

HOW BIG A PIG WILL I BE?

by Donna Knauber, Ph.D.

I met Rafael the potbelly boar on our first visit to the farm we were thinking of purchasing. He was living in a small, dark stall filled with urine-soaked hay. He had no bristles because of mange, was so skinny his ribs stuck out, and he greeted us with the gentlest “ufff” of hello. We convinced the folks who were selling the farm to leave him with us when they moved.

Their last words of advice to us were, “Just be sure to feed him only a little bit of food so he won’t grow to be a big pig.”

That was my first encounter with the idea that pigs can be kept small by chronic underfeeding. I wondered — so, if I have a Great Dane and feed it only bits of food, will it be healthy and stay as small as a beagle? Interesting idea!

Interesting idea, but to my biologist mind, not too likely! Recently the idea of underfeeding pigs to keep them small re-emerged in a heated Internet discussion.

So, here is the question: **Can you prevent a pig from reaching its genetically pre-determined size (this means skeletal dimensions, length of bones) by limiting the pig’s food?**

First, it’s very important to differentiate size, meaning skeletal dimensions from size meaning fat and muscle content. In this discussion size means skeletal dimensions, that is, how long the individual bones grow. To restate the question then: Can a pig’s skeletal size (its bones) be kept small by limiting food?

The next important idea is that of genetics of size. Every individual as well as every species has an inherited, genetically predetermined size potential. “It is critical to recognize that the long bones appear to have a genetic program that determines their eventual length” (ref. 1). That is, no matter how much is eaten, the bones grow to a certain length and stop growing. No matter how much a beagle is fed, it won’t grow to the size of a Great Dane. That’s because the beagle’s genes tell the beagle’s bones to stop growing when they reach a certain size. No matter how much you feed a potbellied pig, it’s not going to reach the 4-foot height of a Duroc hog for the same reason that the beagle won’t grow to the size of a Great Dane — genes.

However, there is a phenomenon called “stunting”.

This is when restricted feed is used to limit the growth of a creature. The amount of food limitation needed to decrease bone growth borders on malnutrition! But, yes, it is possible to limit the skeletal size by chronic and severe underfeeding.

The diets I’ll mention here were either fed “ad lib” which means free-feeding, or according to National Research Council (1988) guidelines (about 2 pounds of food per day for young pigs). Now this is much more than pet pigs are fed. It’s important to understand that close to 100% of the nutritional information for pigs is related to obtaining optimal growth for slaughter at a young age. The idea of maintaining a slim piggy for a long life is relatively new. How to determine what amount of food is adequate would be the subject of an entire article! For this article I’m assuming recommendations such as Mazuri makes on their commercial feed are at least minimally adequate (feed 1-2% of weight of pig per day). Amounts will vary depending on the lifestyle and genetics of individuals. My outside pigs eat 4 - 6 cups of a 12% protein feed per day plus unlimited grazing and aren’t fat. However, Precious, the inside pig, is fat on 1-1/2 to 2 cups per day of the same food.

Piglets who were free-fed a 5% protein diet starting at the age of 3 weeks could be maintained at the weight of a 3–6-week-old piglet for up to 2 years! This severe underfeeding when combined with a starchy diet mimics the human diseases of malnutrition called kwashiorkor and marasmus. Symptoms include retarded growth, apathy, diarrhea, liver disease, hyper irritability and retarded mental development. A low protein and low fat or starch diet gave moderate but still severe symptoms (ref. 2).

There is a long list of nutritional deficiencies other than protein deficiencies that can lead to slow or interrupted growth. Deficiencies in minerals such as manganese, calcium, zinc or too much phosphorus, as well as deficiencies in most of the vitamins can cause interrupted growth. However, these nutrient deficiencies come with effects other than stunted growth, e.g., lameness, weak bones, dermatitis, epilepsy-like fits (Vitamin B6 deficiency), etc., etc. (ref. 3).

Given that vitamin and mineral deficiencies stunt growth with unpleasant health consequences, the question becomes whether or not there is a level of dietary protein that will limit growth yet allow the pig to be healthy?

I could find nothing on this subject. A 10-12% protein diet (fed at recommended levels) will slow the growth rate of young pigs but will not affect the final size. A 10-12% protein for young piglets (weaning age) was far below the recommended level of 15-20% and great care was needed to evaluate the level of necessary amino acids (ref. 2).

In fact, when young pigs are fed a diet deficient in protein, they continue to deposit protein in the skeleton at the expense of muscles and skin. "This hierarchy of tissue responsiveness also extends to longer periods of time" (ref. 1). Thus, an undernourished pig will still show skeletal growth. It's only when severe protein deficiencies are reached that growth is actually stunted.

So, a 5% protein diet leads to stunting and massive health problems while a 10-12% protein diet for young pigs can be a problem unless carefully monitored and although growth is slowed, the eventual size is normal.

From these studies, the concept of limiting size by restricting feed becomes pointless to me! A moderately restricted protein diet can cause health problems and doesn't make for a smaller pig. So, what is the sense of continuing to limit protein? The more that protein is limited below 10%, the greater the probability of the effects of severe malnutrition.

This is not to say that there may not be a combination of nutritional and environmental factors that can limit growth and allow for a smaller, healthy pig. Feral pigs are many times leaner and smaller than relatives reared in captivity. Why? No answer was given in the source that raised the question (ref. 2). Factors such as the type of food, as well as amount and nutritional content, activity and stress level of the pigs could play a part. It also could be that many feral populations are bordering on malnutrition during at least part of the year.

In any case, trying to limit growth by nutritional deprivation while hoping for a healthy pig, is venturing into unknown territory. Is it worth the loss of an inch of height to risk the health and mind of your pigger?

Are pigs different from other creatures in their plasticity of growth? That is, can a pig's skeletal structure be determined by nutrition more easily than, say, a dog or cat, or human? Apparently not. According to the sources I found, pigs are just like other creatures in their skeletal growth requirements. In fact, bone growth studies done with chickens, rats, humans and others are compared directly to pigs (all references).

But then, why is it that litter mates fed different diets are sometimes different sizes? There are instances when siblings from the same litter are adopted by two different people and the piglet that is fed more ends up taller than the piglet that is fed less. Isn't this proof that a pig can be kept small by limiting feed?

Most likely not. This experiment would have to be done using genetically identical piglets (litter mates are not generally genetically identical!) raised in identical environments. The only difference being the amount fed to the piglets. Did you know that stress (noise, illness, physical discomfort, social environment, etc.) can limit growth? Therefore, it's very difficult, or next to impossible, to determine whether feed, genetics, environment, or a combination of factors determined the different sizes.

The best bet for making sure a pig stays small is to be sure the parents were well-fed and genetically small. Although, given the nature of genetics, even that is no guarantee! By the way, when we met Rafael six years ago, he was skinny, starved, and a big guy at 24 inches tall at the hips. Now, after six years of an overly well-balanced diet, he's a plump, round, happy, and no taller pigger.

Which brings me to my last question about this topic.

Isn't it better to have a full-size, perhaps slightly plump piggy (not obese!) who's really happy, than a skinny, small, pigger who's hungry all the time? Food is a joy to a pig, and the idea of starving such a creature in pursuit of a most likely unattainable goal seems so cruel.

References:

1. Growth of the Pig edited by G.R. Hollis
2. Swine in Biomedical Research edited by L.K. Bustad and R.O. McClellan
3. Swine Production by Krider and Carroll
4. Swine Nutrition by Miller, Ullrey and Lewis

About the Author: Donna Knauber is a molecular geneticist who works on potatoes and lives just south of Fargo, North Dakota, with 25 potbellied pigs and two fine Ossabaw Island Swine (and a very understanding husband who is a sugarbeet pathologist and part-time pig parent).