

Economics of Production of Dog Biscuits Incorporated with Chicken Liver Powder and Dicalcium Phosphate

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Abstract

The cost of production of developed dog biscuits was calculated on the basis of cost of raw materials, depreciation in the equipment cost and overhead charges including wages. The total formulation cost was found to be Rs 3627/- (50 Kg dog biscuits) and the formulation cost of 30 % chicken liver powder incorporated product was calculated as Rs 6478/- per 50 Kg. The total overhead cost for the production of 50 Kg dog biscuits was calculated as Rs 2946/-. Total production cost including the formulation cost and overhead charges of control dog biscuits was found to be Rs 6573.00 and for chicken liver powder incorporated dog biscuits it was Rs 9424.00 per 50 Kg. The cost of production of control dog biscuits and for 30% chicken liver powder incorporated dog biscuits was found to be Rs.146.00 and 210.00 per kg respectively.

Keywords: Biscuits, Cost, Dog, Formulation, Liver Powder



Introduction

Dry pet foods such as biscuits are popular because of their convenience to feed, store, economical and having high nutrient density. The popular dog biscuits are small, hard, bone-shaped product that is coloured to reflect its flavour. Dog biscuits are usually used for training purposes and these may be used as regular food for pets. Dog biscuits can be given not only as treats but also as ways to make the dog healthier. To supply the high-quality proteins and other nutrients, the developed biscuits were incorporated with chicken liver powder at 30% level (Virk *et al.*, 2019). Meat and meat products are deficient of calcium (Caceres *et al.*, 2006), but in case of pet mineral requirement, calcium is required in the highest amount (Dobenecker, 2002), therefore the dog biscuits developed under the present study were fortified with dicalcium phosphate at 2% level.

As a result of their low- moisture content, the biscuits resist mold growth and bacterial spoilage, these can be stored for the longer time at ambient temperature. Development of shelf stable dog biscuit is very important in developing countries like India having tropical climate and the maintenance of cold chain for transportation and storage of meat and other perishable food products is very difficult (Kumar *et al.*, 2016). Meat and meat products are perishable items thus have poor shelf life, therefore the development of shelf stable meat products is the challenge (Malav *et al.*, 2017). Development of any technology can be identified as successful until it is used for the benefit of the society. Technology for pet foods such as dog biscuits depends not only on its taste, appearance, color, aroma etc., but also on its nutritive value and cost of production. Therefore, the economics including the cost of production of dog biscuits incorporated with chicken liver powder and dicalcium phosphate was worked out in the present study.

Materials and Methods

Source of Poultry By-Products

Poultry byproducts *i.e.* liver and gizzard required for the experiments were collected from the Instructional poultry Processing Plant of Department of Livestock Products Technology, College of Veterinary Science, Guru Angad Dev Veterinary and Animal Sciences University, Ludhiana, Punjab, India. After slaughtering of poultry birds, poultry liver were collected, cleaned and packed in LDPE bags and stored in freezer.

Other Ingredients

The refined soybean oil (Fortune, Adani Wilmar Ltd), refined wheat flour (Maida), Table salt (Tata chemicals Ltd., Mumbai, India), spice mix, chicken eggs, sugar, baking powder (Weikfield) and packaging material (LDPE and LDPE/polyester/polyethylene laminated plastic bags) were procured from local market of Ludhiana; Punjab.

Formulation of Control Dog Biscuits

Formulation and processing protocols of the dog biscuit was standardized on the basis of available literature and various preliminary trails conducted in laboratory. The standardized formulation is given in Table 1.

Table 1: Formulations of control dog biscuits

S. No.	Ingredients	Percentage (w/w)
1	Refined wheat flour (Maida)	55
2	Vegetable oil	20
3	Whole egg liquid	16
4	Spice mix	3
5	Sugar	3
6	Table salt	2
7	Baking powder	1

Preparation of Dog Biscuits

Poultry liver were collected from the healthy birds after their slaughter and thorough postmortem examination.

These were minced in the meat mincer (Mado Eskimo Mew-714, Mado, Germany). Minced poultry liver were air dried at 60 °C for 15-16 h. in industrial tray dryer. After drying, the by-products were converted into powder form with help of grinder separately. These were stored in PET jar for the subsequent use. For the preparation of dog biscuits, first of all, sugar powder was added in paddle mixer followed by vegetable oil and whole egg liquid. All other ingredients left were mixed. Ingredients were used according to formulation and mixed in paddle mixture and dough was prepared by mixing the ingredients. Mixing of dough is carried on until uniformity is achieved. Biscuits were made by filling dough in stainless steel mold of different shapes and cooking was carried out in hot air oven at temperature of 180⁰ C for 10 minutes. The liver powder was incorporated at 10%, 20% and 30% level after replacing the refined wheat flour in the formulation as presented in Table 2.

Table 2: Different level of liver powder and gizzard powder in treatment dog biscuits

Ingredients	Control	T ₁	T ₂	T ₃
Refined wheat flour	55	45	35	25
Liver powder	-	10	20	30

Where: T₁= 10% Liver powder; T₂=20% Liver powder; T₃=30% Liver powder

Economics

The economics of preparation of chicken liver powder incorporated dog biscuits is worked out with the following assumptions as given by Singh *et al.* (2016):

1. Per day production of chicken liver powder incorporated dog biscuits is 50 kg.
2. The unit remains in production for 25 days in a month therefore monthly production target of chicken liver powder incorporated dog biscuits is 50 x 25 = 1250 kg/ month.
3. Cost of ingredients is calculated on the basis of prevalent market rate (January to June, 2019) in the local market.
4. To estimate accurate cost of production of chicken liver powder incorporated dog biscuits under commercial conditions, the expenditure incurred in terms of recurring items, labor charges, water and electricity charges, depreciation on machineries, rent paid, capital investment and its interest was also taken under consideration.
5. Receipt is from the sale of chicken liver powder incorporated dog biscuits and not from by-product/recovery during processing of raw material. Hence, it can be an additional profit for entrepreneur.

Results and Discussion

The cost of production of dog biscuits was worked out taking the assumption that per day production of dog biscuits was 50 kg. To estimate accurate cost of production of dog biscuits under commercial conditions, the expenditure incurred in terms of recurring items, labour charges, water and electricity charges, depreciation on machineries, rent paid and maintenance cost was taken under consideration.

Formulation Cost

Raw materials are the basic ingredients in the manufacture of dog biscuits. The raw materials required for preparation of dog biscuits were refined wheat flour, table salt, spices mixture, powdered sugar, baking powder, vegetable oil and whole egg liquid. In addition, poultry liver powder and dicalcium phosphate were also utilized in present work. The retail prices for these ingredients are relatively stable in our marketing system. However, the cost of these ingredients can be lowered if purchased in bulk quantities from distributors/whole sale agents.

Table 3: Cost of formulation for dog biscuits

Ingredients	Rate	Control Dog Biscuit		Liver Powder Incorporated Dog Biscuit (30%)	
	Rs/kg	Qt. (Kg)	Amount (in Rs)	Qt. (Kg)	Amount (in Rs)
Poultry liver powder	200			15	3000
Baking powder	40	0.5	20	1	40
Spice mix	418	1.5	627	1	418
Refined oil	100	10	1000	10	1000
Salt	20	1	20	1	20
Refined wheat flour	40	27.5	1100	10.5	420
Sugar	40	1.5	60	1.5	60
Whole egg liquid	100	8	800	8	800
Dicalcium phosphate	360	--		2	720
Total (Rs)	--		3627	--	6478

Cost of Depreciation of Processing Equipment's

The essential equipment's and accessories required for preparation of dog biscuits and approximate cost of processing and other machineries required for the preparation of 50 kg dog biscuits.

Table 4: Cost of processing equipment's

Equipments	No. Required	Cost (in Rs)
Tray drier	1	1,00,000
Meat mincer	1	5,000
Paddle mixer	1	30,000
Refrigerator (500 L)	2	50,000
Cooking oven	1	50,000
Impulse sealer	2	6,000
Geyser(50 L)	1	25,000
Weighing balances	2	5,000
Deep freezer(360 L)	1	60,000
Furniture and utensils (steel table, knives, vessels etc.)	-	50,000
Total (Rs)		3,31,000.00

Depreciation rate = 10% per annum 331,000.00

i.e. = Rs 33100/annum

i.e. = Rs 91.6 ~Rs 92.00/day

Cost of Electricity

A processing plant requires electricity for the operation of various equipment's and adequate illumination of the working space. The electricity charges presently are approximately Rs 8/KWh under industry category use. The cost of electricity incurred for production of 50 kg of dog biscuits can be calculated.

Table 5: Cost of electricity

Equipment's	Watt × hr	KWh
Tray drier	1000 × 3	3
Meat mincer	1000 × 3	3
Paddle Mixer	500 x 3	1.5
Geyser	500 x 4	2
Refrigerator	150 × 2 × 20	6
Deep freezer	150 x 1 x 20	3
Lights, fans, weighing balance etc.	500 × 10	5
Cooking oven	1000 x 2	2
Total unit		25.5

Therefore, the cost of electricity = 25.50 KWh × Rs 8/ KWh = Rs 204 /day

Packaging Cost

Dog biscuits should be properly packaged in LDPE bags. About 2 kg LDPE bags, each with a capacity of holding 250 gm finished product was needed. 1 kg of printed LDPE bag is costing around Rs 200/kg. Thus, cost of packaging material was Rs 200/day. Cartons were also required for bulk packaging, storage, transportation and distribution so the additional cost of packaging was around Rs 100/day. So total packaging cost was Rs 300/day.

Labour Cost

The labour cost of skilled person and unskilled person is Rs 400/day and Rs 300/day respectively. For preparation of 50 kg dog biscuits, one skilled and two unskilled labours were required per day. So, the labour cost was calculated as-

Skilled staff = 400 × 1 = Rs 400 /day
 Unskilled staff = 300 × 2 = Rs 600 /day
 Total labour cost = Rs 1000 /day

Cost of Water

It is the most essential ingredient in food processing plant. For processing of 50 kg, around 500 litre of water was required.

Water charges (500 Lit.) = 500×0.10 = Rs 50

Premises Rent

Properly constructed building is the basic infrastructure required for processing plant. The rentals for the building in a peri urban area / locality which has sufficient space to hold the entire processing unit for setting up a small-scale meat processing unit with all facilities will be around Rs 30,000 per month. Therefore, rent per day was Rs 1,000 /day.

Maintenance Cost

The daily use materials like telephone, detergent, soap, sanitizer etc. that were required to maintain the equipments, building and premises hygienically were cost approximately Rs 300 per day. The total overhead cost for the production of 50 Kg dog biscuits was calculated as Rs 2946/-. Therefore, the total production cost of control and chicken liver incorporated dog biscuits was found to be Rs 6573.00 and Rs 9424.00 respectively including the formulation cost and overhead charges. The cooking yield of dog biscuits was around 90%, Therefore the cost of production of 1 Kg control and chicken liver incorporated dog biscuits was calculated as Rs 126 and Rs 209.42 (Rs 210) respectively.

Similarly, Singh *et al.* (2016) reported that the production cost of developed product was found to be Rs. 176.00 per kg for chicken meat cutlets (control) and Cost of production of fibre enriched chicken meat cutlets was Rs. 176/kg and Rs. 181/kg with carrot powder and broccoli powder respectively. Verma *et al.* (2015) also reported the cost of production of 1 kg of pork loaves (control) and inulin enriched pork loaves which was around Rs 178 and Rs 180/- respectively. Poodari *et al.* (2019) also calculated cost of production of 1 Kg 1 Kg functional chicken meat kachori incorporated with 4% inulin powder was Rs 229.48.

Total Expenditure

The sum of all the above costs (6.1 to 6.8) account for total cost for the production of 50 kg dog biscuits.

Table 6: Total expenditure for preparation of 50 kg dog biscuits

Parameter	Control	Liver incorporated dog biscuits (30%)
Raw materials cost	3627	6478
Cost of machineries (depreciation cost)	92	92
Cost of electricity	204	204
Packaging cost	300	300
Labour cost	1000	1000
Cost of water	50	50
Premises rent	1000	1000
Maintenance cost	300	300
Total expenditure	6573	9424

Product Yield

The product yield was around 90% for control and treatment.

Retail Cost of Dog Biscuits

Total expenditure for the preparation of 50 kg dog biscuits was Rs 6573.00 for control and Rs 9424.00 for treatment. The product yield (Kg) was 90 for control and treatment.

$$\text{Cost of 1kg product} = \frac{\text{Total expenditure}}{\text{Product yield}}$$

Therefore, the cost of 1 kg product was Rs 146.00 for control and Rs 209.42 for treatment.

Assuming Selling price of developed dog biscuits is Rs 300/Kg

Total income for 50 kg = Total sale price of 50 kg– Total cost of production of 50 kg

= Rs 15,000-10471= Rs. 4529 (for 50 kg)

Total Profit

=Total income - Commission to retailer Rs 2/ packet (50 Packs×2= Rs.100 /day)

Total Profit/day (Developed biscuit) =Rs.4529-Rs.100= Rs.4429 (for 50 packet-1kg each)

Total Profit /month (Developed biscuit) = Rs.4429 x 25= Rs.1,10,725

I. Variable cost = Rs.10471 x 25 = Rs.2,61,775

II. Fixed cost = Rs.3,31,000

Total project cost = Rs. 5,92,775.00

Say, loan amount of Rs 6,0,000.00 @ 12% interest per annum for 12 months term = Rs.6,00,000+Rs.72,000=Rs.6,72,000

Amount of loan repayment per month = Rs.6,72,000.00/12 =Rs.56000 /- (for 12 months only)

Net Profit/month= Rs1,10,725- Rs.56000 = Rs.54725

Break Even Point

$$\begin{aligned} \text{Break Even Point (sales in Rs.)} &= \frac{\text{Fixed Cost} \times \text{Selling price}}{\text{Total Sales} - \text{Variable Cost}} \\ &= \frac{3,31,000 \times 300}{15000 - 10471} \\ &= \text{Rs } 21,925/- \end{aligned}$$

Cost Benefit Ratio

$$\begin{aligned} \text{Cost Benefit Ratio} &= \frac{\text{Total profit}}{\text{Total Cost of Production}} \\ &= \frac{4429}{10471} \\ &= 0.42 \end{aligned}$$

Return on Investment (ROI)

$$\begin{aligned} \text{ROI} &= \frac{\text{Net profit per year}}{\text{Working Capital} + \text{Fixed Cost}} \\ &= \frac{54725 \times 12}{10471 \times 25 \times 12 + 33100} \\ &= 0.2068 \text{ or } 21\% \text{ for the first year} \end{aligned}$$

Conclusion

The cost of production of dog biscuits was calculated on the basis of raw material cost, the expenditure incurred in terms of recurring items, labour charges, water and electricity charges, depreciation on machineries, rent paid and maintenance cost. The total overhead cost for the production of 50 Kg dog biscuits was calculated as Rs 2946/-. The total production cost of control and chicken liver incorporated dog biscuits was found to be Rs 6573.00 and Rs 9424.00 per 50 Kg respectively including the formulation cost and overhead charges. The cost of production of per Kg control and chicken liver incorporated dog biscuits was calculated as Rs 126 and Rs 209.42 (Rs 210) respectively.

Conflict of Interests

There is no conflict of interest.

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