One of the ways to compare dog foods is by using the Guaranteed Nutritional Analysis on the label to compare key nutrients. Part of the label is the proximate analysis of crude protein, fat, fiber, ash and moisture. Proximate analysis gives you the information you need to estimate the calorie content of the food, and to compare two foods with different moisture content. With this information, you can compare two different dry foods, or a dry food and a canned food, and see how they match up.

We're going to use the food I've been feeding my hounds (My Food) as our example. The nutritional values listed on the label are:
Crude Protein – 30%
Crude Fat – 20%
Crude Fiber – 4%
Moisture – 12%

From these numbers, we can estimate the percentage of carbohydrates in the food. The listed percentages add up to 66%. From this, we can estimate that carbohydrates make up the remaining 34% (100-66).

The caloric content of the food comes from the protein, fat and carbohydrates. We can estimate the caloric content by remembering two numbers. The calories per gram of protein and carbohydrates is about the same. Fat contributes a little more than twice that. The University of California at Davis School of Veterinary Medicine recommends estimating 3.5 kcal per gram of protein and carbohydrates, and 8.5 kcal per gram of fat. Other nutritionists recommend estimating 4 kcal per gram of protein and carbohydrates, and 9 kcal per gram of fat. A half kilocalorie per gram doesn't seem like much of a difference, but it adds up. Because I don't have an easy way of determining the scientifically-measured digestibility of the food, I prefer to use the lower, more conservative estimate and round to the nearest whole kilocalorie.

Using our example, the kilocalories from protein are 105 kcal per 100 grams (30 x 3.5). The kilocalories from carbohydrates are 119 kcal per 100 grams (34 x 3.5). The kilocalories from fat are 170 kcal per 100 grams (20 x 8.5). The total estimated calories from 100 grams of this food are 394 kcal per 100 grams. I measure the food I feed by volume, not weight, so I need to weigh a measure of food. I use a one-cup measure to portion the food, so I weighed a cup of the food in grams, and found that one cup weighs 115 grams. That means one cup of my food contains about 453 calories. If I want to, at this point I can also calculate the percentage of calories from protein, fat and carbohydrates.

I am considering switching to another food, higher in quality of ingredients, but lower in protein and fat. The other food also has a different moisture content, so I need to standardize the proximate analysis for each food by calculating the content of each food on a dry matter basis. The dry matter basis removes moisture from the equation. Canned foods contain much more moisture than dry foods. Looking at the nutritional values on a dry matter basis allows you to compare two different foods. In my case, I'm looking at two dry foods.

The nutritional values for the other food are:
Crude Protein – 28%
Crude Fat – 12%
Crude Fiber – 4%
Moisture – 10%

If a cup of the other food weights 120 grams, how many calories per cup does the other food contain? (The answer is 433 kcal per cup).

To convert the nutritional information to a dry matter basis, we have to determine the dry matter content of the food – the total content less the moisture. The dry matter content of my food is 88% (100%-12%). The dry matter content of the other food is 90% (100%-10%). To compare the values on a dry matter basis, I divide the values from the labels by the dry matter percentage.

The dry-matter nutritional values of my food are:
Crude Protein – 34% (30/.88)
Crude Fat – 23% (20/.88)
Crude Fiber – 5% (4/.88)
Carbohydrate – 39% (34/.88)

The dry-matter nutritional values of the other food are:
Crude Protein – 32% (28/.9)
Crude Fat – 14% (12/.9)
Crude Fiber – 5% (4/.9)
Carbohydrate – 52% (46/.9)

Evaluating a canned food on the dry-matter basis is very important, because once the body removes the moisture from the food, the nutritional balance of the remaining dry matter is very different from what appears on the can label. A can might contain 78% moisture, leaving only 22% dry matter, so the percentage of protein in the dry matter might be much higher than the percentage of protein in the can, and may be significantly higher than the dry food you are feeding.

Remember that these are estimates, only, and not precise calculations of the number of calories in the food. Still, this gives you a starting point for determining how much to feed your dog, and a means for comparing two different foods.

How do I Calculate the Calorie Content?

Where a label calorie content statement is required or simply desirable, it may be calculated from the same proximate analysis data used for setting guarantees. Unlike guarantees, it is NOT declared as a minimum or a maximum, but as an average based on multiple proximate analysis data.

The calorie content of a food is dependent on the amounts of crude protein, crude fat, and carbohydrate in the product. Carbohydrates are not measured directly, but can be estimated by calculating the “nitrogen-free extract” (or NFE) in the product. This is determined simply by subtracting the average of each of the other components (percent crude protein, crude fat, crude fiber, moisture AND ash) from 100 [see the following example].

The next step is to multiply each of the average percentages for the calorie-containing nutrients by the appropriate “modified Atwater” value. Protein and carbohydrate are assigned a value of 3.5. Fat is much more calorie dense, hence has a value of 8.5. The results of the three calculations are added. Then, to convert the answer to kcal/kg (the units required on the label), the sum is multiplied by 10.

Some lab reports include calorie values. However, this information is only useful and can be used in lieu of the above calculations if the lab is familiar with calorie calculations specifically for pet foods. A laboratory that primarily analyzes human foods will not use the same modified Atwater values in its calculations, hence will give you an inaccurate calorie content number.

Also useful information is the number of calories per treat or cup of product. First needed is the weight of a single treat or a cup of product in grams. Dividing the kcal/kg value as determined above by 1000 converts it to kcal per gram. Then, multiplying by the number of grams per treat or cup gives you the calories per treat or cup.

Example: Calculating calorie content from proximate analysis data

Batch	Crude Protein % AF	Crude Fat % AF	Crude Fiber % AF	Moisture % AF	Ash % AF	Nitrogen-Free Extract % AF	Metabolizable Energy kcal/kg AF
1	25	15	4.5	7.8	3.2		
2	26	14.3	3.2	8.9	3		
3	25.2	13	4	8.1	2.9		
4	23	16	3.8	9.1	3.3		
Average	24.80	14.58	3.88	8.48	3.10	45.18	3688

Nitrogen-Free Extract = 100 – (crude protein + crude fat + crude fiber + moisture + ash)

Metabolizable Energy = [(3.5 X crude protein) + (8.5 X crude fat) + (3.5 X nitrogen-free extract)] X 10

Calorie content (ME)= 3688 kcal/kg; If a treat weighs 10 grams apiece, the calories per treat = 3688/1000 X 10 = 36.9 kcal/treat; If a food weighs 120 grams per cup, the calories per cup = 3688/1000 X 120 = 442.6 kcal/cup