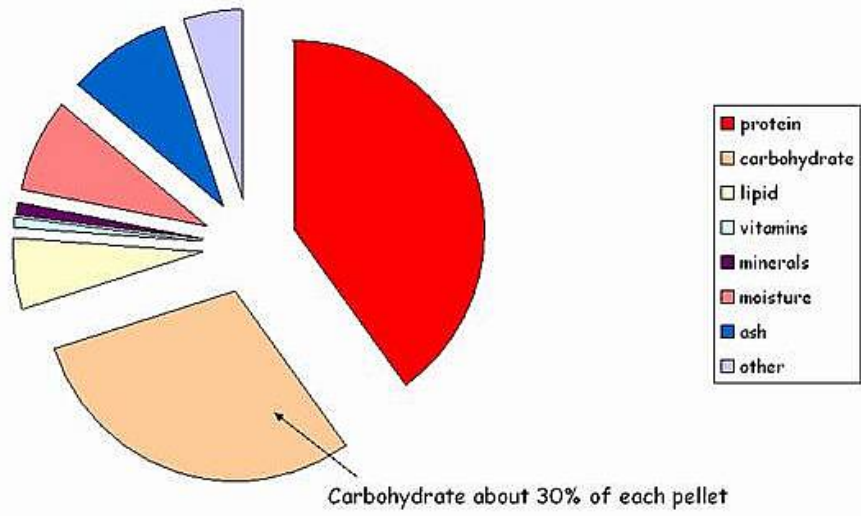
Koi food labels should list the ingredients in order of inclusion rate. I.E. the ingredient most used. So a 38% protein koi food should have "white fish meal" as its first ingredient or the protein source it uses. The next ingredient most used is carbohydrate then other things. Krill, crab, spirulina etc should be way down the list as they are far too expensive to be used above a few % of the diet and will never figure to any great extent in the overall percentage or the price of your koi food would go out of the window

Below a table of what makes up a koi pellet and how the protein / carbohydrate % changes as one goes down (protein) the other goes up ( carbohydrate)

And an actual real life laboratory study of some worlds leading koi foods with the names taken out and the price per kilo see the claimed protein % "V" the **actual** % content

A single koi pellet

a single koi pellet with 38 - 40 % protein - note the % of protein source relative to the carbohydrates



### 30 - 32% protein koi food

A single koi pellet

protein	carbohydrate	lipid	vitamins	minerals	moisture	ash	other	
30	40	6	1	1	8	9	5	100

