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Utilization of Slaughterhouse By-products as a Preparation of Pet Food

Abstract

The demand of pet food is increased day by day due to increasing its population and also a 60-80% byproducts of animal live body weight produce during slaughtering of each animal. For proper disposal and minimize health or environmental hazard it utilizes as a preparation of pet food to increase nutritive value. There are three main types of pet food: dry food, semi moist food and canned food. In pet food meat meal, meat cum bone meal, blood meal and feather meal utilized as a source of protein as well as tallow, lard and poultry fat utilize as a fat source. Animal byproducts such as organ meat also having a good source of vitamin and minerals. Different types of pet food are produced by combination with cereal grain or floor at different moisture levels.

Introduction

The pet dog population in India increased from 19 million in 2018 to over 31 million in 2023, witnessing a growth rate of approximately 11 percent. Currently, India has the fifth largest pet population in the world. About 60% of Indians adopt pets (The Economic Times Report, 2024). The dog is the most common pet with 34% and cat 20% followed by fish. Rapid urbanization, rising crime, the desire for company, the constant increase in nuclear households, shifting attitudes toward pet animals, and the need for companionship are the main causes of the rise in dog adoption. Pet dogs are regarded as family members, receiving proper nutrition, health treatment, and overall well-being. Over the past 20 years, pet owners have started moving away from traditional scrap feeding and handmade food to commercially manufactured pet diets, which are generally considered to be more palatable, convenient, and nutrient-dense. Additionally, homemade pet meals are typically lacking in energy, protein, calcium, phosphorus, vitamins, and microminerals because these foods are frequently poorly balanced and may not meet the necessary standards for a dog's safety, digestibility, or palatability (Pame *et al.*, 2023).

As per as Indian Market Research Report, Indian dog food market size reached US\$ 2.4 bn in 2022 and is expected to reach US\$ 3.5 bn by 2028, exhibiting a growth rate (CAGR) of 6.1% during 2023-2028 (Pet Food Market Size, Share and Trends Analysis Report, 2023). Dogs are carnivores that hunt for opportunities. Contrarily, cats are regarded as strict carnivores with unique biochemistry that necessitates particular vital nutrients from animal-based sources, like taurine and arachidonic acid (Thompson, 2008).

By-products of the meat processing industry comprise 57% of the live load of fish, 62% of the live load of broilers, 80% of the live load of pigs, and 66% of the live load of cattle, all of which are deemed inedible by humans. To minimize environmental and health hazards, great focus has been devoted to the conversion of slaughterhouse by-products to useable biomaterials and animal feed, rather than disposal by landfilling, incineration, or burial (Limeneh *et al.*, 2022). Slaughterhouse wastes can be processed and used as feed supplements for the poultry, fish and pets like dogs and cats. Currently, pet and livestock feed production in India primarily involves cereals rather than animal byproducts. As a result, pet animal competes with humans for grains and cereals, which can be partially replaced with recycled and processed abattoir waste. Slaughterhouse waste is first processed into feed supplements such as Meat Bone Meal (MBM), Dicalciumphosphate (DCP), and Bicalphos (BCP) which are essentially feed supplements. To provide a complete animal feed, they are subsequently combined with different crop ingredients (Kulkarni and Devatkal, 2015). Slaughterhouse byproducts are protein-rich biomass made up of collagen (gelatine), keratin, lipids, amino acids, and mineral compounds (Limeneh *et al.*, 2022).

Pet food standards

Any ingredient used must be within the limits of its established safety and utility by Association of American Feed Control Officials

2007. It is responsible for establishing the recommended nutritional requirements for dogs and cats. Minimum crude protein and crude fat required for growth and maintenance in dog feed is 22.5% and 8.5%, respectively as well as for adult maintenance crude protein and crude fat requirement is 18.0% and 5.5%, respectively (AAFCO, 2007).

Types of Pet Food

1	Dry food	○ It makes up approximately four-fifths of the pet food market. ○ Contain a 10-12 % moisture, 5-12.5 % fat, 20-35 % protein, 35-50 % carbohydrates and 2.9-4 digestible energy kcal/g. ○ It is manufactured in the form of meals, pellets, biscuits, kibbles or extruded products. ○ It can be fed dry or with water added to make it more palatable during feeding time.
2	Semi moist food	○ It contains a 25-50 % moisture, 16-25 % proteins, 3-10% fat, 25-35% carbohydrates, and 2,180 digestible kcal/kg. ○ This product is manufactured as imitative meat chunks or patties. ○ Semimoist pet food must be carefully packaged with natural and synthetic preservatives to maintain the quality and to protect it against spoilage. ○ Semimoist feeds are easier to store and have a higher palatability than dry diets.
3	Canned food	○ Canned pet food is primarily animal by-products like bones, cheek meat, damaged carcass parts, intestines, liver, lungs, and stomach tissue. ○ It contains a 74-80 % moisture, and-20% protein, 2-15% fat, 1-2 digestible energy kcal/g. ○ It superior in palatability.

(Source: Ockerman and Hansen, 2000)

Utilization of slaughterhouse byproducts in pet foods

● Protein source

It is beneficial to include an animal protein source in the formulation of pet food because canine species, such as dogs, prefer animal tissues over vegetables in meals (Pame *et al.*, 2023). The protein source in pet food are meat cum bone meal, meat meal, poultry byproduct meal, fish byproduct meal (Meeker and Meisinger, 2015). MCBM is a good source of animal-based protein and has a protein content of about 50%. It can be used to raise the nutritional value of pet diets. Poultry byproduct protein meals are a popular and high-quality protein source for pet food. the poultry byproduct meal and meat and bone meal are made by the rendering process. Rendering is a process in which poultry and animal byproducts such as an organ meat, skin, viscera, residue muscle tissue, poultry feet are subjected to steam or dry heat to extract fat. Here, either the fat is drained off and turned into animal fat or the water in the "soup" is dried out, and the solid part is then crushed into a fine, protein-rich "meal" (Thompson, 2008).

Poultry feathers contain about 90% protein and high levels of sulphur-containing amino acids as well as feather is the most abundant keratinous by-product from animal origin. Breaking the toughest bonds of the feather and unwind the complex structure can facilitate the action of proteases to act on this 'untouched' protein molecule, which can facilitate the digestibility of feathers by natural gastric enzymes will be a promising invention to pet food manufacturing (Faslu Rahman, 2021).

Blood meal also good source of protein, it contains >80% protein. Because of the nutritional and physiological advantages of blood and plasma protein, their use as valuable components in pet food is steadily growing. Spray-dried blood plasma significantly enhance the texture by improving cohesion between the different ingredients in the recipe due to its excellent water binding and emulsifying capacity, when used in loaf, chunk, and pouch type pet foods (Pame *et al.*, 2023).

● Fat Source

Fat in pet food contributes texture, flavour, smell, essential fatty acids, a concentrated source of energy, and a pathway for the absorption of fat-soluble vitamins (Meeker and Meisinger, 2015). Fat in pet food supplied by animal fat. Tallow, lard, and poultry fats are examples of rendered fat and oil that enhance the flavour, texture, and nutritional value of pet diets while serving as an additional energy source (Pame *et al.*, 2023). Additional fat comes from the poultry waste meal and corn, with minor amounts coming from meat and bone meal, wheat, soybean meal, and animal digest. A variety of fatty acids, including linoleic acid, an important unsaturated fatty acid, are included in this mixture (Thompson, 2008).

Poultry and, more particularly chicken fat, has become a very popular fat source in pet foods and chicken fat is a good source of the essential linoleic acid (Peña-Saldarriaga *et al.*, 2020). Tallow extracted from beef and having a saturated fatty acid. Digestibility of tallow is higher than the poultry fat and lard. Lard is also animal fat extracted from pork and essential fatty acids such as linoleic acid can range between 3 percent and 16 percent as well as it is relatively easy to stabilize due to a preponderance of palmitic and oleic acids (Meeker, 2006).

● Carbohydrate source

The physical characteristics of pet feeds are enhanced by the addition of carbohydrates for efficient processing. Meat scraps, hydrolysed protein, and other fibrous materials can be combined with cereal grains or substances with a high starch content to create a soft crumb dry pet meal (Pame *et al.*, 2023). Cereals are commonly utilized in dry commercial pet food due to their inexpensive cost and ability to provide starch during the extrusion process (Corsato Alvarenga, 2021). Carbohydrate is a broad category of compounds from sugars to starches to oligosaccharides to celluloses. While carbohydrates are not considered essential for dogs and cats, pets do have a physiologic need for carbohydrates. In addition to being an energy

supplement, they promote optimal gastrointestinal function of pet animal (Fritsch *et al.*, 2023).

- **Vitamin Source**

Organ meats usually possess a higher vitamin content than lean meat. Some of the organs like lung, heart, kidney, brains, spleen and tripe have high nutritive value and constitute part of the diet in different countries worldwide (Meti *et al.*, 2024) The highest concentration of riboflavin is found in the kidney and liver, which have five to ten times greater than found in lean meat. The liver has the highest levels of niacin, vitamins B12, B6, ascorbic acid, and vitamin A. Vitamins B6 and B12 are also found in kidneys. Pork, liver, lungs, spleen, and lamb kidneys are great sources of iron and vitamins. The liver of beef, lamb, and veal has the highest concentration of copper (Kulkarni and Devatkal, 2015).

Traditionally by-products from animal slaughter house have served as rich source of protein, mineral and many vitamins for all the pet animals (Alao *et al.*, 2017).

Process of manufacture pet food

Pet Food Production and Processes

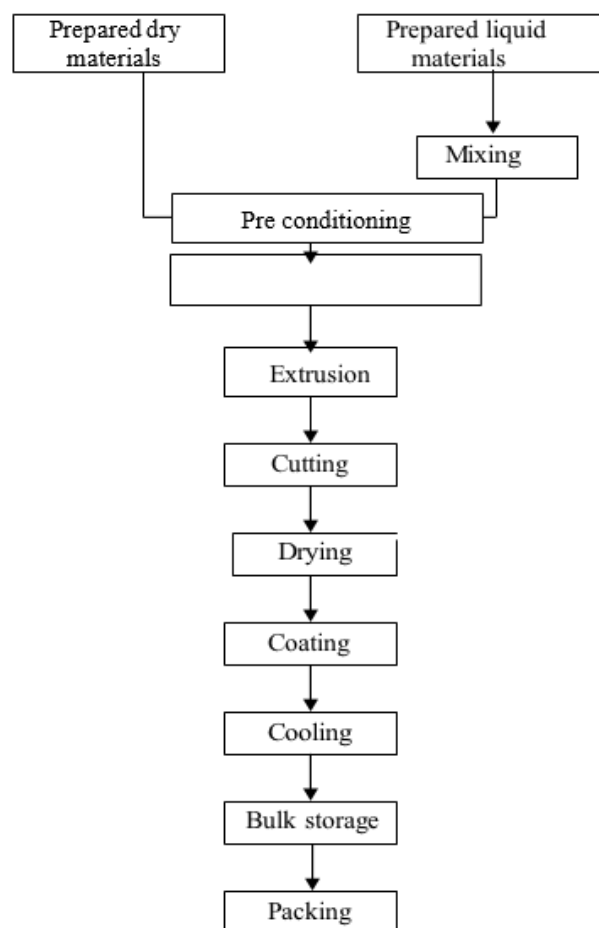
- **Dry food**

The most common method for making dry pet food is extrusion, which involves cooking a mixture of wet and dry ingredients at high pressure and temperature. Food extraction is a cooking, forming and puffing that added nutrient rich products of protein and fat meal combination with cereal ingredients such as an oat, corn, rice bran and soyabean. A single extruder performs several functions including mixing, utilizing ingredients, kneading, cooking and forming products with desired shape, expansion, sterilization and dehydration (Gibson and Sajid, 2013).

The procedure entails making stiff dough made mostly from wheat flour or other cereal flour. A rotary mold is used to press the dough into "shape." The molded pieces are cooked by applying heat directly while being transported on a chain belt through a lengthy tunnel oven. When

baking is complete, the end product is a dry brittle wafer, pellet, or biscuit. A significant amount of grain flour, such as wheat, which contains gluten protein, is necessary to produce a product that will maintain its shape. The gluten protein serves as a glue, maintaining the shape of the piece and preventing it from splitting (Meeker, 2006).

Dry pet food production process

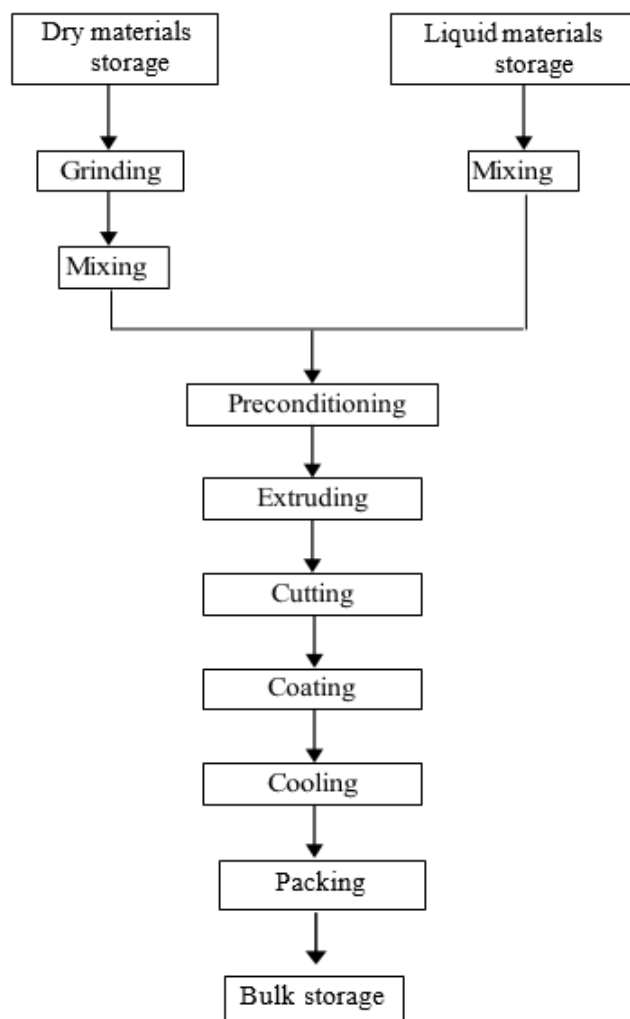


- **Semi moist food**

Semi-moist pet food is made by combining ingredients, cooking, extruding, and cooling to create a soft and safe texture. A preconditioner is used to combine dry components like cereal flours with liquids. After that, they are combined, heated, and hydrated using steam injection or hot water (60°C). An extruder is filled with preconditioned materials. Drying is not required after extrusion for semimoist pet foods (Devahastin, 2010). Instead of drying them to restrict microbial growth,

humectants and mold-inhibitory preservatives are used to regulate water activity, which in turn inhibits fungal growth. Water is bound together by humectants such as glycerin, propylene glycol, dextrose, and emulsifiers, which stops mold spores from using it. (Meeker, 2006).

Semimoist pet food production process



Source: (Devahastin, 2010)

• Canned food

Production of canned food is similar to producing human canned food except raw material is different. Canning procedure include coarse grinding of animal byproducts or meat and meat cum bone meal as well as precooking in a continuous cooker with steam. This ingredient

mixes with a cereal grain, vitamins and minerals to produces a balance food supplement. Then mixer filled into a hermetically sealed cans and transferred to retort for sterilization. Temperature of can depends on can content, movement of cans and steam pressure. The cans are next rapidly cool to 38°C and transferred to labelling Ockerman and (Hansen, 2000).

• Conclusion

Utilizing processed animal by-products such as MCBM, rendered fat, and processed blood provides excellent nutritional value, improved palatability, and increased owner preferences. Using animal by-products in pet food production reduces environmental damage and increases profitability per animal. Different types of pet food produce at different moisture level with utilizing animal byproducts and cereal grains.

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