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Practical Dog Feeding

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Contents

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INTRODUCTION

THE PURPOSE of this publication is to present useful information concerning the feeding of the dog. This information was obtained from experiments conducted at the Alabama Agricultural Experiment Station which involved the use of over 500 dogs*, and from a survey of the literature dealing with the nutrition of the dog. The details of the experiments at this Station have been published elsewhere, and only practical problems in dog feeding will be discussed in these pages.

There is much misinformation prevalent as to what constitutes a suitable ration for the dog. The first part of this publication, therefore, will be devoted to a discussion of the nutritional requirements of the dog. The second part will deal with means of meeting these requirements under practical conditions.

NUTRITIONAL REQUIREMENTS OF THE DOG

Protein Requirement.—The protein requirement of the dog is similar to that of any other animal. Protein is necessary in the diet for the building and repairing of tissues. Proteins are built up of a number of relatively simple compounds called amino acids. Certain of these amino acids must be supplied to the dog in the ration. The quality of a protein, therefore, depends upon the number and quantity of these essential amino acids which it contains. The dog can be raised on a ration composed solely of vegetable products, which demonstrates that all the essential amino acids can be obtained in sufficient quantities from a combination of vegetables. Many individual vegetable proteins, however, are deficient in one or more essential amino acids whereas most animal proteins, though more expensive, are more complete. Under practical conditions, therefore, it is best to feed a combination of animal and vegetable proteins to insure a well-balanced protein intake.

If the ration contains 20 per cent (dry basis) of good quality protein, this amount is sufficient to meet the requirements of the dog under all conditions. Most foods contain some protein but the following foods are particularly good sources: lean meat, milk, eggs, fish meal, meat scrap, soybean meal, and peanut meal.

It is not advisable to feed rations containing more than 25 per cent of protein in warm weather, because proteins have a specific effect in increasing heat production in the body.

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It has often been stated that hard-working dogs require large amounts of raw meat. The main value of lean meat in the diet, however, whether it is raw or cooked, lies in its high protein content. Since it is known that the protein requirement does not appreciably increase during hard work, there is no reason to believe that meat will enable the dog to do more work than would any other type of food. The limiting factor in the ability to do work is usually the amount of available energy in the ration.

Energy Requirement.—The energy requirement of the dog is usually stated in terms of calories per unit of body weight. This is of little value from a practical standpoint, however, because the energy requirement depends upon many variable factors such as the amount of exercise, age, and size of the dog. Moreover, it is no simple matter to determine the energy value of a dog food. It is important, however, to see that a proper relationship exists between the amount of available energy and the amount of protein, minerals, and vitamins present in the diet. When this relationship is optimum, the diet is referred to as being well balanced.

Energy can be supplied most economically in the form of starchy foods. Care should be exercised, however, to see that the dog is also getting a liberal supply of protein, minerals and vitamins, because most starchy foods are low in these nutrients. The common belief that the dog does not digest starch has been disproved. Although the dog does not have a starch-digesting enzym in his saliva, there is a powerful enzym in the intestinal juice which is capable of digesting large amounts of starch.

Under conditions of extremely hard work, energy can be supplied most effectively in the form of fat, which has more than twice the energy value of protein or carbohydrate. Under conditions of moderate exercise, however, the use of large amounts of fat in dog foods should be avoided. Because of the high energy value of fat, the energy requirement and, therefore, the appetite of the dog will be satisfied before he has consumed enough food to meet his protein, mineral and vitamin requirements, unless these constitutents are raised to a high level.

A small amount of certain fats is essential in the diet of the dog. These fats occur in sufficient quantities in natural foods, however, so that special provision does not have to be made for them.

Vitamin Requirements.—The role of vitamins in the nutrition of the dog has received much publicity by the manufacturers of dog foods and proprietary vitamin products. There are many vitamins which are essential to the life of a dog, but under practical feeding conditions only a few of them need to be considered.

Care must be taken to incorporate sufficient amounts of

vitamins A and D into the ration, particularly for the growing dog. A lack of vitamin A in the diet results first in a condition known as night blindness, in which the dog is unable to distinguish objects in dim light. As this condition progresses it results in ulceration of the eyes and eventually leads to complete blindness. A dog suffering from a lack of vitamin A is also susceptible to respiratory infections.

In order to prevent this disease, the dog requires about 100 international units or U. S. P. units of vitamin A daily for each pound of his body weight. Three teaspoonfuls of sardine oil or cod liver oil weekly will suffice to meet this requirement for the average size dog. Foods rich in vitamin A are fresh greens, carrots, sweet potatoes and liver. Less rich foods are butter, milk and eggs.

Vitamin D is necessary for proper tooth and bone formation and its absence from the diet results in a disease called rickets. In rickets the leg bones are deformed producing a bow-legged or knock-kneed appearance; the dog does not carry his weight squarely on the pads of his front feet but distributes it along the pastern. If this disease is not checked in its early stages, a permanent deformity will result.

The exact amount of vitamin D necessary to prevent this condition is unknown. One hundred U. S. P. units of vitamin D per day is enough, however, except for the very largest breeds of dogs. One teaspoonful of sardine or cod liver oil per week is more than enough to meet this requirement. If fish oils are not available, a half teaspoon of irradiated yeast weekly will suffice. Most foods are low in vitamin D. Exposure of the dog to direct sunlight helps to prevent the disease but is not entirely effective. Fortunately vitamin D is needed only by growing dogs and bitches during gestation or lactation.

Blacktongue is a deficiency disease of dogs resulting from a very poor diet. It commonly occurs when the diet is restricted mainly to corn meal or corn bread. The symptoms are loss of appetite, loss of weight, vomiting, bloody diarrhea and ulceration of the mouth and tongue. This disease is caused by a lack of nicotinic acid in the diet. Dogs suffering from blacktongue should be given large quantities of liver, milk, or eggs, and then placed on an adequate diet. In severe cases nicotinic acid should be administered by a veterinarian.

A deficiency disease closely related to and usually occuring with blacktongue is caused by a lack of riboflavin in the diet. Unfortunately the symptoms of this disease are not very well defined in the dog. Since it usually occurs with blacktongue and is cured by the same foods, this disease does not present a serious problem.

Beri-beri is a disease resulting from a lack of vitamin B_1 (thiamin) in the diet. It rarely occurs in dogs receiving natural foods, but is occasionally seen in dogs receiving dog biscuits or canned food. In order to preserve these products, it is neces-

sary to apply heat, which, if not carefully controlled, will destroy the vitamin B_1. The lack of this vitamin in the diet will result in loss of appetite, loss of weight and finally paralysis and death. To cure this disease the dog should be given yeast or wheat germ and placed on a diet of natural foodstuffs. In severe cases where the dog refuses all food, the administration of pure vitamin B_1 or thiamin may be necessary.

The vitamins necessary to cure these deficiency diseases are available on the market in pure form, but their use is not recommended except in severe cases where the dog cannot or will not take food. The reason for this is that a dog suffering from one vitamin deficiency is very likely to be suffering from other closely related deficiencies which will not be cured by a pure vitamin preparation but which will respond to natural foods rich in all these factors.

Fright disease, or running fits, is apparently a deficiency disease, but its cause has not been satisfactorily explained. Intestinal worms probably play a role in this disease by competing with the dog for essential food elements. If a dog is properly dewormed and placed on a well-balanced ration, he will not suffer from running fits.

The other vitamins necessary for the health of the dog are of academic interest but have not been shown to be of practical importance because they occur in sufficient quantities in natural foods.

Mineral Requirements.—The dog requires the same mineral elements as man and in about the same proportion. The two elements most likely to be low in the average ration are calcium and phosphorous. It is not only necessary that they be fed in sufficient amounts but also in the correct proportion. This is most easily accomplished by allowing the dogs to chew on raw bones. In a home-mixed ration it is convenient to add bone meal as a source of these minerals. Rations containing commercial meat scrap as a source of protein usually contain enough calcium and phosphorous.

The optimum amounts of calcium and phosphorous required by the dog and the optimum ratio of calcium to phosphorous in the ration have not been determined. Excellent results were obtained at this Station, however, with rations containing 1.2 per cent calcium and 0.8 per cent phosphorus. The calcium/phosphorus ratio in these rations is 1.5:1.0.

Salt is also required by the dog in about the same proportion as in the human diet.

Other essential mineral elements such as manganese, magnesium, potassium, iron, copper, zinc, etc., are needed in relatively small amounts and are usually contained in sufficient quantities in natural foods.

TYPES OF DIET

Kitchen Scraps.—The dog was originally a meat-eating animal. Through generations of domestication, however, he has been forced to eat the same food as man. He is well equipped with enzyms to digest these foods. It is good practice, therefore, where only one or two dogs are kept, to feed scraps from the family table and kitchen. Thus the dog theoretically should receive a diet as balanced as his master's. Such scraps, however, are usually low in protein since they contain mostly leafy and starchy foods. This can be remedied by supplementing the scraps with milk, eggs, hamburger, or other meat from the butcher shop. These rations, however, should not contain any raw pork, because of the danger of infestation with parasites.

Canned Dog Food.—Commercial canned dog food originated as a canned meat or fish product designed to be used as a protein concentrate to supplement table scraps. The increased tendency among city or small apartment dwellers, however, to consume commercially prepared foods, and the use of modern refrigerators, has caused the disappearance of nearly all edible scraps from the kitchens of these families. It was to meet the demand of this type of dog owner for a complete ration, which could be easily fed, handled and stored, that the modern canned dog food was developed. The transition from the protein concentrate to the complete canned food, however, was not accomplished without confusion. Many of the canned dog foods on the market today are far from complete nutritionally. Unfortunately it is impossible to tell, either by looking at the food or reading the label, whether or not a brand of canned dog food is a complete ration.

As a result of the research done on canned dog food at this Station, the Department of Agriculture and Industries of the State of Alabama has established a standard for canned dog food. This department exercises rigid control over the chemical composition and conditions under which canned dog foods sold in this State are manufactured. It is also required that these products be complete for the nutrition of the dog when fed as the sole diet. This requirement is difficult to enforce because of the tremendous amount of work necessary to determine if a food is nutritionally complete. The enforcement of the chemical standard, however, has excluded most of the poor foods from the Alabama market. Nevertheless, care should still be exercised in the choice of brands of canned dog food.

A good canned dog food has a pleasant meaty smell. Dark brown products or those with a charred odor have probably been over-processed with a resultant loss of vitamin B_1. It is not good practice to feed one brand of dog food exclusively. If several brands are fed, deficiencies in one brand may be overcome by excesses in another.

Canned dog foods retailing at 5 cents a can should be avoided. It has been estimated that the cost of production of a can of dog food, exclusive of the value of its contents, is between 4 and 5 cents. It is obvious, therefore, that a can of dog food retailing at 5 cents contains food worth less than one cent.

Many brands of canned dog food have feeding directions on the label of the can, in which specific amounts of food are recommended for dogs of various weights. It is best to disregard these recommendations because many of them are still based on the assumption that canned dog food is to be used as a supplement and not as a complete ration. Therefore, they are usually grossly inaccurate. The dog should be fed enough to keep him in good condition. This will require from one to four cans daily depending upon the size, age and activity of the dog and the energy value of the food.

There are several brands of canned dog foods on the market which are nutritionally complete for the dog. Canned dog foods in general, however, must be considered as luxury foods. The consumer is paying mainly for the convenience of feeding. The average canned dog food contains 72 per cent water and retails for 8.3 cents a pound. It is obviously uneconomical to pay 8.3 cents a pound for a dog food containing that much water.

Raw Meat.—The question has often been asked whether it would not be more economical to feed raw beef than canned dog food. Raw beef contains only slightly less water than canned dog food and is obviously not a balanced diet. It usually costs as much or more than canned dog food and is therefore no more economical. Because the high moisture content of raw beef or canned dog food reduces the energy value, neither is as suitable for hard-working dogs as a dry ration.

There is no evidence that horse meat is different from beef in its nutritive value for the dog.

Raw pork should not be fed to a dog under any circumstances because of the danger of infestation by parasites which may kill the dog. After it has been thoroughly cooked, lean pork has the same nutritive value as beef.

Commercial Dry Rations.—One of the earliest types of dry dog food was marketed in the form of a biscuit. A high heat treatment was necessary to dry the interior of the biscuit thoroughly. This drastic treatment caused a marked decrease in the nutritive value of the product and many deficiency diseases resulted from its use. Such biscuit are still on the market, but they should not be used as the main part of the dog's diet.

A type of feed which is as convenient to use as canned dog food but not as expensive is marketed in the form of pellets. These have not been subjected to such drastic heat treatment as have dog biscuit and retain most of the original nutritive value of their ingredients. They are a convenient and relatively economical ration for the house dog.

The most economical type of commercial dog food is the dry ration marketed in the form of a meal. Many large milling companies manufacture a well-balanced ration in this form. The manufacturers of these feeds usually state that the feed may be mixed with water and fed raw. Better results are obtained if these feeds are cooked before feeding, unless most of the ingredients have been pre-cooked. These feeds sell for $5.00 to $10.00 per hundred pounds; at the present price levels, it should be unnecessary to pay more than $5.00 for one hundred pounds of well-balanced commercial ration. This type of dog feed is recommended for those who do not wish to mix rations for their dogs.

Home-Mixed Rations.—The cost of feed is a very important item to farmers, hunters, and operators of commercial kennels who feed large numbers of dogs. This cost can be reduced to a minimum by feeding home-mixed rations. The ingredients of these rations can be produced at home or purchased at feed stores for much less than the price of commercial mixed feeds. Unless a formula of proved value is used, however, home-mixing of dog rations is unsatisfactory.

There is a demand on the part of owners of large numbers of dogs for the formulas of dry dog rations which are nutritionally complete, yet simple and composed of ingredients which are readily available. The home-mixed rations developed as a result of research conducted at the Alabama Agricultural Experiment Station and recommended in this publication are particularly suited to the needs of these dog owners.

RECOMMENDED HOME-MIXED RATIONS

Auburn Ration I.—The Auburn Ration I was developed at the Agricultural Experiment Station and, after thorough testing under practical hunting conditions, its formula (Table 1) was published in 1935 in Leaflet No. 13.

When the experimental kennel of fox hounds was established at Auburn in 1936, Auburn Ration I was fed to the 12 brood bitches as the sole ration for 3½ years. During this time over 500 dogs were raised. Some of the bitches produced 7 litters of 10 healthy pups each. Better reproduction was obtained with

TABLE 1

Composition of Auburn Ration I

Yellow corn meal	35 lbs.
Wheat bran	10 lbs.
Wheat shorts	20 lbs.
Meat scrap	10 lbs.
Fish meal	10 lbs.
Skimmilk powder or dried buttermilk	10 lbs.
Alfalfa leaf meal	2 lbs.
Bone meal	2 lbs.
Salt	1 lb.

this ration than with any other one tried. Auburn Ration I, therefore, is especially recommended for brood bitches where reproduction and raising of pups is the main consideration.

The dried milk powder used in this ration is a very important ingredient for successful reproduction. Feeding tests with foxhounds in which the milk powder was omitted from Auburn Ration I have resulted in reproductive failure. If dried milk products are not available, liquid skimmilk or buttermilk should be used to supplement the ration as described later.

Modification of Auburn Ration I.—Although exhaustive tests have shown that Auburn Ration I is complete in all respects for the nutrition of the dog, there are several objections to its use. It contains a large number of ingredients, some of which are expensive and difficult for the average dog owner to obtain. The ingredients used only in small amounts in the ration are often not sold by local feed dealers in less than 100-pound lots. It is possible that these ingredients would deteriorate before they could be completely consumed. Furthermore, the ration is somewhat bulky and may not furnish enough energy for hard-working dogs.

After a large number of rations were tested, the following modified rations were selected as giving the best results. Although these modified rations are not as complete for reproduction as Auburn Ration I, they are nutritionally complete for raising pups and maintaining working dogs. They have the advantage of being less bulky and simpler to mix.

TABLE 2.—Composition of Modified Rations.

Auburn Ration II

Yellow corn meal	58 lbs.
Wheat shorts	20 lbs.
Meat scrap	20 lbs.
Salt	1 lb.
Sardine oil	1 lb.

Auburn Ration III

Yellow corn meal	46 lbs.
Wheat shorts	20 lbs.
Peanut meal	29 lbs.
Bone meal	2.5 lbs.
Salt	1.0 lb.
Limestone	0.5 lb.
Sardine oil	1.0 lb.

Auburn Ration IV

Yellow corn meal	55 lbs.
Wheat shorts	20 lbs.
Meat scrap	10 lbs.
Peanut meal	12 lbs.
Salt	1 lb.
Limestone	1 lb.
Sardine oil	1 lb.

Auburn Ration II is recommended for growing pups and maintaining dogs under average conditions because it is the simplest ration which is nutritionally complete for this purpose.

Auburn Ration III is especially recommended for hard-working dogs because it is the most economical ration and is very effective in maintaining dogs in good condition during hard work. It is not as good as Ration II for dogs which are penned up, however, because dogs receiving it tend to become overweight if their food intake is not carefully restricted. Peanut meal contains a higher percentage of total digestible nutrients than any of the other ingredients used and therefore furnishes more energy.

Auburn Ration IV is slightly more expensive than Ration III but it is more palatable because of the presence of the meat scrap. Very good results have been obtained with this ration.

Although these modified rations are not recommended for brood bitches, reproduction can be obtained in dogs receiving them if skimmilk powder is incorporated to the extent of 5 per cent of the rations. If this amount of skimmilk powder is added to Ration II, the reproduction is almost as consistently good as that produced by Auburn Ration I.

Description of Ingredients.—Yellow corn meal is finely ground whole yellow corn containing the germ. From a nutritional standpoint yellow corn is superior to white corn because it contains substances which the dog is able to convert to vitamin A. The form of vitamin A contained in yellow corn is more stable in a mixed feed than that contained in fish oils. If an adequate amount of vitamin A is insured by the proper use of fish oil or by supplementing the rations with green leafy material, white corn may be used. The use of yellow corn is recommended because the dog owner may be careless in the way in which he stores his feed or lax in furnishing his dogs with fish oil; consequently, the dog may suffer from a vitamin A deficiency.

Wheat shorts and wheat bran are standard by-products from the milling of wheat into flour. The shorts are commonly called wheat gray shorts or standard middlings.

Meat scrap (55 per cent protein) is a dry-rendered by-product of the meat packing industry. As obtained on the market this product is a finely ground dry meal.

Fish meal (55 to 60 per cent protein) is a by-product of the fishing industry marketed as a dry meal. It should be light in color and free from putrid odor.

Peanut meal is 45 per cent protein peanut oil meal. It should be light yellow in color and free from mustiness.

Skimmilk powder or dried buttermilk are products used in poultry feeds. If fresh skimmilk or buttermilk is available, the skimmilk powder may be omitted from the Auburn Ration and the liquid milk fed at the rate of one pint per pound of ration.

Sardine oil is prepared from sardines and is rich in vitamins A and D. Cod liver oil or other vitamin-containing oils usually used for poultry feeding may be used. The shortage of cod liver oil in this country caused by the war has resulted in an increase in price. Sardine oil, produced domestically, is now cheaper. The vitamin potency of these oils vary. Sardine oil or cod liver oil used for poultry feeds usually contains 3,000 units of vitamin A and 400 units of vitamin D per gram. Refined medicinal cod liver oils usually contain lesser amounts of these vitamins. The fish oils should be stored in a refrigerator. For practical purposes, a pint of oil may be considered to weigh a pound.

All of the above ingredients are usually carried in stock by feed stores. If the local feed merchant does not stock some of these ingredients, he will do so if there is a demand for them.

Ingredients Not Recommended.—Cottonseed meal, a protein concentrate widely used in livestock feeds in the South, is definitely poisonous to dogs. Although cooking makes the meal less poisonous, it is still dangerous to feed it to dogs in large amounts. Dogs may appear healthy and thrive on cooked rations containing cottonseed meal for long periods, but eventually they will die very suddenly.

Tankage or low grade products called meat and bone scraps should not be used. They are of low nutritive value and variable composition.

Soybean meal is a protein concentrate of high nutritive value, but its use in dog foods in large quantities is not recommended because of its laxative effect. If fed raw to dogs, soybean meal causes severe diarrhea. If rations containing soybean meal are cooked, this condition is remedied to some extent but is not completely overcome. Diarrhea is objectionable because many valuable nutrients are lost in the feces.

Use of White or Whole Wheat Bread.—Many inquiries have been received as to the possibility of substituting dry bread for part of these rations. Unless the bread can be obtained for less than two cents a loaf, this substitution is not economical because a pound of the ingredients which it would replace costs less than this. Furthermore, a loaf of bread weighing one pound when fresh would weigh considerably less when dry. An equal weight of ground whole wheat bread may be used to replace the bran and shorts of Auburn Ration I or the shorts of the other rations whose formulas are given in Table 2. White bread may be used to replace the corn meal up to 10 per cent of the ration. If a supply of ground whole wheat is available, this may be used to replace the wheat bran and shorts.

How to Mix the Rations.—It is recommended that 50 to 100 pounds of these rations be mixed at one time. Each dry ingredient should be weighed on a scale and placed in a pile on a

clean smooth floor. Any lumps should be thoroughly crushed. The pile of feed should then be completely shoveled to a new position and back. This should be repeated until the ration is evenly mixed as evidenced by the fact that individual ingredients can no longer be distinguished. If the amount of feed mixed is enough to last only two weeks, the sardine oil may be added to the whole mix at one time. From five to ten pounds of the mix should be placed in a dish pan and the sardine oil poured over it. The oil should be incorporated by rubbing the mixture between the hands until it is uniform. The feed containing the oil should then be thoroughly mixed with the rest of the ration. If the feed is to be stored for longer periods of time, a proportionate amount of the oil should be mixed with enough of the ration to last not more than two weeks.

Instead of mixing the sardine oil into the feed, it may be poured over the feed of each dog at the time of feeding. Three teaspoonfuls of the oil per dog per week is sufficient. Although this latter method of feeding the oil is less convenient than mixing it with the ration, it will be noted that a considerable saving of oil is effected. More oil must be fed when it is mixed with the ration than when fed in liquid form because the vitamin A in the oil is more stable when stored in liquid form.

It is usually necessary to buy the ingredients for these rations in 100-pound lots. If it is not advisable to buy such large amounts of feed or if no suitable place for mixing them is available, local feed merchants or milling companies may mix the rations. Many feed companies will do this and charge only slightly more than the cost of the ingredients.

How to Store the Rations.—These rations may be stored for several months without deterioration if they are kept in closed containers in a cool, dry place. Galvanized iron garbage cans with tightly fitting covers are very effective for this purpose. The rations will keep better if mixed in dry weather than when mixed in damp weather. If trouble is encountered with grain weevils in the feed, a bottle containing a small amount of carbon bisulfide and loosely stoppered with cotton should be placed in the feed container. The cheapest grade of carbon bisulfide which may be purchased in the drug store may be used. Extreme caution should be exercised to keep open flames or lighted cigarettes away from the carbon bisulphide fumes as they are highly explosive!

How to Feed.—It is recommended that these rations be cooked before feeding. The cooking not only increases the digestibility of the food but renders it much more palatable to the dog. The ration may be mixed with water to form a thick paste and baked in loaf tins in an oven for an hour at 400°F. or for an hour and a half at 350°F. The length of time necessary for baking depends upon how full the oven is and upon the

temperature of the oven when the food is put in. If the oven is not equipped with a thermostat, the food should be baked the same as corn bread. The food is done when there is a brown crust formed over the top. The amount of water to be added and the temperature and time of baking can readily be ascertained after a few trials.

An alternate method of preparing the food is to cook it in a kettle over a flame or in a steam jacketed kettle. Enough water should be added to the feed to form a thin gruel. Heat is then applied to the kettle and the mixture stirred until the boiling point is almost reached. At this point, the mixture suddenly thickens. Heating should be continued for one minute with constant stirring. Care should be exercised not to scorch the food at the bottom of the kettle. After the food has cooled it is ready for feeding.

The baked ration should not be kept more than two or three days at the most because it becomes "ropey" if kept longer, particularly in warm weather. The boiled ration should be prepared fresh each day.

If no means of cooking the food are available, it may be moistened with water and fed raw. Although most dogs will do as well on the raw as on the cooked food, these rations are less palatable when fed raw, and difficulty may be encountered in getting some dogs to eat them. Moistening with milk instead of water will help to some extent. The food is also not as completely digested when fed raw; consequently, more must be fed. There is less tendency for the dogs to develop diarrhea on the cooked food.

These remarks about cooking the food also apply to commercial dog feeds which have not been pre-cooked.

These home-mixed rations do not need supplementation with other foods except as recommended in special cases in these pages. Substances having special flavors to add to the palatability of dog rations are of doubtful value as are enzym preparations designed to aid in the digestion of the food.

How Much to Feed.—The amount of these feeds required each day depends upon the size, age, activity, and physical condition of the dog. Enough food should be fed to keep the dog in good condition. Each dog must be considered as an individual; therefore the owner should be the best judge as to how much to feed, because he knows the condition in which he wants to keep his dog. Excess fat on dogs should be avoided under any circumstances. If a dog becomes too fat, it is not the fault of the diet but the fault of the owner for feeding too much.

A grown dog weighing 50 pounds will require about 1½ pounds of dry food a day under average conditions. Smaller adult dogs will require proportionately less. A young, rapidly growing dog will require the same amount of food as a mature dog weighing three times as much. The amount of food given

a bitch should be doubled in late pregnancy and while she is nursing pups.

Because of the low moisture content of dry rations, they are a concentrated food. People who are unaccustomed to using these rations commonly make the mistake of feeding too much. The inability of the dog to eat all his ration is then often attributed to unpalatability of the food. It is better to feed too little than too much of these rations until the dog and his feeder have become accustomed to them.

How Often to Feed.—An adult dog under normal conditions needs to be fed only once a day, preferably in the morning. Hard-working dogs require food twice a day, but these feedings should be so arranged that they will not come immediately before work. Growing dogs should be fed in the morning and evening. Young pups receiving milk and solid food should be given the solid food in the morning and evening and the milk at noon.

Cost of Feeding.—The cost of the recommended home-mixed rations per hundred pounds at present market prices is as follows: Auburn Ration I, $2.52; Auburn Ration II, $2.72; Auburn Ration III, $2.20; and Auburn Ration IV, $2.45. This is about half the cost of commercial dry rations which sell for $5.00 to $7.00 per hundred pounds.

Most dry feeds contain about 10 per cent moisture as compared with an average of 72 per cent for canned dog food. If the cost of canned dog food is calculated on a 10 per cent moisture basis, it costs $26.67 per hundred pounds or ten times as much as the home-mixed rations.

FEEDING PUPS

A bitch nursing pups should be fed all the food she will eat in order to supply a generous supply of milk for the pups. If more than eight pups are born at one time, the litter should be reduced to eight at the end of the first week. With large litters it is necessary to supplement the bitch's milk with cow's milk after the third week. This can be done by teaching the pups to drink from shallow pans. The pup's muzzle should be pushed into the milk (lukewarm) until he learns to lap it up. If the pup wanders away from the pan, he should be brought back until he has finished his share of the milk. After two days the pups usually learn to drink and consume the milk eagerly. For a litter of eight pups a pint of milk daily will suffice for the first three days, after which they should receive a quart.

At five or six weeks of age, the pups should be weaned and receive cow's milk and solid food. It is well to wean the pups on the type of diet that they are to receive later. If a pup is weaned on meat, for instance, difficulty might be encountered

in changing to a dry ration when he is older. When the dog has reached the age of eight weeks, he can receive the same food as a mature dog.

ACKNOWLEDGMENTS

The American Dry Milk Institute of Chicago and the F. E. Booth Company of San Francisco donated generous supplies of skimmilk powder and sardine oil, respectively, for the experiments which led to this publication.

APPENDIX I

Alabama Standard for Canned Dog Food Adopted July 18, 1938

1. **Canned Dog Food.**—The term "Dog Food" or "Dog and Cat Food" or any similar term used in connection with canned products shall mean a wholesome, commercially sterile food product packed in hermetically sealed containers. This product shall be composed of edible fresh and/or frozen or cured meat and/or meat by-products and/or fish. It may contain milk solids, cereals, vegetables, or other edible accessory food products and edible mineral or vitamin containing substances. It must contain such accessory substances as required to render the canned products adequate for normal nutrition of the dog when used as the sole ration.

2. **Normal Nutrition.**—The term "Normal Nutrition" as used here shall mean normal growth for the species and breed, together with reproduction and rearing of young.

3. **Edible.**—The term "Edible" shall be construed to mean suitable with respect to the conditions of manufacturing and handling of each ingredient and the product as a whole. In the case of a manufacturer operating a Federally inspected plant, production and handling under inspection and regulations of the Bureau of Animal Industry, U.S. Department of Agriculture shall be prima facie evidence of suitability with respect to cleanliness and freedom from disease. In the case of a manufacturer operating a non-federally inspected plant, the Board of Agriculture and Industries of the State of Alabama will decide whether the conditions, regulations and inspection under which said manufacturer operates are suitable within the meaning of this standard.

4. **Adulterated.**—Any canned dog food shall be deemed adulterated and subject to seizure if it consists in whole or in part of a filthy, decomposed or putrid animal or vegetable substance, or if it is the product of a diseased animal or one that has died otherwise than by slaughter.

5. **Standards.**—Chemical Composition

Dry matter not less than	26 %
Protein not less than	7.5 %
Fat: not less than	2 %
not more than	6 %
Ash not more than	3.5 %
Calcium (Ca) not less than	0.25%
Phosphorus (P) not less than	0.30%
Salt (NaCl) not more than	0.50%
Crude fiber not more than	1.50%

6. **Label.**—The label of all canned dog food must bear imprinted thereon in a legible manner the following:

Guaranteed Analysis

Dry matter	——%
Protein	——%
Fat	——%
Ash	——%
Calcium (Ca)	——%
Phosphorus (P)	——%
Salt (NaCl)	——%
Crude fiber	——%

This analysis must conform to the minimum (and maximum where required) limits of the above standard.

7. **Ingredients.**—The label must likewise have imprinted thereon a statement of all the ingredients used in the manufacture in order of their preponderance as to weight (dry basis for all ingredients except water).

8. **Name of Manufacturer.**—The label must bear the name of the manufacturer in clear, distinct English words in legible type.

9. **Weight.**—Each can must contain one pound or multiple thereof, net weight of product, and the net weight must be shown on the label in a conspicuous place.

10. **Amount of Feed.**—No statement regarding amount of canned dog food to be fed shall be made on the label.

11. **Use by Humans.**—Statements such as "Fit for human food", "Fit for human consumption", or other similar statements which imply that the canned dog food may be eaten by humans shall be prohibited on canned dog food labels.

APPENDIX II

TABLE 1.—Chemical Composition of Recommended Rations Tabulated by Ingredients to Show the Sources of Protein, Fat, Carbohydrate, Fiber, Calcium, and Phosphorus.

Auburn Ration I

Ingredient	% of ration	Pounds per 100 pounds					
		Protein	Fat	Carbohydrate	Fiber	Calcium	Phosphorus
Yellow corn meal	35	3.3	1.4	23.9	0.8	.0035	.0945
Wheat bran	10	1.6	0.5	5.4	0.9	.0120	.1320
Wheat shorts	20	3.5	0.9	11.5	1.1	.0160	.1880
Meat scraps	10	5.5	1.1	0.1	0.2	.8700	.4300
Fish meal	10	5.6	0.9	0.5	0.1	.5370	.2980
Skimmilk powder	10	3.5	0.1	5.0	—	.1240	.0960
Alfalfa leaf meal	2	0.4	0.1	0.8	0.3	.0380	.0044
Bone meal	2	0.1	—	—	—	.6522	.3034
Salt	1	—	—	—	—	—	—
TOTAL	100	23.5	5.0	47.2	3.4	2.2527	1.5463

Gross Energy Value = 3.28 calories per gram.

Auburn Ration II

Ingredient	% of ration	Pounds per 100 pounds					
		Protein	Fat	Carbohydrate	Fiber	Calcium	Phosphorus
Yellow corn meal	58	5.4	2.3	39.7	1.3	.0058	.1566
Wheat shorts	20	3.5	0.9	11.5	1.1	.0160	.1880
Meat scrap	20	11.0	2.1	0.2	0.4	1.7400	.8600
Salt	1	—	—	—	—	—	—
Sardine oil	1	—	1.0	—	—	—	—
TOTAL	100	20.0	6.3	51.4	2.8	1.7618	1.2046

Gross Energy Value = 3.42 calories per gram.

Auburn Ration III

Ingredient	% of ration	Pounds per 100 pounds					
		Protein	Fat	Carbohydrate	Fiber	Calcium	Phosphorus
Yellow corn meal	46	4.3	1.8	31.5	1.0	.0046	.1242
Wheat shorts	20	3.5	0.9	11.5	1.1	.0160	.1880
Peanut meal	29	13.0	2.5	7.0	2.7	.0493	.1595
Bone meal	2	0.1	0.1	0.1	—	.6522	.3034
Limestone	1	—	—	—	—	.4000	—
Salt	1	—	—	—	—	—	—
Sardine oil	1	—	1.0	—	—	—	—
TOTAL	100	20.9	6.3	50.1	4.8	1.1221	.7751

Gross Energy Value = 3.41 calories per gram.

Auburn Ration IV

Ingredient	% of ration	Pounds per 100 pounds					
		Protein	Fat	Carbo-hydrate	Fiber	Calcium	Phos-phorus
Yellow corn meal	55	5.2	2.1	37.6	1.2	.0055	.1485
Wheat shorts	20	3.5	0.9	11.5	1.1	.0160	.1880
Peanut meal	12	5.4	1.0	2.9	1.1	.0204	.0660
Meat Scrap	10	5.5	1.1	0.1	0.2	.8700	.4300
Limestone	1	—	—	—	—	.4000	—
Salt	1	—	—	—	—	—	—
Sardine oil	1	—	1.0	—	—	—	—
TOTAL	100	19.6	6.1	52.1	3.6	1.3119	.8325

Gross Energy Value = 3.42 calories per gram.

TABLE 2.—A Comparison, by Age, of Body Weight and of Feed Consumed Daily by Foxhounds Receiving Dry Rations and a Good Brand of Canned Dog Food.

Age	Auburn Ration II		Auburn Ration III		Canned Dog Food	
	Body Weight	Food Consumed	Body Weight	Food Consumed	Body Weight	Food Consumed
weeks	lbs.	lbs. oz.	lbs.	lbs. oz.	lbs.	lbs. oz.
8	10	1 0	10	0 10	9	1 13
10	15	1 4	12	0 12	14	2 11
12	20	1 8	14	0 13	18	3 0
14	25	1 7	17	0 14	21	3 2
16	29	1 10	20	1 2	25	3 8
18	34	2 1	23	1 2	28	3 4
20	38	2 0	25	1 3	31	3 4
22	43	2 3	27	1 4	34	3 9
24	46	1 15	31	1 7	37	3 11
26	49	1 15	35	1 9	39	3 8
28	51	1 10	38	1 13	41	3 5
30	52	1 6	41	1 14	42	3 10
32	53	1 10	43	1 14	43	3 7
34	54	1 6	44	1 14	42	3 6
36	54	1 7	45	1 14	43	3 9
38	55	1 10	48	1 14	43	3 9
40	54	1 4	46	1 14	43	4 1
42	54	1 4	46	1 12	44	3 8
44	53	1 4	46	1 9	45	3 14
46	53	1 4	46	1 9	45	3 10
48	54	1 6	47	1 9	46	3 13
50	54	1 8	48	1 8	45	3 7
52	54	1 8	47	1 8	46	4 0

Each value represents the average for four dogs.

TABLE 3.—Percentage Chemical Composition of Commercial Canned Dog Foods.

Brand No.	Moisture	Fat	Ash	Protein	Fiber	N.F.E.	Calcium*	Phosphorus	Salt**
1	46.34	25.40	1.70	13.91	0.85	11.81	Trace	0.21	0.95
2	66.34	3.86	4.20	13.43	1.34	10.83	1.18	0.75	0.12
3	68.18	4.57	3.83	8.48	0.85	14.09	1.05	0.64	0.38
4	69.90	3.52	5.15	9.63	0.78	11.02	1.62	0.87	0.43
5	70.16	1.67	4.79	8.89	1.12	13.37	1.24	0.80	0.82
6	70.24	4.82	2.81	11.35	0.69	10.09	0.54	0.46	0.52
7	70.52	2.74	2.80	10.18	0.85	12.91	0.57	0.42	0.65
8	71.39	4.83	2.24	9.12	0.67	11.75	0.41	0.39	0.35
9	71.18	2.30	3.79	7.36	1.35	14.02	0.95	0.60	0.22
10	71.48	6.12	1.41	10.42	1.63	8.94	Trace	0.27	0.33
11	71.61	3.68	1.76	12.22	0.79	9.94	Trace	0.23	0.66
12	71.88	3.24	0.85	8.39	0.52	15.12	Trace	0.18	0.12
13	72.63	3.79	1.10	11.44	0.88	10.16	Trace	0.25	0.14
14	73.24	3.41	2.48	10.78	0.80	9.29	0.24	0.30	0.96
15	73.48	2.03	2.79	7.14	0.86	13.70	0.75	0.48	0.28
16	73.93	2.40	3.31	10.71	0.93	8.72	0.89	0.33	0.27
17	75.02	1.85	2.65	6.22	0.88	13.38	0.72	0.45	0.23
18	75.76	2.15	3.21	9.17	0.79	8.92	0.82	0.52	0.86
19	76.58	0.45	1.80	9.45	1.21	10.51	0.28	0.27	0.16
20	76.66	1.24	2.26	5.63	0.98	13.23	0.53	0.33	0.19
21	76.71	0.80	0.90	6.75	2.18	12.66	Trace	0.07	0.22
22	77.53	1.55	0.96	7.39	1.14	11.43	Trace	0.22	0.04
23	79.55	0.81	1.35	4.66	0.84	12.79	0.23	0.23	0.20

*Values for calcium below 0.01 per cent are reported as trace.
**Total chlorides calculated as sodium chloride.

Average Gross Energy Value = 1.17 calories per gram.

TABLE 4.—Formulas Which Have Been Tested and Found to be Unsatisfactory for Home Mixed Rations.*

1.	Yellow corn meal	86	lbs.
	Skimmilk powder	10	lbs.
	Bone meal	3	lbs.
	Salt	1	lb.
2.	Yellow corn meal	66	lbs.
	Skimmilk powder	10	lbs.
	Wheat shorts	20	lbs.
	Bone meal	3	lbs.
	Salt	1	lb.
3.	Yellow corn meal	44	lbs.
	Wheat shorts	20	lbs.
	Skimmilk powder	5	lbs.
	Soybean meal	27	lbs.
	Bone meal	2.5	lbs.
	Limestone	0.5	lb.
	Salt	1.0	lb.
4.	Yellow corn meal	41	lbs.
	Wheat shorts	20	lbs.
	Skimmilk powder	5	lbs.
	Soybean meal	27	lbs.
	Bone meal	2.5	lbs.
	Limestone	0.5	lb.
	Salt	1.0	lb.
	Sardine oil	3.0	lbs.
5.	Yellow corn meal	56.5	lbs.
	Wheat shorts	20	lbs.
	Skimmilk powder	5	lbs.
	Fish meal	17	lbs.
	Limestone	0.5	lb.
	Salt	1.0	lb.
6.	Yellow corn meal	58	lbs.
	Wheat shorts	20	lbs.
	Fish meal	20	lbs.
	Salt	1	lb.
	Sardine oil	1	lb.
7.	Yellow corn meal	56	lbs.
	Wheat shorts	20	lbs.
	Skimmilk powder	5	lbs.
	Meat scrap	18	lbs.
	Salt	1	lb.
8.	Yellow corn meal	60	lbs.
	Wheat shorts	20	lbs.
	Tankage	18	lbs.
	Salt	1	lb.
	Sardine oil	1	lb.
9.	Yellow corn meal	44	lbs.
	Wheat shorts	20	lbs.
	Skimmilk	5	lbs.
	Cottonseed meal	27	lbs.
	Bone meal	1	lb.
	Salt	1	lb.
	Limestone	1	lb.
10.	Yellow corn meal	45	lbs.
	Wheat shorts	20	lbs.
	Cottonseed meal	30	lbs.
	Bone meal	1	lb.
	Salt	1	lb.
	Limestone	2	lbs.
	Sardine oil	1	lb.
11.	Yellow corn meal	46	lbs.
	Wheat shorts	20	lbs.
	Cottonseed meal	27	lbs.
	Bone meal	1	lb.
	Salt	1	lb.
	Limestone	2	lbs.
	Sardine oil	3	lbs.
12.	Yellow corn meal	47	lbs.
	Wheat shorts	20	lbs.
	Meat scrap	5	lbs.
	Fish meal	5	lbs.
	Cottonseed meal	15	lbs.
	Skimmilk powder	5	lbs.
	Salt	1	lb.
	Limestone	1	lb.
	Sardine oil	1	lb.
13.	White corn meal	47	lbs.
	Wheat shorts	20	lbs.
	Meat scrap	5	lbs.
	Fish meal	5	lbs.
	Cottonseed meal	15	lbs.
	Skimmilk powder	5	lbs.
	Salt	1	lb.
	Limestone	1	lb.
	Sardine oil	1	lb.

*Reasons why these rations are not recommended:—Rations 1 and 2 are deficient in protein; ration 3, deficient in vitamin D, laxative; ration 4, laxative; rations 5 and 6, poor quality protein; ration 7, deficient in vitamin D; ration 8, poor quality protein; rations 9, 10, 11, poisonous to dogs.

Good results were obtained with rations 12 and 13 when they were fed to dogs as the sole ration for one year. It is not wise, however, to feed dogs rations containing cottonseed meal until it has been established that small amounts of cottonseed meal fed over a period of several years will not result in an accumulative poisoning.

Ration 14 is similar to Auburn Ration I but contains sardine oil. The addition of sardine oil to the Auburn Raton increases the cost and is not necessary. Ration 15, which is Auburn Ration I without skimmilk powder, is not satisfactory for reproduction. For growing dogs one of the simpler rations is just as good.

14.

Yellow corn meal	34	lbs.
Wheat bran	10	lbs.
Wheat shorts	20	lbs.
Meat scrap	10	lbs.
Fish meal	10	lbs.
Skimmilk powder	10	lbs.
Alfalfa leaf meal	2	lbs.
Bone meal	2	lbs.
Salt	1	lb.
Sardine oil	1	lb.

15.

Yellow corn meal	35	lbs.
Wheat bran	10	lbs.
Wheat shorts	20	lbs.
Meat scrap	10	lbs.
Fish meal	10	lbs.
Alfalfa leaf meal	2	lbs.
Bone meal	2	lbs.
Salt	1	lb.