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## Preparation of dry extruded pet foods and its nutrient composition

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### Abstract

The four different dietary formulations *viz.*, Normal diet (T<sub>1</sub>) based on AAFCO recommendations for an adult dog maintenance diet (2014), high protein high fibre diet (T<sub>2</sub>), high protein medium fibre diet (T<sub>3</sub>) and control diet supplemented with choline chloride (T<sub>4</sub>), were prepared by dry extrusion. The percentage of crude protein and crude fibre of T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> diet were 15.74 and 4.09; 21.90 and 11.28; 21.73 and 8.23; 15.72 and 3.99, respectively. The gross energy value (kcal/kg) of normal (T<sub>1</sub>) and choline supplemented diets (T<sub>4</sub>) were 4448.50 and 4478.50, respectively, whereas T<sub>3</sub> and T<sub>4</sub> were 3714.50 and 3743.50, respectively. The four therapeutic diets were extruded through BTPL twin screw extruder (Model – TSE 002, Kolkatta, India) with the extruder temperature fixed at 124 °C and the prepared food was conveyed through pneumatic conveyer to the drier, where the product was dried at 80 °C for two hours. Then, the therapeutic diets were packed in LDPE bags and stored at room temperature (30.16 ± 1.26 °C).

**Keywords:** High protein high fibre, extruded foods, pet foods, dry foods

### Introduction

Dry-extruded pet foods were first produced in 1950's using extrusion cookers. Since then, the market for dry expanded foods had grown immensely around the world and had become the common manufacturer of commercial dry canine and feline diets. The ingredients were mixed properly and were steam conditioned, compressed and forced through the die of the extruder (Rokey and Plattner, 1995) <sup>[10]</sup>. Ninety five per cent of dry pet foods were produced by extrusion cooking technology (Spears and Fahey, 2004) <sup>[11]</sup>. The stability and shelf-life of dry pet foods were increased by extrusion (Cheftel *et al.*, 1986) <sup>[3]</sup>. Hendriks and Sritharan (2002) <sup>[6]</sup> reported the improved digestibility of proteins because of mild denaturation of proteins during extrusion. Extrusion process may affect the palatability of the diet by controlling the level of specific mechanical energy (Kvamme and Phillips, 2003) <sup>[7]</sup>. Fatma *et al.* (2018) <sup>[4]</sup> reported that the digestibility of protein had increased in the process of extrusion from 76.05% in the pelleted food to 79.63% in the extruded diet with the same composition

### Materials and Methods

#### Collection of Raw Ingredients

The ingredients *viz.*, maize, wheat bran, soybean meal, sunflower oil cake, poultry by-product meal, vegetable oil and choline chloride were purchased from the manufacturers in required quantities. The vitamin and mineral premixes were procured from Feed Manufacturing Technology Unit, Department of Animal Nutrition, Veterinary College and Research Institute, Namakkal. The ingredients were dried and ground properly, and stored in a hygienic manner for the preparation of pet food.

#### Proximate Principles of Raw Ingredients

The ingredients were analyzed for its proximate composition *viz.*, moisture, total ash, crude fibre, crude protein, ether extract and nitrogen free extract as per AOAC (2012) <sup>[2]</sup>.

#### Pet Food Formulation and Preparation

Based on the nutrient specifications and recommendations given by the AAFCO (2014) <sup>[1]</sup> for the adult dog maintenance diet, the normal or control diet (T<sub>1</sub>), high protein high fibre diet (T<sub>2</sub>), high protein medium fibre diet (T<sub>3</sub>) and control diet supplemented with choline chloride

(T<sub>4</sub>). were formulated.

### Weighing

The ingredients were weighed individually according to the formulated level of inclusion with an electronic digital balance at the Pet Food Processing Unit, Department of Livestock Products Technology (Meat Science), Veterinary College and Research Institute, Namakkal.

### Mixing and pre-conditioning of ingredients

All the ingredients including oil were mixed thoroughly and 10% of water was added gradually in the mixer before extrusion.

### Extrusion

The materials were extruded through BTPL twin screw

extruder (Model – TSE 002, Kolkata, India) with the extruder temperature fixed at 124 °C and the prepared food was conveyed through pneumatic conveyer to the drier, where the product was dried at 80 °C for two hours. All the four diets were prepared by the above-said procedure and was cooled and packed in LDPE bags and stored at room temperature (30.16 ± 1.26 °C).

### Estimation of Gross Energy in Therapeutic Diets

For estimation of gross energy of feed samples using digital Bomb calorimeter (Rajdhani make RSV-5) was used. A known quantity of dry feed samples in pellet form was burnt in bomb under oxygen pressure (25 atmospheric pressure) and rise in temperature was recorded. The energy value (kcal/kg) of samples was calculated by using the following formula.

$$\text{Calorific value} = \frac{\text{Rise in temperature} \times (\text{calorific value of thread} - \text{calorific value of wire})}{\text{Weight of sample (g)}}$$

## Results and Discussion

### Proximate Analysis of Raw Ingredients

The proximate composition of the raw ingredients used for preparation of therapeutic diets is presented in Table 1.

The percentage of crude protein and crude fibre content of maize, wheat bran, soybean meal, sunflower oilcake and poultry by-product meal were 9.06 ± 0.08 and 2.02 ± 0.09; 15.93 ± 0.08 and 15.99 ± 0.09; 42.83 ± 0.71 and 3.96 ± 0.29;

28.80 ± 0.20 and 26.10 ± 0.15; 52.06 ± 0.08 and 1.03 ± 0.06, respectively.

The proximate principles of the raw ingredients were in agreement with the standard reference values of NRC (2006) [6]. The slight increase in ether extract value of maize, crude fibre value of soybean and comparatively lower crude protein values of soybean might be due to agro climatic condition and cultivation process adopted.

**Table 1:** The proximate composition of the raw ingredients (% DM) to formulate different therapeutic diets for obese dogs (Mean ±SE)

Nutrients	Maize	Wheat bran	Soybean meal	Sunflower oilcake	Poultry by-product meal
Dry matter	85.46±0.36	86.76±0.64	86.60±0.55	86.86±0.20	90.20±0.05
Crude protein	9.06±0.08	15.93±0.08	42.83±0.71	28.80±0.20	52.06±0.08
Crude fibre	2.02±0.09	15.99±0.09	3.96±0.29	26.10±0.15	1.03±0.06
Ether extract	5.90±0.01	1.29±0.04	2.35±0.06	1.10±0.01	26.26±0.16
Total ash	7.56±0.01	7.58±0.15	8.56±0.06	3.22±0.01	10.26±0.11
NFE	75.44±0.04	59.20±0.32	42.28±0.60	40.77±0.31	10.37±0.32
Organic matter	92.43±0.22	92.42±0.15	91.43±0.06	96.77±0.25	89.73±0.11

Each value is a mean of three observations

### Proximate Principles and Fibre Fractions of Prepared Extruded Pet foods

The proximate principles and fibre fractions of feed samples were analysed and the results are presented in Table 2.

The percentage of crude protein and crude fibre of T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub> were 15.74 ± 0.04 and 4.09 ± 0.06; 21.90 ± 0.18 and 11.28 ± 0.16; 21.73 ± 0.25 and 8.23 ± 0.17; 15.72 ± 0.04 and 3.99 ± 0.12, respectively. The NDF and ADF fractions of four therapeutic pet foods were 53.69 ± 1.30 and 32.09 ± 0.99, 71.54 ± 1.08 and 52.95 ± 0.68, 66.26 ± 0.63 and 49.43 ± 1.13, 51.64 ± 1.02 and 34.40 ± 0.71, respectively for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and

T<sub>4</sub>. The percentage of crude protein was 28.12 and 27.56 and crude fibre was 63.74 and 50.30 per cent higher than the control, respectively for T<sub>2</sub> and T<sub>3</sub>. The fibre level of the T<sub>2</sub> diet was 27.03% higher than T<sub>3</sub>.

The proximate principles of T<sub>1</sub> and T<sub>4</sub> diets revealed that the nutrient contents were as recommended for the maintenance requirements of adult dog (AAFCO, 2014) [1]. The T<sub>2</sub> and T<sub>3</sub> therapeutic diets contained 39 and 38 per cent higher protein and 276 and 200 per cent higher fibre content, respectively than the normal diet (T<sub>1</sub>).

**Table 2:** Proximate composition and fibre fractions (%) of formulated therapeutic diets for obese dogs (Mean ± SE)

Nutrients	T <sub>1</sub>	T <sub>2</sub>	T <sub>3</sub>	T <sub>4</sub>
<b>Proximate composition (%)</b>				
Dry matter	90.10±0.22	90.20±0.51	89.80±0.17	89.16±0.17
Crude protein	15.74±0.04	21.90±0.18	21.73±0.25	15.72±0.04
Crude fibre	4.09±0.06	11.28±0.16	8.23±0.17	3.99±0.12
Ether extract	14.40±0.41	15.77±0.05	13.91±0.03	14.43±0.88
Total ash	7.83±0.20	6.43±0.12	8.33±0.12	8.16±0.17
Nitrogen-free extract	57.92±0.18	44.60±0.12	47.78±0.28	57.68±0.82
Organic matter	92.16±0.20	93.56±0.12	91.66±0.12	91.83±0.17
GE (kcal/kg)	4448.50±70.50	3714.50±42.50	3743.50±45.50	4478.50±39.50
ME* (kcal/kg)	3518.00	3018.00	3029.00	3518.00

Calorie: Protein ratio	223.40	137.70	139.30	223.70
<b>Fibre fractions (%)</b>				
Neutral detergent fibre	53.69±1.30	71.54±1.08	66.26±0.63	51.64±1.02
Acid detergent fibre	32.09±0.99	52.95±0.68	49.43±1.13	34.40±0.71
<b>Minerals* (%)</b>				
Calcium	0.50	0.94	0.73	0.50
Available phosphorus	0.35	0.61	0.50	0.35
<b>Amino acids* (%)</b>				
Lysine	0.61	0.98	1.07	0.61
Methionine	0.24	0.30	0.31	0.24

Each value is the mean of three observations

\*Calculated based on the level of inclusion as per NRC, 2006

The Calorie: Protein ratio of T<sub>2</sub> and T<sub>3</sub> were 137.70 and 139.30, respectively which is 38.56 and 37.66 per cent lower than the control diet. However, German *et al.* (2010) [5] produced pet diets with calorie: protein ratio of 96.66 and 95.58 in HPHF and HPMF diets, respectively and studied their effects on obese dogs. The calculated calcium, phosphorus, lysine and methionine levels were found to be optimum in the prepared therapeutic diets as recommended by AAFCO (2014) [1].

### Estimation of Gross Energy in Therapeutic Diets

The estimated gross energy value of control and therapeutic diets ranged from 3714.50 to 4478.50 kcal/kg and the calculated ME values of prepared diets were 3518, 3018, 3029 and 3518 kcal/kg for T<sub>1</sub>, T<sub>2</sub>, T<sub>3</sub> and T<sub>4</sub>, respectively. The ME values calculated from the gross energy were found to be in accordance with AAFCO (2014) [1] for an adult dog. Adult maintenance diets available for dogs ranged from 3500 to 4000 kcal/kg (Linder and Parker, 2016) [8].

### Conclusion

The present study prepared pet foods of four different dietary formulations by extrusion and the nutrient composition of raw ingredients and prepared extruded pet foods were analyzed and presented.

### Conflict of Interest

The authors declare there was no conflict of interest for conducting this research.

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