DEVELOPMENT AND EVALUATION OF PET KIBBLES USING MEAT-CUM-BONE MEAL

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Abstract

A study was carried out to develop a suitable formulary for pet kibbles by using meat-cum-bone meal (MCBM) and to evaluate their nutritional quality and palatability. The developed pet kibbles were formulated with cereal flour mix (33%), buffalo meat (25%), meat-cum-bone meal (MCBM) (20%), offals (20%), dietary fiber (8%) and bovine collagen peptide (1%). The ingredients were made into a dough, which was then moulded and baked at 150°C for 50 minutes. The addition of MCBM improved the overall nutrient quality, cooking yield and palatability compared to control. Evaluation of palatability was done through score card and preference was observed based on intake ratio using two-pan palatability test. The addition of MCBM had significantly ($p<0.05$) increased the protein and fat per cent resulting in higher calories per 100 g of product. The redness (a) value significantly ($p<0.05$) decreased for treatments. Owners preference attributes was higher for treatment T_1 compared to control and T_2. Thus, it can be inferred that pet kibbles with good nutritive value and palatability can be prepared by incorporating 20 per cent MCBM.*

Key words: *MCBM, pet kibbles, two pan test, nutritional qualities*

The pet population in India is increasing at a robust pace especially due to a steady rise in nuclear family. Pets are increasingly being fed with commercially prepared pet foods (Pattanaik, 2011). Indian pet food industry is expanding tremendously in the past few decades. The ever rising cost of pet food has necessitated the development of cheap as well as nutritious food, by use of slaughter house primary and secondary byproducts. Rendered protein meals such as meat-cum-bone meal and slaughter house byproducts are almost universally used in pet foods. Generally, they provide high quality protein with a good balance of amino acids and minerals of high nutritional quality.

The rendered materials are more prone to rancidity, therefore application of these components and oxidation issues are the most common challenges faced in their uses in pet foods. Hence this study was undertaken to optimize the level of MCBM in dry type of pet kibbles.

Materials and Methods

Raw materials

MCBM prepared by dry rendering of bovine primary byproducts, fresh hot deboned

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lean buffalo meat from round portion of adult carcass and offals were obtained from the Meat Technology Unit, College of Veterinary and Animal Sciences, Thrissur, Kerala. All external fats and fascia of the meat and offal were trimmed off and stored in refrigerator (4±1^{0}C) for 24 hours for conditioning. The offal's were washed and stored under frozen condition at -18^{0}C until use. The cereals flours mix, black gram husk and wheat bran were procured from local market at Thrissur, Kerala. Food grade collagen peptide was purchased from Nitta Gelatin India. Limited, Kochi, India.

Estimation of Proximate composition

The moisture content was determined by hot air oven drying, protein by automatic Kjeldhal method, fat by Soxhlet extraction with petroleum ether and total ash by muffle furnace as described in AOAC (1990). The gross energy was found out by the equation; GE= (Protein x 0.24) + (Fat x 0.38) + (Carbohydrate x 0.17) according to Kienzle *et al.* (1998). The calcium and phosphorus was estimated using atomic absorption spectrophotometer (AOAC, 1990).

pH

The pH was determined using a combined electrode digital pH meter (µ pH system 362, Systronics, India) as per Troutt *et al*., 1992.

Determination of water activity

For determination of water activity the pet kibbles samples were crushed suitably and filled in the sample cup upto the mark. The filled sample cup was kept in the measurement chamber of Labswift a_w meter (Novasina, Switzerland). The readings were taken when the stable water activity was shown in the display.

Hunter Lab Colour ($L^*a^*b^*$)

Colour of the baked pet kibble sample was determined objectively as per Page *et al*. (2001) using Hunter Lab Mini Scan XE Plus Spectrophotometer (Hunter L*a*b* Virginia, USA) with diffuse illumination. The instrument was set to measure Hunter L^*, a^* and b^* using illuminant 45/0 and 10^o standard observer with an aperture size of 2.54 cm. It was calibrated using black and white calibration tiles before starting of the measurement and colorimeter score recorded with 'L' of black equals zero and 'L' of white equals 100, 'a' of lower numbers equals more green (less red), higher numbers equals more red (less green) and 'b' of lower numbers equals more blue (less yellow), higher numbers equals yellow (less blue). The colour coordinates L^* (lightness), a^* (redness) and b^* (yellowness) of the samples were measured thrice and mean values were taken.

Cooking Yield per cent

The weights of sample was recorded before (raw weight of dough) and after baking of pet kibbles. Per cent cooking yield was determined by calculating weight differences for sample before and after baking according to Berry and Wergin (1992).

$$\text{Product yield (\%)} = \frac{\text{Weight of final baked product X 100}}{\text{Weight of raw dough}}$$

Palatability/acceptability and Preference assessment

To evaluate the palatability of the pet kibbles, homogenous group of 20 adult dogs of the same breed and size were selected. The dog owners were explained about the nature of experiment without disclosing the identity of samples and were asked to rate their preference. The kibbles prepared in four different batches were used for replicating four different feeding trials. The palatability attributes for different levels of MCBM were studied with the help of a score card comprising of two parts. The first part contains the remarks of the dog owners and the second part with palatability attribute, which has been noticed during feeding time. All the attributes were classified as high, medium and low categories. Observations were made giving stress towards the approach to kibbles, interest to eat and nature of eating.

The preference of the kibble samples were evaluated based on intake ratio [A/(A+B)] (Griffin *et al*., 1984). Each dog were offered 180 gm of different kibble

samples 3-4 hour after the normal feeding in two separate bowls. The position of the feeding bowls was changed randomly to avoid bias on site preference. Forty different preference tests were performed. The dogs were allowed to feed for 15 min and during this time if one bowl was emptied or rejected, then the two bowls were removed and the leftovers of kibble were recorded.

Statistical analysis

The preparation of pet kibbles and proximate composition was repeated six times and the acceptability/palatability was studied using 20 dogs from a homogenous group over a period of 20 days per replication and the data were statistically analyzed as per Snedecor and Cochran (1994) and intake ratio was analysed using Wilcoxon Sign rank test according to Siegal (1956) by using SPSS software Version 21.0.

Results and Discussion

Physico-chemical properties and proximate composition

The physico-chemical characteristics of the developed pet kibbles *viz.* control C_1, treatments T_1 and T_2 are presented in Table 2. The treatment T_1 and T_2 had significantly higher protein and fat per cent resulting in higher calories per 100 g of product. The developed pet kibbles were in line with nutrient profile recommended by AAFCO (2007) for dogs and can be categorized as dry type pet food based on its moisture content as recommended by NRC (2006), and it agrees with the result reported by Rani *et al.* (2011) in shelf-stable pet food using meat cum bone meal and ghee residue. Gross energy in T_1 and T_2 were significantly ($p<0.05$) higher than control. This result supported the finding of Karthik *et al.* (2010), who reported that addition of spent hen meal increased energy value of spent hen meal based pet food.

Hunter Lab Colour ($L^*a^*b^*$)

The colour characteristics of the control and two test samples of pet kibbles were measured in terms of L* a* and b* values and the results were given in Table 3. The redness value was significantly ($p<0.05$) lower for T_1 and T_2 compare to C_1. However there was no significant difference noted for L* and b* values among the three types pet kibble samples. Which might be due to the higher moisture per cent in the treatment sample, which might have resulted in dilution of pigment concentration leading to reduction in redness colour.

Table 1. Formulation for the preparation of developed pet kibbles

Sl No	Ingredients	C_1 Quantity (%)	T_1 Quantity (%)	T_2 Quantity (%)
1	Cereals flour mix	33.0	33.0	33.0
2	Buffalo meat	25.0	25.0	25.0
3	Offal	20.0	20.0	20.0
4	Water	11.0	11.0	11.0
5	Black gram husk	4.0	4.0	4.0
6	Wheat bran	4.0	4.0	4.0
8	Bovine collagen peptide	1.0	1.0	1.0
9	Salt	0.5	0.5	0.5
10	Turmeric powder	0.5	0.5	0.5
11	BHT	0.05	0.05	0.05
12	Brewer's yeast	0.5	0.5	0.5
13	Potassium sorbate	0.2	0.2	0.2
14	MCBM	Nil	*20	*35

*MCBM was added over and above the control as formulation suggested by the experimental design for developed pet kibbles.

Palatability/acceptability

Different palatability attributes (owner and dog) of the kibbles *viz,* C_1, T_1 and T_2 are presented in Fig. 2. The results tabulated in per cent as high, medium and low aspects reveled that T_1 with 20 per cent MCBM scored highest in all attributes and predominantly in high aspects. The effects of various levels of MCBM in pet kibbles on intake ratio are presented in Fig. 3. The result showed that T_1 was most preferred by dogs among C_1, T_1 and T_2. Therefore treatment T_1 was selected as the optimum level of MCBM with higher intake by dogs. Similar result observed by Dust *et al.* (2005) that the physical attributes of the pet food were preferred by the pet owner and the palatability of the dog food was enhanced by the use of animal protein. But incorporation of MCBM at 35% level was less preferred, which may be due to loss of firm texture and intense odour developed on baking.

Fig. 1: Flow chart for the preparation of pet kibbles

Selection and weighing of ingredients (non meat ingredients)

↓

Beef and offal minced through 12mm plate ((MADO primus, Germany)

↓

Preparation of dough (ITALYA Mixer, India)

↓

Moulding (stainless steel molder)

↓

Baking (150^{0}C for 50 min.)

↓ ← Cooling under room temperature

Packaging (PE/Al/PA laminated pouches)

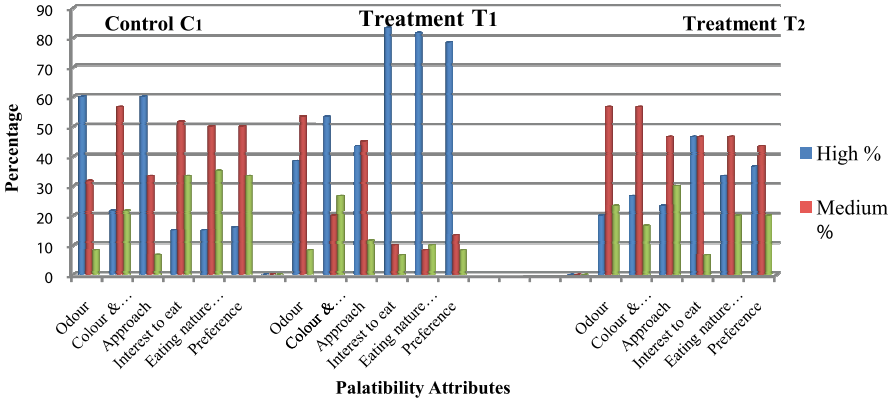

Fig. 2. Palatability attributes score of pet kibbles incorporated with different levels of MCBM on dog owners and dogs

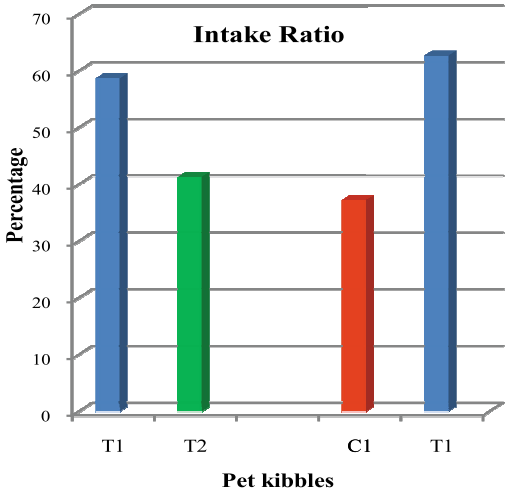

Fig. 3. Effect of different levels of MCBM on the intake ratio of the developed pet kibbles in dog

Table 2. Effect on the Physico-chemical characteristics and Proximate composition on addition of different levels of meat cum bone meal on developed pet kibbles

Parameters	C_1	T_1	T_2
pH	5.58±0.00	5.69±0.01	5.30±0.42
a_w	0.69±0.01	0.64±0.01	0.66±0.00
Yield (%)	57.16±0.27^a	65.02±0.54^b	69.71±0.25^c
Moisture (%)	9.77±0.16^a	10.92±0.38^b	10.71±0.33^b
Dry matter (%)	90.23±0.16^b	89.74±0.24^a	89.28±0.16^a
Crude protein (%)	17.09±0.53^a	22.04±0.52^b	23.94±0.54^c
Fat (%)	7.22±0.24^a	8.90±0.18^b	8.94±0.36^b
Crude fiber (%)	3.30±0.12	3.35±0.14	3.29±0.11
Total ash (%)	6.60±0.44	6.79±0.08	6.71±0.15
Calcium (%)	1.97±0.02	1.13±0.24	1.94±0.18
Phosphorus (%)	0.81±0.11	1.21±0.19	0.99±0.28
Carbohydrate (%)	58.77±0.95^b	51.77±0.73^a	50.29±1.03^a
NFE (%)	55.46±0.90^b	47.05±0.71^a	48.42±0.98^a
Gross energy (Kcal/100g)	1697±0.11^a	1757±0.06^b	1747±0.20^b

Mean ± SE with same superscripts in a row does not differ significantly (P<0.05)
C_1=Control 1 (0% MCBM) T_1=Treatment 1 (C_1 + 20% MCBM) T_2= Treatment 2 (C_1 + 35% MCBM)

Table 3. Effect on Colour (Hunter L*a*b*) on addition of different levels of meat cum bone meal on developed pet kibbles

Parameters	C_1	T_1	T_2
L* (lightness)	30.40±0.82	30.88±0.57	31.17±0.40
a* (redness)	7.24±0.30^b	5.27±0.21^a	5.06±0.15^a
b* (yellowness)	19.12±0.53	18.10±0.34	19.20±0.40

Mean ± SE with same superscripts in a row does not differ significantly (P<0.05)
C_1=Control 1 (0% MCBM) T_1=Treatment 1 (C_1 + 20% MCBM) T_2= Treatment 2 (C_1 + 35% MCBM)

From the study it can be inferred that, shelf stable dry type pet kibbles for dogs incorporated with MCBM at 20% level and offal could be prepared with good nutritive value and acceptable quality. Usage of animal byproducts in the preparation of pet kibbles will help in adding value to the product as well it would serve to overcome the major issue faced by the industries in the disposal of slaughter house byproducts.

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