Journal of Animal Research: v.8 n.1, p. 47-55. February 2018

DOI: 10.30954/2277-940X.2018.00150.08

Fiber Enriched Egg Kofta Incorporated with Bottle Gourd and Its Economics of Production

Mehak Jandyal, Nitin Mehta*, Manish Kumar Chatli, Pavan Kumar and Om Prakash Malav

Department of Livestock Products Technology, College of Veterinary Science, Guru Angad Dev Veterinary Animal Sciences University, Ludhiana, Punjab, INDIA

**Corresponding author: N Mehta; Email: nmvets220@gmail.com*

Received: 01 Nov., 2017 **Revised:** 10 Dec., 2017 **Accepted:** 01 Jan., 2018

ABSTRACT

The purpose of this study was to develop egg kofta, a novel egg based product incorporated with fiber source to improve nutritional value together with high sensory acceptability and to study the cost economics of its production. Three different levels of boiled shredded bottle gourd as a source of fiber viz. 20% (T-1), 30% (T-2) and 40% (T-3) in mashed boiled egg were incorporated in order to increase the fiber content in the developed product and the optimum level was standardized based on physico-chemical, proximate, instrumental texture, color profile and sensory parameters. The textural attributes of the standardized product were comparable to that of the control. The scores for overall acceptability found to be highest for control and lowest for T-3 but scores for T-1 and T-2 were found comparable to control. Hence, 30% level of bottle gourd incorporation was found to be optimum. The cost of production of Egg kofta varied from ₹ 150, ₹ 135, ₹ 129 and ₹ 122 for control, T-1, T-2, T-3, respectively. Breakeven point and cost benefit ratio were found to be Rs. 121,864.84 and 50%, respectively.

Keywords: Egg kofta, bottle gourd, fiber, economics, proximate, sensory

A change in traditional food habits and induction of fast food culture has shifted the preference of consumer, the egg product not being an exception (Pandey and Yadav, 2010). There has been an increasing trend in consumption of egg and egg products that can be attributed to the health consciousness amongst people. The demand of novel egg based products with an improved nutritional value and better shelf life is increasing day by day. The high nutritional properties of eggs make them ideal diet for humans with special dietary requirements. They are also suitable for nutritional improvement of several kinds of foods by virtue of its four major nutritional components i.e. proteins, lipids, all necessary vitamins (except Vitamin C), and minerals. Eggs are classified among the rich protein foods together with milk, meat, poultry and fish and are also an excellent source of essential fatty acids. The high nutritional value, the low caloric content, blandness and the easy digestibility are the characteristics that make eggs ideal for young or old people, healthy or convalescent (Gutierrez *et al.,* 1997). The demand for various egg based processed products is on rise due to convenience, wide acceptability and cost effectiveness. To make a holistic diet, the egg products need to provide all essential nutrients but egg as such is completely devoid of fiber. With increasing consciousness among consumers about their nutrition and well being, there is a growing concern over nutritional diseases of affluence. Therefore an increase in dietary fiber inclusion in daily diet has been recommended. (Mehta *et al.,* 2015). Incorporation of fiber sources such as bottle gourd can help making up the nutritional quality of egg based product. Egg kofta is one of egg based products which can be enriched with fiber and has not been standardized and marketed so far. It has a potential of capturing the market owing to its novel concept. Keeping this as center point, the present study was undertaken to evaluate the effects of incorporation of

bottle gourd at 20%, 30% and 40% levels on physico-chemical, textural, color and organoleptic qualities of Egg kofta.

MATERIALS AND METHODS

Source of raw materials

Large sized chicken eggs (Grade A) were procured from University poultry farm, Department of Livestock Production Management, GADVASU, Ludhiana. Other ingredients used in formulation like salt and gram flour used were of food grade and procured from local market, Ludhiana. All the spice ingredients were procured from local market and were carefully cleaned and dried in hot air oven at 45±2ºC for 2 h. They were ground mechanically in a domestic grinder (Inalsa, Taureg Marketing Private Limited, Mumbai, India) and sieved through a fine mesh. The fine powder of different ingredients was mixed as per standard formulation and stored in moisture proof PET (polyethylene terephthalate) jars for subsequent use. Fresh bottle gourds (*Lagenaria siceraria*) were purchased from local market of Ludhiana. They were washed, peeled off, boiled, shredded and then used in the formulation. Condiment mix was developed in laboratory itself by mixing onion, ginger and garlic paste, respectively in 3:1:1 ratio and packed in LDPE bags and stored at -18±1ºC till further use.

Methodology for preparation of Fiber enriched Egg kofta

The formulation for processing Egg kofta is described in Table 1.

Table 1: Formulation of Fiber enriched Egg kofta using boiled shredded bottle gourd as a source of fiber

Ingredients %	Control	T-1	T-2	T-3
Whole egg boiled	80.5	60.5	50.5	40.5
Spices	2.5	2.5	2.5	2.5
Condiments	5.5	5.5	5.5	5.5
Gram flour (Besan)	10	10	10	10
Salt	1.5	1.5	1.5	1.5
Boiled shredded bottle gourd	—	20	30	40
Total (%)	**100**	**100**	**100**	**100**

Control = Egg kofta without boiled shredded bottle gourd. T-1 = Egg kofta with boiled shredded bottle gourd at 20% level; T-2 = Egg kofta boiled shredded bottle gourd at 30% level; T-3 = Egg kofta with boiled shredded bottle gourd at 40% level.

Three different levels of boiled shredded bottle gourd was incorporated at 20%, 30% and 40% replacing mashed boiled eggs in formulation along with control without any bottlegourd. Other ingredients were same in all treatments viz. salt (1.5%), dried spice mix (2.5%), condiments (5.5%) and gram flour (10%). Egg kofta was prepared by mixing of all the ingredients in the above mentioned proportion. The mix was manually moulded into a ball shape and was cooked in pre Heated hot air oven at 160ºC for 20 minutes, tempered at room temperature and evaluated after cooling, weighing and packing.

Analytical Techniques

pH

The pH of raw and cooked Egg Kofta was determined as per the method given by Trout *et al.* (1992) using digital pH meter equipped with a combined glass electrode. For this, 10 gram of sample was homogenized (S22 digital ultra turrax, Germany) with 50 ml of distilled water for 1 min using pestle and mortar. The pH meter (SAB 5000, LAB INDIA, Mumbai) was calibrated using standard buffer solution. The pH meter was dipped into the test sample suspension and the pH value of the sample was recorded.

Cooking Yield

The weight of raw and cooked Egg Kofta of each replicate was recorded before and after cooking and yield was expressed as percentage by using following formula:

$$\text{Cooking yield \%} = \frac{\text{Weight of cooked Egg kofta}}{\text{Weight of raw egg kofta}} \times 100$$

Proximate analysis

Moisture (oven drying), protein (Kjeldahl distillation), fat (Soxhlet method) and ash (muffle furnace) content of both control and treatments were determined by using standard procedure described by AOAC (1995).

Water Activity

Water activity (a_w) was determined using hand held portable digital water activity meter (Rotonix HYGRO Palm AW1 Set/40, Serial no. 60146499). Finely ground Egg kofta was filled up (80%) in a moisture free sample cup provided along with a_w meter. The sample cup was placed into the sample holder, and then sensor was placed on it for five min for getting a_w value. Duplicate reading was recorded for each sample.

Texture profile analysis

Texture profile analysis (TPA) was conducted using texture analyzer (TMS- PRO, Food Technology Corporation, USA). Sample size of 1.0 cm × 1.0 cm × 1.0 cm were cut from cooked Egg kofta and subjected to pre-test speed (30 mm/sec), posttest speed (100 mm/sec) to a double compression cycle with a load cell of 100 N. A compression platform was used as a probe. The Texture Profile Analysis was performed as per the procedure outlined by the Bourne (1978). Parameters like hardness, gumminess, stringiness, springiness, resilience, chewiness, and cohesiveness were calculated automatically by the preloaded software in the equipment from the force time plot.

Color Profile Analysis

Color profile was measured using Lovibond Tintometer (Lovibond RT-300, Reflectance Tintometer, United Kingdom) set at 2ºC of cool white light (D65) and known as *L*, a*, b** values. *L** value denotes brightness (100), or lightness (0), *a** (0+ redness/- greenness), *b** (+ yellowness/-blueness) values were recorded on Egg kofta sample. The instrument was calibrated using light trap (back hole) and white tile provided with the instrument. Then the above color parameters were selected. The instrument was directly put on the surface of 6 individual.

Sensory evaluation

The Egg koftas were cut into slices of 7 mm thickness and sensory evaluation was conducted using an eight point descriptive scale with slight modifications, where 8 = extremely desirable and 1 =extremely undesirable. A seven membered experienced panel consisting of scientists and postgraduate students of department evaluated the samples for various attributes viz. appearance and colour, flavor, texture, juiciness and overall acceptability.

Statistical Analysis

The data obtained from various trials was subjected to statistical analysis (Snedecor and Cochran, 1994) using completely randomized design and Duncan's multiple range test to compare the means by using SPSS-16 (SPSS Inc., Chicago, IL,USA). Each experiment was replicated thrice and the samples were analyzed in duplicate leading to total observation 6 (n = 6), whereas for sensory attributes n = 21. The statistical significance was expressed at 5% level of significance ($P<0.05$).

RESULTS AND DISCUSSION

Physicochemical Parameters and proximate composition

The effect of different levels of boiled shredded bottle gourd on physicochemical characteristics and proximate composition of egg kofta is depicted in Table 2.

Table 2: Effect of levels of incorporation of boiled shredded bottle gourd on the physico-chemical characteristics and proximate composition of Egg kofta (Mean± S.E.)

Parameters	Treatments			
	Control	T-1	T-2	T-3
pH	6.32 ± 0.12^{d}	6.23 ± 0.12^{c}	6.13 ± 0.06^{b}	5.85 ± 0.02^{a}
Water activity	0.84 ± 0.03^{a}	0.89 ± 0.01^{a}	0.92 ± 0.02^{b}	0.95 ± 0.01^{c}
Cooking yield	90.73 ± 0.23^{d}	89.18 ± 0.40^{c}	87.22 ± 0.25^{b}	85.27 ± 0.23^{a}
Moisture%	55.82 ± 0.10^{a}	56.35 ± 0.07^{b}	58.40 ± 0.09^{c}	59.73 ± 0.27^{d}
Fat %	11.14 ± 0.21^{d}	10.39 ± 0.25^{c}	9.59 ± 0.37^{b}	8.85 ± 0.28^{a}
Protein%	15.00 ± 0.19^{d}	12.65 ± 0.20^{c}	11.19 ± 0.21^{b}	9.73 ± 0.20^{a}
Ash %	0.84 ± 0.05^{a}	1.04 ± 0.05^{b}	1.29 ± 0.02^{c}	1.59 ± 0.09^{d}
Crude fiber %	0.64 ± 0.11^{a}	1.06 ± 0.03^{b}	1.54 ± 0.04^{c}	1.82 ± 0.08^{d}

n=6, Control; T-1: 20%; T-2: 30%; T-3: 40% boiled shredded bottle gourd; *Mean ±S.E with different superscripts row wise (a-d) differ significantly ($P< 0.05$).

The mean pH of freshly prepared egg kofta showed a decreasing trend with increasing level of incorporation of bottle gourd and was measured lowest in T-3. This might be due to lower pH of bottle gourd (4.6) as compared to an egg (7.6) (Stadelman and Coterill, 1995). Similar trend has been reported by Verma *et al.* (2013) and Zargar *et al.* (2014) in chicken sausages incorporated with guava powder and pumpkin, respectively. A significant ($p<0.05$) increase in water activity of the treatments as compared to the control was observed and it was found highest in the T-3 which can be attributed to higher moisture content in bottle gourd. Similar findings have been observed by Das *et al.* (2013) and Zargar *et al.* (2014). Cooking yield of treatments showed a decreasing ($p<0.05$) trend with increasing levels of bottle gourd. This could be due to comparatively lesser binding ability of the bottle gourd than the egg in the product leading to an increased loss during cooking. It was measured lowest in the T-3 as compared to the control. Similar decrease in cooking yield was also reported by Verma *et al.* (2013) in sheep meat nuggets on incorporation of guava powder. A significantly higher moisture percentage in treated product than control, irrespective of level of incorporation of boiled shredded bottle gourd was observed and it was measured highest in T-3 and lowest in control. This might be due to presence of high moisture in the boiled bottle gourd itself and can be correlated with an increased water activity in the treatments. The findings were in agreement with Malav *et al.* (2016). Fat content also showed a decreasing trend with increased level of incorporation of boiled bottle gourd in all the treatments. The results are in consonance with Banerjee *et al.* (2015) who observed as significant ($P< 0.05$) decrease in fat content of meat balls with addition of cauliflower powder. The crude protein content of egg kofta decreased significantly ($P < 0.05$) with the replacement of egg with the boiled shredded bottle gourd and it was measured lowest in the T-3 and highest in the control. The probable reasons for the decreased protein content may be due to the replacement of boiled egg which is rich in protein with boiled bottle gourd that has comparatively lesser protein content than egg (Majumdar *et al.,* 2011). This result is in consonance with (Mehta *et al.,* 2013) who observed a decrease in protein content of chicken meat patties incorporated with psyllium husk. Crude fiber content followed an increasing trend ($P < 0.05$) with increase in incorporation level of boiled shredded bottle gourd in the formulation and it was measured lowest in control and highest in T-3. This increase in crude fiber could be possibly due to the higher fiber content in bottle gourd. Verma *et al.* (2010) observed similar increase in the crude fiber in low fat chicken nuggets incorporating apple pulp.

Instrumental Texture, colour and sensory Profile Analysis

The mean values for the instrumental texture profile of egg kofta with different levels of incorporation of bottle gourd has been presented in Table 3. Texture profile analysis exhibited decrease in value of hardness with increase in level of incorporation of boiled bottle gourd but a significant ($P < 0.05$) effect was observed only in T-3 and hardness value in T-1 and T-2 were comparable to control. This could be due to poor binding ability of boiled shredded bottle gourd. There was significant decrease ($P < 0.05$) in gumminess and chewiness values with the addition of increase level of bottle gourd in the product. Gumminess and chewiness values are secondary parameters; they were affected in a similar fashion as that of primary parameters i.e, hardness and cohesiveness. However cohesiveness was not affected with incorporation of bottle gourd in the treatment. A decrease in hardness value in low-fat, high dietary frankfurters with the increasing concentration of peach dietary suspension was also reported by Grigelmo -Miguel *et al.* (1999). A progressive decrease in shear force value with increasing level of orange pulp in functional mutton patties and low-fat chicken nuggets has been reported by Malav *et al.* (2016) and Verma *et al.* (2010). Springiness was found to be higher ($P<0.05$) in control as compared to treatments. Choi *et al.* (2010) studied the effects of rice bran on the textural properties of heat induced gels and found that hardness, springiness, cohesiveness, gumminess and chewiness were lower in all samples with added rice bran when compared to controls. Resilience was found to be decreased significantly ($p<0.05$) amongst the treatments.

The mean values for the instrumental color profile have been presented in Table 3. The value for lightness L* (lightness) was found to be comparable amongst control and all the treatments. The redness (a*) value of fiber enriched egg kofta decreased ($P<0.05$) with the higher levels of bottle gourd incorporation (Fig. 2). It might be due to dilution in color leading to a decrease in the

redness value. Similar findings have been reported by Yilmaz (2005) in meatball with wheat bran addition. The mean yellowness (*b**) value was recorded significantly (P<0.05) higher for control and lowest for T-3. The mean sensory score for appearance and color scores decreased significantly (p <0.05) with increase in incorporation of boiled shredded bottle gourd, being highest in control and lowest in T-3 (Table 3; Fig. 3).

Table 3: Effect of boiled shredded Bottle gourd on Instrumental Textural, colour Parameters and sensory profile of Egg kofta (Mean ±S.E)*

Parameters	Treatments			
	Control	T-1	T-2	T-3
Instrumental Texture Profile				
Hardness(N)	11.07 ± 0.16^{b}	10.79 ± 0.11^{b}	10.75 ± 0.19^{b}	9.82 ± 0.10^{a}
Springiness (mm)	14.78 ± 0.19^{a}	13.69 ± 0.095^{b}	11.78 ± 0.01^{c}	10.79 ± 0.17^{d}
Stringiness (mm)	15.47 ± 0.09^{a}	15.70 ± 0.02^{b}	16.13 ± 0.02^{c}	17.31 ± .057^{d}
Cohesiveness	0.36 ± 0.03	0.37 ± 0.02	0.34 ± 0.03	0.36 ± 0.10
Gumminess(N)	4.23 ± 0.095^{d}	3.99 ± 0.07^{c}	3.58 ± 0.06^{b}	3.35 ± 0.05^{a}
Chewiness(J)	61.06 ± 0.10^{d}	58.14 ± 0.21^{c}	51.13 ± 0.17^{b}	40.48 ± 0.17^{a}
Resilience	2.69 ± 0.08^{d}	2.51 ± 0.02^{c}	2.33 ± .03^{b}	2.17 ± 0.08^{a}
Instrumental Colour Profile				
L (Lightness)	38.19 ± 0.43	38.42 ± 0.42	38.52 ± 0.51	38.69 ± 0.42
*a** (Redness)	10.63 ± 0.08^{d}	10.21 ± 0.06^{c}	10.05 ± 0.09^{b}	9.38 ± 0.12^{a}
*b** (Yellowness)	29.21 ± 0.36^{c}	27.34 ± 0.42^{b}	26.61 ± 0.53^{a}	26.07 ± 0.74^{a}
Sensory Profile				
Appearance/ Color	6.67 ± 0.07^{c}	6.5 ± 0.06^{b}	6.45 ± 0.04^{b}	6.35 ± 0.07^{a}
Flavour	6.47 ± 0.05^{a}	6.61 ± 0.06^{b}	6.83 ± 0.05^{d}	6.70 ± 0.06^{c}
Texture	6.9 ± 0.04^{c}	6.72 ± 0.12^{b}	6.60 ± 0.13^{b}	6.44 ± 0.07^{a}
Juiciness	6.8 ± 0.05^{d}	6.68 ± 0.07^{c}	6.60 ± 0.06^{b}	6.51 ± 0.05^{a}
Overall Acceptability	6.8 ± 0.05^{d}	6.74 ± 0.05^{c}	6.70 ± 0.07^{b}	6.58 ± 0.06^{a}

n=18 for Instrumental colour and texture profile; n= 21 for sensory analysis; Control; T-1: 20%; T-2: 30%; T-3: 40% boiled shredded bottle gourd; *Mean ±S.E. with different superscripts row-wise (a-d) differ significantly (P< 0.05).

This could be correlated with a decreasing redness value in color profile. Mean flavor scores showed a significant (P<0.05) increase up to T-2 whereas a decrease in flavor scores was observed in T-3. This could be due to fact that sensory panelists might have rated the product high with blend of egg and bottle gourd flavor but as the level of incorporation of bottle gourd increased, vegetable flavor might have dominated and diluted the egg flavor intensity. So, the panelists rated T-2 better amongst all treatment and control. The scores for texture and binding showed a significant (P<0.05) decline with increasing level of incorporation and can be correlated with texture profile analysis. Similar findings have been reported by Mehta *et al.* (2013) in chicken meat rolls and patties incorporated with black gram hull and psyllium husk. The scores for overall acceptability found to be highest for control and lowest for T-3 but scores for T-1 and T-2 were found comparable to control.

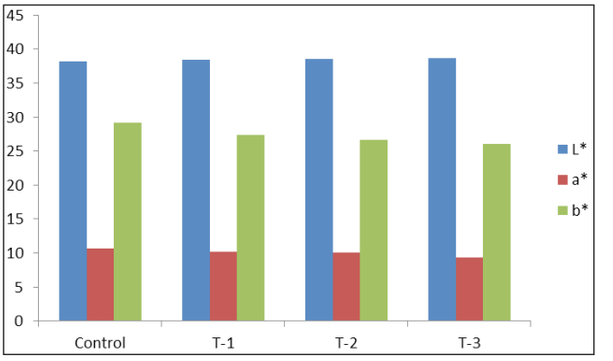

Fig. 1: Effect of boiled shredded bottle gourd on color profile of Egg Kofta

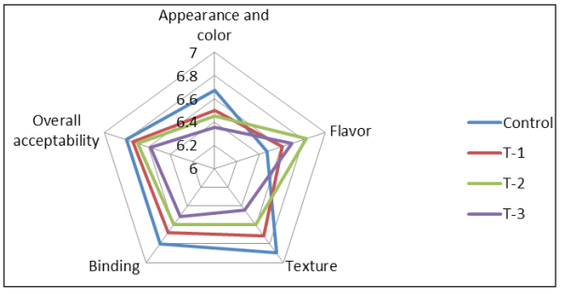

Fig. 2: Effect of boiled shredded bottle gourd on sensory attributes of Egg kofta

Hence, on the basis of compositional textural and sensory attributed 30% level of bottle gourd (T-2) incorporation was to be optimum for development of fiber enriched egg kofta.

Cost Economics for production of Egg Kofta

Development of fiber enriched egg kofta can said to be successful only when it will provide better nutrition with low cost of production. So, it is necessary to compute cost of production of any developed product in order to make the project competitive and compatible.

Calculation of economics of production:

The economics was worked out with the following technical assumptions as per Singh *et al.* (2016):

1. Per day production of egg kofta is 100 kg.
2. The unit remains in production for 25 day in a month therefore monthly production target of egg kofta is 100 × 25 = 2500 kg/ month.
3. Cost of ingredients is calculated on the basis of current market rate in the local market.
4. To estimate accurate cost of production of egg kofta under commercial conditions, the all the expenditure incurred in terms of recurring items, labor charges, water and electricity charges, depreciation on machineries, rent paid, capital investment and its interest, had to be taken into consideration.
5. Receipt is from the sale of egg kofta and not from by-product.
6. Disposal of finished product is cent percent and handling and other charges are nil.

Table 4: Cost of production of condiment mix

Name of the ingredient	Condiment mix		
	Quantity (g)	Rate (₹/Kg)	Approx Cost (₹)
Garlic	200.00	40.00	8.00
Ginger	200.00	120.00	24.00
Onion	600.00	20.00	12.00
Total	1000.00		₹ 44.00/-

Price of eggs = ₹. 383/100 kg

The cost of formulation of control as well as all the three treatments was calculated individually on basis of ingredients used and is listed in Table 5. The cost of formulation of 100 kg control egg kofta was ₹ 11,314.5, whereas for T-1, T-2 and T-3 it was ₹ 9714.5, ₹ 8914 and ₹ 8114.5, respectively. The difference in price is mainly due to replacement of boiled mashed egg with fairly economical bottle gourd. The production cost of 100 kg egg kofta was computed separately for control and all the treatments by adding formulation cost and overhead cost. The total project cost was estimated on basis of summation of fixed and variable cost and was found to be ₹ 348,800 and net profit per month was found to be ₹ 102,667.

Overhead production cost for 100 Kg Egg Kofta

(a) Labour charges

Unskilled worker (5-daily paid labourers) (₹220.00/day × 6) = ₹1320/-

Table 5: Cost formulations for 100 Kg Egg kofta

Ingredients	Rate ₹/Kg	Control		Boiled shredded bottlegourd (20%)		Boiled shredded bottlegourd (30%)		Boiled shredded bottlegourd (40%)	
		Qt (Kg)	₹	Qt (Kg)	₹	Qt (Kg)	₹	Qt (Kg)	₹
Whole boiled egg	110	80.5	8855.00	60.5	6655.00	50.5	5555.00	40.5	4455.00
Condiment mix (3:1:1)	44.00	5.5	242.00	5.5	242.00	5.5	242.00	5.5	242.00
Spice mix	418.00	2.5	1045.00	2.5	1045.00	2.5	1045.00	2.5	1045.00
Bottlegourd	30.00	—	—	20.00	600.00	30.00	900.00	40	1200.00
Salt	15.00	1.50	22.50	1.50	22.50	1.50	22.50	1.50	22.50
Binder (Gram flour)	115.00	10.00	1150.00	10.00	1150.00	10.00	1150.00	10.00	1150.00
Total (₹)		**—**	**11,314.5**		**9714.5**		**8914**		**8114.5**

Table 6: Electricity charges incurred in operation

Equipment	Watt × hrs	KWH Unit
Refrigerator (2Nos.)	2 ×200 × 24	9.60
Hot air oven (2Nos.)	2000 × 8.00	16.000
Packaging machine	100 × 2.0	0.200
Light, fan etc.	400 × 10	4.00
Total		**29.80**

(b) Electricity charge (₹ 6/Unit) (29.80 × ₹ 6.0) = ₹178.80/-

Table 7: Equipment depreciation

Equipment	Cost (₹)
Deep Freezer	30000.00
Hot air oven	16000.00
Blender	3000.00
Sealing machine	5000.00
Karahi, stainless steel tables, knives, utensils, furniture, gas stove etc.	15000.00
Total	**69000.00/-**

Depreciation @10% per annum = ₹ 6900.00/-

(c) Depreciation cost per day = ₹ 18.90/-

(d) Water charges (1000 lit) = ₹ 30.00/day

(e) Gas charges = ₹ 200.00/day

(f) Cost of packaging material (pack 250g each) (8"×6" LDPE Pouches @ ₹ 0.4/pouch) (400 × 0.40) = ₹ 160.00

(g) Room rent (₹ 3000/ month) = ₹ 120.00 per day

(h) Miscellaneous (Detergent, transportation etc) = ₹ 250.00 per day

B. Total overhead cost (a+ b+ c+ d+ e+ f +g +h) = ₹ **2277.70/** (≈ ₹ **2278/-)**

Table 8: Production cost (₹) of 100 kg Egg Kofta

Total cost of production obtained from 100 Kg formulation	Formulation cost (A) + overhead production cost (B)
Total cost of production of Egg Kofta (control)	11314+2278 = 13,592/-
Total cost of production of Egg kofta (with 20% Boiled shredded bottle gourd)	9714+2278 = 11992/-
Total cost of production of Egg kofta (with 30% boiled shredded bottle gourd)	8914+2278 = 11,192/-
Total cost of production of Egg kofta (with 40% boiled shredded bottle gourd)	8114+2278 = 10,392/-

Table 9: Production cost of 1Kg Egg Kofta

Egg kofta	Total yield of Production (kg)	Production cost of 1 kg	Total income (₹)
Egg Kofta control (13,592/90.73)	= 90.73 Kg	= 149.80 /- (≈ ₹ 150/-)	50.20
Egg Kofta (with 20 % Boiled) (11992/89.18)	= 89.18 Kg	= ₹ 134.46 /- (≈ ₹ 135 /-)	65.54
Egg Kofta (with 30% Boiled shredded bottle gourd) (11,192/87.22)	= 87.22Kg	= ₹ 128.31 /- (≈ ₹129 /-)	71.69
Egg Kofta (with 40% Boiled shredded bottle gourd) (10392/85.27)	= 85.27Kg	= ₹ 121.87 /- (≈ ₹122 /-)	78.13

Total income = total sale – total production cost

Total profit

Total income – Commission to retailer ₹ 2/Packet (400 Packs × 2 = ₹ 800/day)

Total profit/day = 6400 – 800 = ₹ 5600

Total profit/Month = 5600 × 25= ₹ 140000.00

I. Variable cost = 11,192 × 25 = ₹ 279,800

II. Fixed Cost = ₹ 69000.00

Total project cost = 348,800

Say, loan amount of ₹ 400000.00@ 12 % interest per annum for 12 months term = ₹ 448000.00

Amount of loan repayment per month = ₹ 448000.00/12 = ₹ 37,333.00

(For 12 months only)

Net profit/month = ₹ 140000 – 37,333 = ₹ 102,667

Break Even Point

$$\text{Break Even Point (₹ sales)} = \frac{\text{Fixed Cost} \times \text{Total Sales}}{\text{Total sales} - \text{Variable cost}}$$

₹ 69000 × 25800

25800 – 11,192

= ₹ 121,864.73

Cost benefit ratio

Break Even Point (₹ sales) =

$$\frac{\text{Total profit}}{\text{Total cost of production}}$$

5600

11,192

= 0.50 or 50%

CONCLUSION

For the development of fiber enriched egg koftas, 30% incorporation level of boiled shredded bottle gourd was found to be most suitable on the basis of physico chemical, proximate, textural, color and sensory properties. Cost computation of the developed product reveals that a variation in cost of control and all the three treatments was there mainly because of difference in formulation. The cost of production of Egg Kofta varied as (≈ ₹ 150/-), (≈ ₹135 /-), (≈ ₹129 /-) and (≈ ₹ 122 /-) for control, T-1, T-2 and T-3, respectively. Hence, it can be revealed from the above observations and discussions that utilization of whole boiled egg for the development of egg kofta can be successful enterprise. It can be utilized as an alternative to provide a good source of fiber at very low cost for the masses, which can provide the society nutritional security and employment opportunities.

REFERENCES

AOAC. 1995. *Official methods of analysis* (16th edition). Association of Official Analytical.

Banerjee, R., Verma, A.K. and Narkhede, H.P. 2015. Cauliflower powder in pork meatballs: effects on quality characteristics and oxidative stability. *Fleischwirtschaft Int*., **1:** 97-102.

Das, A., Nath, D. R., Kumari, S and Saha, R. 2013. Effect of fermented bamboo shoot on the quality and shelf life of nuggets prepared from desi spent hen. *Vet. World*., **6**(7): 419-423.

Gutierrez, M. A., Takahashi, H and Junaja, L. R. 1997. Nutritive evaluation of hen eggs, In: Yamamotot, T., Juneja, L .R., Hatta, A. H and Kim, M (Eds), *Hen Eggs: Their Basic and Applied Science*, CRC Press, Boca Raton, FL. 25-33.

Grigelmo-Miguel, N., Abadías-Serós, M.I. and Martín-Belloso, O. 1999. Characterisation of low-fat high-dietary fibre frankfurters. *Meat Sci*., **52**(3): 247-256.

Mehta, N., Ahlawat, S.S., Sharma, D.P. and Dabur, R.S. 2015. Novel trends in development of dietary fiber rich meat products—a critical review. *J. Food Sci. Technol*., **52**(2): 633-647.

Mehta, N., Ahlawat, S.S., Sharma, D.P., Yadav, S. and Arora, D. 2013. Organoleptic Quality of Chicken Meat Rolls and Patties Added with the Combination Levels of Black Gram Hull and Psyllium Husk. *J. Anim. Res.*, **3**(2): 237-243.

Majumdar, T.K., Wadikar, D.D., Vasudish, C.R., Premavalli, K.S. and Bawa, A.S. 2011. Effect of storage on physico-chemical, microbiological and sensory quality of bottlegourd-basil leaves juice. *Am. J. Food Technol*., **6**(3): 226-234.

Malav, O.P., Sharma, B.D., Kumar, R.R., Talukder, S., Ahmed, S.R. and Irshad, A. 2016. Quality characteristics and storage stability of functional mutton patties incorporated with red kidney bean powder. *Indian J. Small Rumin*., **22***(*1): 83-91.

Pandey, N. K and Yadav, A. S. 2010. Development and shelf life of egg waffles as influenced by packing and storage. *Indian J. Poult. Sci*., **45**: 326–29.

Singh, V., Mehta, N., Chatli, M.K., Kumar, P. and Malav, O.P. 2016. Development of egg cutlets from whole egg liquid incorporated with mashed potato as binder and its economics of production. *J. Anim. Res*., **6(4):** 619-628.

Snedecor, G.W. and Cochran, W. G. 1994. Statistical Methods, 8th Edn. IOWA State University Press, Ames, IOWA.

Stadelman W.J. and Coterill J.O. 1995. Egg Science and Technology, CRC Press, AVI Publishing Company, Inc, Wetsport, Connecticut, 4th ed., pp. 38-41.

Trout, E. S., Hunt, M. C., Johson, D. E., Clans, J. R., Castner, C. L and Kroff, D. H. 1992. Characteristics of low fat ground beef containing texture modifying ingredients. *J. Food Sci.,* **57**: 19-24.

Verma, A. K., Sharma, B. D and Banerjee, R. 2010. Effect of sodium chloride replacement and apple pulp inclusion on the physico-chemical, textural and sensory properties of low fat chicken nuggets. *LWT-Food Sci. Technol.,* **43**(4): 715–719.

Verma, A.K., Rajkumar, V., Banerjee, R., Biswas, S., and Das, A.K. 2013. Guava (*Psidium guajava* L.) powder

as an antioxidant dietary fiber in sheep meat nuggets. *Asian Australas. J. Anim. Sci*., **26**(6): 886–895.

Yılmaz, I. 2005. Physicochemical and sensory characteristics of low fat meatballs with added wheat bran. *J. Food Eng.,* **69**(3): 369-373.

Zargar, F. A., Kumar, S., Bhat, Z. F., and Kumar P. 2014. Effect of pumpkin on the quality characteristics and storage quality of aerobically packaged chicken sausages. *Springer Plus.,* **3(1)**: 1.