

# McCay's Nutrition of the Dog

Presented at Midwest Small Animal Clinic

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THE author, Clive M. McCay, was born in Winamac, Indiana, on March 21, 1898. He graduated from the University of Illinois in 1920, with the degree of Bachelor of Arts. He received a Master of Science degree from Iowa State College in 1923, the Doctor of Philosophy degree from the University of California in 1925. He was an assistant at Iowa State College from 1921 to 1923. He was a member of the staff at the University of California from 1923 to 1925. He held a National Research Council fellowship at Yale 1925 to 1927. He was assistant professor of animal husbandry at Cornell University from 1927 to 1934, and professor of nutrition at the same institution since 1934.

## Past Researchers Recognized

The book is dedicated to those researchers of the past and their experimental animals that have contributed their lives in order that men and dogs might have better health during their brief span spent on this earth.

The preface states that the purpose of this is to improve the health and happiness of my favorite, the dog. There is probably more misinformation concerning the nutrition of the dog than of any other species; as a result, many fine animals have aged prematurely and died early. This work presents only information supported by evidence gained from experiments and gleaned from the technical literature of the world.

To satisfy the needs of both the pet

owner and the scientist, each chapter is arranged so that essential applied knowledge is presented in the introduction. As the subject is developed, the complete technical picture is presented. For the benefit of veterinarians and other scientists, a bibliography of the most important papers follows each chapter.

The subject matter is presented in ten chapters as follows:

- Chapter 1. Americans and their dogs.
- Chapter 2. Carbohydrates for dogs.
- Chapter 3. Fat in the diet of dogs.
- Chapter 4. Proteins for dogs.
- Chapter 5. Mineral requirements for dogs.
- Chapter 6. Vitamins for dogs.
- Chapter 7. Modern dog feeds.
- Chapter 8. The ingredients of dog feeds.
- Chapter 9. Testing dog feeds.
- Chapter 10. Practical feeding and management of dogs.

There follows an author index and a subject index.

## Chapter 1. Americans and Their Dogs

In 1938 the dog population in America was estimated at about fifteen million. In the same year Americans spent about one hundred and twenty million dollars for dog shows, and the State of New York collected over nine hundred thousand dollars in dog taxes.

Mention is made of possible means why the dog was originally domesticated. Among them has been suggested that, because the dog is an excellent scavenger by eating the refuse and garbage, the dogs

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helped to prevent the accumulation of waste, thus keeping down the numbers of flies and insects that thrive on putrid refuse and enabling primitive peoples to occupy encampments for longer periods. Another idea suggested is that dogs licked the children and thus saved the mothers the trouble of bathing them.

Studies on dogs have laid the basis for much of our modern knowledge of nutrition. The nutritional needs of the dog are very much like those of man.

The Russians have erected a monument to Pavlov's famous dog, the dog that taught so much about digestion early in the present century.

In 1816 Magendie, the great French physiologist, reported that dogs could be kept in health upon meat diet, but failed if fed gelatin alone. He also observed that some dogs developed cataracts and ulcerations if fed on a diet of only sugar and water. This probably was the first observation that diet could influence the eyes.

As far as anyone knows today the dog has practically the same nutritional requirements as man, except that man develops scurvy if his diet is deficient in vitamin C, while the dog does not seem to need this vitamin. Therefore, in most cases the dog should be fed like man.

## Chapter 2. Carbohydrates for Dogs

Although the arrangement of the digestive tract of the dog would indicate that they were intended for a carnivorous diet, McCay brings out the fact that dogs can make use of the same carbohydrates as man, and there is no evidence that they develop any specific disease as a result of eating carbohydrates.

Bread and other carbohydrates are excellent food for dogs. The dog will thrive on diets containing 50 per cent of cooked starch and can also be maintained for long periods upon diets containing the same amount of cane sugar in place of starch. Thus the dog utilizes both starch and sugar, but the remainder of the diet should be well selected.

Milk sugar or lactose is not utilized as readily as other sugars. Lusk believes that lactose may undergo fermentation

before being absorbed from the intestine; also, perhaps enzymes are lacking for the break-down of lactose in large amounts. He doesn't mention the usually accepted fact that the liver has limited ability to convert galactose into glycogen.

Small amounts of raw starch are well tolerated, but large amounts tends to cause diarrhea. This is due to the passage of considerable amounts of raw starch into the large intestine where it is fermented with the evolution of gas. Many animals can digest raw starch as well as cooked. The white rat and common farm animals, for example, make good use of raw starch.

## Chapter 3. Fat in the Diet of Dogs

The statement is often made that dogs should not be fed lard. There is no basis for this statement. Some students of nutrition have used as much as 20 per cent of lard in diets fed to dogs over periods of many years. Dogs are usually very fond of lard.

Most dry dog feeds are usually kept low in fat because it tends to become rancid. For this reason, if a dog becomes too thin, it is a good practice to add some fat, such as mutton tallow or lard.

It is even possible that dogs may require certain essential fatty acids, as has been found necessary in human dietaries.

He brings out the fact that meals rich in fat slow down the passage through the alimentary canal, especially in the stomach, and gives this as the reason that fried fats are hard to digest.

We now realize that the major sources of fat for storage in the animal body are the fats and carbohydrates in the food. A little may be made from protein. In herbivorous animals the main source of body fat is from the carbohydrates, whereas in carnivorous animals the main source of body fat is from food fat.

The purpose of fat in the body of the dog is to act as insulation, to form a reserve of food fat, and to help anchor such organs as the kidneys. As a rule, it is probably better to keep a dog from becoming very fat. Probably the greatest evil in over-feeding either men or ani-

mals is the deposition of excess body fat. It shortens the span of life.

The feeding of rancid fats to dogs has been shown to be injurious. The first symptoms, according to Whipple, were severe loss of body hair from all parts of the body. A rash soon spreads over the body and ulcers developed. This was accompanied by a loss of appetite. After a period of constipation there was a severe diarrhea and the animals died. Control dogs fed the same diet with the same amount of good lard suffered no ill effects.

Many substances are added to fats to check rancidity, such as flour and gum guaiacol.

#### Chapter 4. Proteins for Dogs

As a rule, animal proteins are more complete and are better utilized by the body than are vegetable proteins. However, it is possible to rear and maintain most animals upon vegetarian diets, if those diets are well selected. The more complete a protein is the less of it is needed to maintain a dog in good health or in nitrogen equilibrium. The most complete proteins are those from milk, meat, soybeans, peanuts and yeast. The more incomplete proteins are those from white flour, gelatin and corn meal.

The cooking of meat for dogs is a waste of time from the point of view of nutrition. Cooking tends to destroy the vitamins. Raw meat is probably the best digested protein.

Dogs can be kept upon a meat diet alone for long periods. Early workers found that the amount of meat needed to keep a dog was 4 to 5 per cent of its live weight. Over long periods such dogs had to be fed bones, also, since meat is deficient in calcium.

The latest work of Rose and Roe now indicates that, for dogs, proteins must contain ten of the twenty-two well recognized amino acids. In other words, the body of the dog can probably make twelve amino acids for building its protein, while it must have ten provided in the protein of the diet. These ten are tryptophane, lysins, histidine, phenylalanine, leucine, isoleucine, threonine, methionine, valine and arginine.

The author has found that the dog digests and absorbs about four-fifths of the protein in the usual mixed food. About one-fifth of the protein is excreted in the feces of the dog.

Cottonseed meal is one plant protein concentrate that seems toxic to dogs. Dogs may appear healthy and thrive on cooked rations containing cottonseed meal for long periods, but eventually they will die very suddenly. Diets rich in gliadin (the protein from wheat) will ultimately kill dogs.

The feeding of raw eggs to dogs is often followed by vomiting and diarrhea. In dogs weighing 12 to 15 pounds Batman found that a single egg produced no effect, but that two eggs caused the feces to soften, and four or five eggs caused marked diarrhea. If the eggs were fed with cracker meal and lard, the ill effects were less marked.

When raw fish is fed to foxes in large amounts they produce a deficiency in vitamin B. Cooking of the fish destroys the factor that destroys B. Egg white ties up biotin in a similar manner.

#### Chapter 5. Mineral Requirements of Dogs

The dog needs the same inorganic elements to build its body as the higher animals. The more common of these are sulfur, calcium, phosphorus, magnesium, sodium, potassium, chlorine, iron, iodine, silicon, manganese, copper and fluorine.

Potatoes and vegetable foods are rich in potassium which causes a depletion of sodium. Dry food should contain not less than 0.5 per cent of NaCl. Meat diets require less, but plant diets require more.

The most desirable calcium phosphorus ratio for dogs seems to be 1.2:1.

#### Chapter 6. Vitamins for Dogs

Dogs need most of the recognized vitamins, with the exception of vitamin C. The four vitamins of most importance in the practical feeding of dogs are vitamins A, D, B (thiamine) and niacin.

#### Chapter 7. Modern Dog Feeds

Two classes of dogs are often poorly fed: those pampered by the rich, and those living in the families of the poor. In both

cases the dogs are apt to suffer because they tend to dine on food of their own selection. The pampered dog of the wealthy is likely to be allowed his choice of delicacies, while the dog of the poor family often supplements his diet from the garbage pail.

The usual house dog weighing 12 to 14 pounds needs one-third of a pound of dry food per day. In kennels a very close estimate of the needs of the dogs can be made if one pound of food is allowed for every 36 pounds of dog. This estimate assumes summer weather or heated kennels. During the winter months, when the dogs are living in unheated quarters with the temperature well below freezing, the daily requirements should be increased to one-half a pound per 14 pounds of dog. For estimating the utilizable energy values one may assume three calories per gram, as about three-fourths of such mixtures are utilized. The State of North Dakota has analyzed dog foods and has published the results. The State of Kentucky has attempted to control commercial feeds.

#### Chapter 8. Ingredients of Dog Feeds

Corn flakes and wheat flakes provide starch and should be well cooked. The protein concentrates include meat meals, cheese meal, dry skim milk, dried buttermilk, soybean meal, dry brewer's yeast, fish meal and wheat germ. These contribute protein and flavor to dog feeds.

#### Chapter 9. Testing Dog Feeds

The following methods should be considered and utilized in testing dog feeds, namely, metabolism studies, storage methods, palatability testing, analysis of tissues and the rate of digestion, and the movement of foods through the digestive tract.

#### Chapter 10. Practical Feeding and Management

This is perhaps the most interesting chapter. Pups should have cod liver oil one or two times per week and cheap organ meat, such as boiled pig liver.

The female dog should have a good diet during the gestation period, which lasts

about two months. Most of the materials of the developing puppies are built into their bodies during the last three weeks before birth. The pregnant female should be fed all she wishes during this period. After the puppies are born the feeding should be moderate for the first three days, since no great amount of milk is consumed by the pups during this early stage of lactation.

Maintenance studies indicate that the dog needs 70 to 80 calories per kilogram of body weight per day. The average dry dog food sold in New York has a utilization value of between 70 to 80 per cent. The dog excretes between 20 and 30 per cent of the dry matter of the feed in the feces.

Home remedies are discussed, as is also the shipping of dogs and shipping crates. A short discussion on breeding of dogs and, finally, mention of a few desirable dog books.

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#### Bob Veal

Bob veal is the flesh of calves less than two or three weeks old. Bob veal is not objectionable from a health standpoint, and the prejudice against it is illogical. The meat is flabby, edematous, and soft. The connective tissue is gelatinous and is present in greater quantity than in mature animals. The fat is reddish-gray and soapy, the meat less nutritious in value, as it contains a large proportion of water. The digestibility of the protein of bob veal is the same as market veal, namely, 93 per cent. On account of its moist and soft condition, bob veal has a greater tendency to spoil than the flesh of mature animals. Young calves are highly susceptible to a number of infections, particularly diarrheal diseases and infections which enter through the navel, but trouble has seldom been traced to bob veal. A few cases of illness due to eating the meat of diseased animals have been reported.

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In 1943 approximately 118½ billion pounds of milk were produced on American farms. This is second only to 1942 in annual production.