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Development of Egg Cutlets from Whole Egg Liquid Incorporated with Mashed Potato as Binder and its Economics of Production

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ABSTRACT

The present study was envisaged to develop egg cutlets from whole egg liquid as a novel food concept. To enhance the binding and quality characteristics of egg cutlets, mashed potato was incorporated at three different levels viz. 10% (T1), 15% (T2) and 20% (T3). The optimized formulations was mixed uniformly so that no clumps were formed, followed by preparation of egg cutlets of uniform size. The products were cooked in pre-heated oven at 155˚C for 15 min followed by deep frying. The developed cutlets were evaluated for various parameters such as physico-chemical, proximate, instrumental texture and colour profile, and sensory attributes. The moisture, fat and cooking yield increased significantly ($P<0.05$) with the increasing levels of mashed potato in batter. Textural attributes improved significantly ($P<0.05$) upon incorporation of mashed potato. The overall acceptability scores of the egg cutlet with 20% mashed potato was significantly ($P<0.05$) higher than control and other treatment products. On cost analysis, the cost of production of Egg Cutlets varied as ₹ 152, ₹ 137, ₹ 130 and ₹ 123 for control, T1, T2 and T3 respectively. Break Even Point (₹), Cost benefit ratio and Return on investment (%) were found to be ₹ 131,017.84, 0.56 and 46.00, respectively

Keywords: Egg cutlets, mashed potato, whole egg liquid, proximate, sensory

Eggs have been valuable foodstuffs since prehistory. Statistics have shown that 1,165 billion eggs are consumed annually (FAO, 2010). They supply all essential amino acids for humans, a complete source of protein and provide several vitamins and minerals for the development of human body (FAO, 2010). These are nutritious, inexpensive meat substitute, low in calories and can be used in a wide variety of recipes. India has one of the world's largest and fastest growing poultry industries, ranking third in egg production and sixth in broiler meat production (DAHDF, 2010). With the induction of fast food culture and change in traditional food habits, the consumer preference is continuously shifting, the egg product sector not being an exception (Mehta *et al.,* 2015; Pandey and Yadav, 2011). There has been an increasing trend in consumption of egg and egg products. Egg products sector has tremendous growth potential in India though at present, the insistence is on consumption of raw and boiled eggs only. Formulation of convenience egg products for Indian market is a relatively new development (Pandey and Yadav, 2011). Along with changes in egg processing technology, there has been a continuous growth of further processed egg products. In fact, today when the fast food culture is on its peak approximately 30% of total egg is in form of processed products (Froning, 2008). Its demand is expected to grow in near future because of popularity, preference and cost effectiveness. Eggs are generally consumed as egg *pakoda*, omelet, *burji*, boiled eggs, egg curry and in various other forms in India (Modi *et al.,* 2008). Processing of egg products in various forms of fast foods will promote the better utilization of egg which will not only increase the popularity among egg lovers but it will also help in overcoming the fluctuations in seasonal prices of eggs. Cutlets are one of the most common snack product widely consumed in Northern part of India. However, Egg cutlets from the whole raw

whole egg liquid (WEL) have not been developed so far. It is a novel food concept with potential market. The major problem encountered in development of egg cutlets using WEL is poor texture, which can be overcome by utilizing various binders. Keeping these points in view, the present study was undertaken to develop WEL egg cutlets with incorporation of potato as binder at 10%, 15% and 20% levels on physico-chemical, texture, colour and organoleptic qualities of egg cutlet.

MATERIALS AND METHODS

Source of materials

The large sized chicken eggs (Grade A) were procured from university poultry farm, Department of Livestock Production Management, GADVASU, Ludhiana. All the spice ingredients were procured from local market, Ludhiana, Punjab. Thereafter, these were carefully cleaned and dried in hot air oven at 45±2ºC for 2 h. The ingredients were ground mechanically in a domestic grinder (Inalsa, India) and sieved through a fine mesh. The fine powder of different ingredients was mixed as per formulation already standardized in department and stored in moisture proof PET (polyethylene terephthalate) jars for subsequent use. Fresh ginger, onion and garlic were purchased from local super market. It was peeled, washed, and minced in a grinder (Inalsa, India) in the form of uniform paste. The condiment mix was prepared 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. Fresh Potato (*Solanum tuberosum*) was purchased from local market and were washed, boiled and then pulverized in domestic grinder (Inalsa, India) and stored in a moisture free PET jar separately till further use. Bread crumbs were prepared by drying the market bread in a preheated oven at 70±2ºC for 2 h, followed by grinding in a domestic grinder (Inalsa, India). Bread crumbs were also stored under room temperature in a moisture proof PET jars till further use.

Methodology of Preparation of egg cutlets from whole egg liquid

The formulation for the development of Egg Cutlets has been mentioned in Table 1. Boiled and mashed potato at three different levels viz. 10% (T1), 15% (T2) and 20% (T3) was added in formulation replacing whole egg liquid. Four batches (one control and three treatments) of batter were prepared by mixing all the ingredients. The batter was moulded into the shape of cutlets using a mould of dimensions 59 × 40 × 18 mm. It was cooked in pre Heated hot air oven at 160ºC for 15 min with turning once after ten minutes, and then cooled. The moulded cutlets were dipped in egg albumin and were enrobed with bread crumbs. The breaded cutlets were deep fried to golden brown and were turned repeatedly to avoid charring. The fried cutlets were cooled, weighed and packed for further analysis.

Table 1: Formulation for preparation of egg cutlets from whole egg liquid

Ingredients %	Control	T-1	T-2	T-3
Whole egg liquid	70	60	55	50
Spices	2	2	2	2
Condiments	12	12	12	12
RWF (Maida)	12	12	12	12
TSPP	2.5	2.5	2.5	2.5
Salt	1.5	1.5	1.5	1.5
Boiled Potato	—	10	15	20
Total (%)	100	100	100	100

Physico-chemical analysis

The pH of raw and cooked egg cutlets was determined as per the method given by Trout *et al.* (1992) using digital pH meter (Model LI 127, Elico Limited Hyderabad, India) equipped with a combined glass electrode. Cooking yield was determined by measuring the difference in the sample weight before and after cooking (Murphy *et al.*, 1975).

$$\text{Cooking yield \%} = \frac{\text{Wt. of cooked Egg cutlets}}{\text{Wt. of Raw Egg Cutlets}} \times 100$$

Water activity (a_w) was determined using potable digital water activity meter (Rotronix Instrument Ltd., West Sussex, UK). Briefly, finely ground Egg Cutlets were filled up (80%) in a moisture free sample cup. The sample cup was placed into the sample holder, and then sensor was placed on it for five min for a_w value.

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 (2000).

Texture profile analysis

Texture profile analysis of egg cutlets was performed using a Texture Analyser (TMS-PRO, Food Technology Corporation, Maries Road, Suite 120 Sterling, VA, USA) following the procedures of Bourne (1978). The samples were cut into uniform cube size of 1.0×1.0×1.0 cm. and subjected to double compression cycle to 50% of their original height using pre-test speed of 5 mm/s, test speed of 1 mm/s, post-test speed of 1 mm/s, distance 10 mm and exposure time 3s. Texture profile parameters such as hardness, adhesiveness, cohesiveness, springiness chewiness and gumminess were estimated using software (TMS-Pro, USA).

Colour profile analysis

Colour profile was measured using Lovibond Tintometer (Model: RT-300, The Tintometer Limited, Amesbury, UK) set at 2° of cool white light (D65) and known as '*L*', *a**, and *b** values. '*L*' value denotes brightness (100) or lightness (0), *a** (+redness/–greenness) and *b** (+yellowness/–blueness) values. The instrument was calibrated using a light trap (black hole) and white tile provided with the instrument. Then the above colour parameters were selected. The instrument was directly put on the surface of egg cutlets at different points.

Sensory evaluation

The Egg Cutlets were cut into slices of 7 mm thickness and sensory evaluation was conducted using an eight point descriptive scale (Keeton, 1983) 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 under each experiment was subjected to statistical analysis (Snedecor and Cochran, 1994) for one way Analysis of Variance 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 (n = 6), whereas for sensory attributes it was n = 21. The statistical significance was expressed at 5% level.

RESULTS AND DISCUSSION

Physicochemical Parameters and proximate composition

The effect of different levels of mashed potato on physicochemical characteristics and proximate composition of egg cutlets is depicted in Table 2. The product pH did not vary with incorporation and increase in level of mashed potato. A significant ($P<0.05$) increase in water activity on increasing level of mashed potato was observed and it was measured highest in T3 and lowest in control. This might be due to higher moisture absorbance capacity of boiled potato and it can be correlated to increasing moisture content in treatments. Similar finding was reported by Chetna *et al.* (2014) in chicken meat cutlets. Cooking yield of treated products was significantly higher ($P<0.05$) than control and showed an increasing trend with level of incorporation of mashed potato. It was recorded maximum for T3 amongst treatments and lowest in control. It could be attributed to gelatinizing property of starch in potato on heating. A significantly ($P<0.05$) higher moisture content in treated products than control irrespective of level of incorporation of mashed potato was observed. It might be due to higher moisture retention and water binding property of potato (Malav *et al.*, 2012). Martin *et al.* (2000) also observed that 5 percent potato starch incorporation in pork batter significantly improved the moisture retention. The fat percentage followed an increasing trend with the increase in incorporation of level of mashed potato in the formulation. This could be due to higher fat retention during frying due to addition of boiled potato. The protein content was found to be lowest in T3 as compared to control. It may be attributed to the replacement of egg liquid which is rich in protein with that

Table 2: Effect of levels of incorporation of Mashed potato on the physico-chemical and proximate composition of Egg Cutlets (Mean±S.E.)*

Parameters	Treatments			
	C	T-1	T-2	T-3
Physico-chemical characteristics				
pH	6.42±0.01	6.42±0.05	6.43±0.08	6.41±0.04
Water activity (a_w)	0.90±0.04^a	0.92±0.08^b	0.93±0.01^c	0.95±0.09^d
Cooking yield (%)	84.16±0.85^a	87.86±0.46^b	90.17±0.22^c	92.74±0.23^d
Proximate Composition				
Moisture (%)	52.88±0.40^a	53.90±0.25^{ab}	54.46±0.29^b	55.84±0.30^c
Fat (%)	10.85±0.28^a	11.73±0.37^{ab}	12.39±0.25^{bc}	12.91±0.25^c
Protein (%)	15.17±0.15^d	13.32±0.31^c	12.36±0.38^b	10.06±0.23^a
Ash (%)	3.47±0.15	3.40±0.10	3.58±0.09	3.63±0.06

n=6, Control = egg cutlets without boiled potato. T1 = egg cutlets with 10% boiled and mashed potato; T2 = egg cutlets with 15% boiled and mashed potato; T3 = = egg cutlets with 20% boiled and mashed potato.

*Mean±S.E. with different superscripts row wise (a-d) differ significantly (P< 0.05).

of starch rich mashed potato.

Instrumental Texture, colour profile and sensory analysis

The mean values for the instrumental texture profile, colour and sensory scores have been presented in Table 3. A significant (P<0.05) increase in the values of hardness and chewiness was observed in all the treatments as compared to control. The highest value for both hardness and chewiness attributes was observed in T3 and lowest in control. This could be due to the binding ability of mashed potato in egg cutlets. Cohesiveness was comparable for all the treatments and control. Yang *et al.* (1995) and Pietrasik (1999) observed no significant effect on cohesiveness due to variation of starch content. Springiness and resilience values were found to be higher (P<0.05) in control as compared to treatments whereas gumminess and stringiness followed reverse pattern.

The value for lightness was found to be comparable amongst control and treatments. The redness (*a**) value of egg cutlets improved with frying and was recorded highest for T3 and lowest for control. The progressive increase in *a** value upon frying might be due to non- enzymatic browning reactions which had also been observed in potato slices (Pedreschi *et al.*, 2005; Baik and Mittal, 2003). The mean yellowness (*b**) value was recorded significantly (P<0.05) higher for control and lowest for T3.

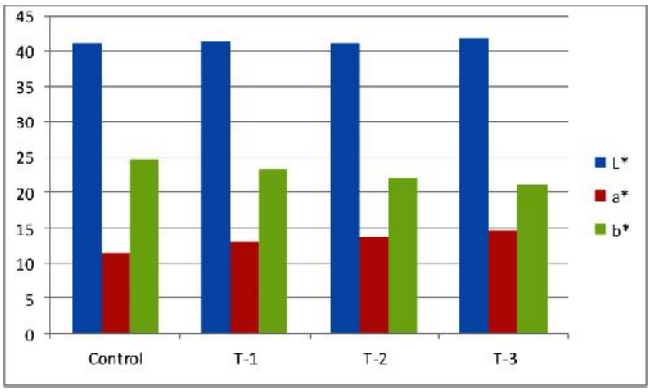

Fig. 1: Effect of mashed potato on colour profile of Egg Cutlets

Mean sensory scores of both control and treatments are presented in Table 3. The sensory scores for color and appearance were reported higher for treatments than control and gradually increased as level of potato incorporation increased.

Table 3: Effect of Mashed Potato on Instrumental textural, colour and sensory parameters of egg cutlets (Mean±S.E.)*

Parameters	Treatments			
	Control	T-1	T-2	T-3
Instrumental Texture Profile				
Hardness(N)	11.75±0.15^{a}	13.74±0.19^{b}	17.64±0.29^{c}	18.53±0.20^{d}
Springiness(mm)	16.62±0.03^{d}	14.78±0.01^{c}	13.72±0.02^{b}	11.23±0.07^{a}
Stringiness(mm)	17.18±0.04^{a}	17.48±0.12^{b}	18.16±0.20^{c}	18.81±0.05^{d}
Cohesiveness	0.49±0.09	0.49±0.07	0.49±0.03	0.49±0.01
Gumminess(N)	6.72±0.06^{a}	7.15±0.06^{b}	7.35±0.08^{c}	7.91±0.09^{d}
Chewiness(J)	90.69±0.57^{a}	91.47±0.09^{b}	93.36±0.24^{c}	97.41±0.26^{d}
Resilience	2.69±0.08^{d}	2.60±0.04^{c}	2.35±0.02^{b}	2.20±0.05^{a}
Instrumental Colour Profile				
L (Lightness)	41.05±0.54	41.29±0.86	41.13±0.12	41.91±0.52
*a**(Redness)	11.42±0.30^{a}	12.87±0.03^{b}	13.78±0.63^{c}	14.61±0.19^{d}
*b**(Yellowness)	24.54±0.15^{d}	23.29±0.49^{c}	22.17±0.59^{b}	21.07±0.48^{a}
Sensory Profile				
Appearance/ Color	6.41±0.20^{a}	6.78±0.27^{b}	6.88±0.23^{c}	6.96±0.10^{d}
Flavour	6.56±0.15^{a}	6.66±0.16^{a}	6.73±0.21^{a}	7.08±0.15^{b}
Texture	6.08±0.083^{a}	6.50±0.18^{b}	7.01±0.12^{c}	7.25±0.11^{d}
Juiciness	6.25±0.11^{a}	6.83±0.21^{b}	6.91±0.15^{b}	7.25±0.11^{c}
Overall Acceptability	6.41±0.20^{a}	6.78±0.20^{ab}	7.02±0.15^{b}	7.34±0.15^{c}

n=6 for texture and colour profile and n = 21 for sensory profile, Control = egg cutlets without boiled potato. T1 = egg cutlets with 10% boiled and mashed potato; T2 = egg cutlets with 15% boiled and mashed potato; T3 = = egg cutlets with 20% boiled and mashed potato.

*Mean±S.E. with different superscripts row wise (a-d) differ significantly (P< 0.05).

The results can be correlated with an increasing redness value in colour profile which was highly appreciated by the panelists. Similar finding have been reported by Chetna *et al.* (2014). Mean flavor scores varied from control to T3 and was found to be significantly (P<0.05) higher in T3 as compared to control and other treatments, though it was comparable amongst control, T1 and T2. It could be due to higher fat retention in T3 during frying.

The mean sensory scores for texture were reported lowest in control and a significant increase (P<0.05) in texture scores with increasing level of potato incorporation was observed. This could be due to better binding capacity of potato in whole egg liquid cutlets. Juiciness also followed a similar trend and scores were found highest in T3. This could be due better moisture retention capacity of mashed potato.

Similar finding have been reported by Chetna *et al.* (2014). This can be further correlated with moisture content and compositional analysis. The mean scores for overall acceptability in treatments were higher as compared to control and were found to be highest (P<0.05) in T3. Hence on the basis of compositional, textural and sensory attributes, 20% level of incorporation of mashed potato was found to be optimum for development of whole egg liquid cutlets.

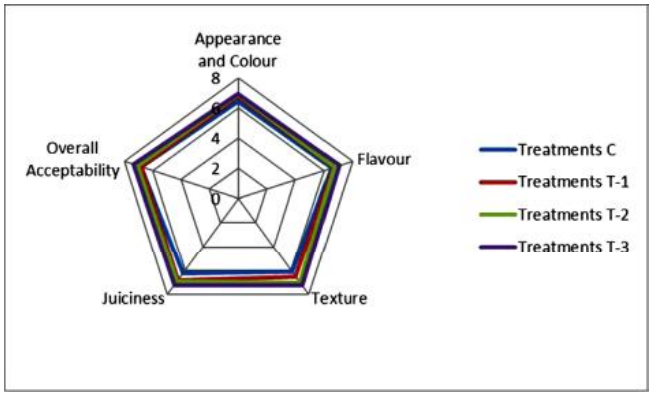

Fig 2: Effect of mashed potato on sensory attributes of Egg Cutlets

Economics of production of Egg Cutlets

Development of any technology cannot be said to be successful until it is used for the benefit of the society. Technology for food products depends not only upon its taste, appearance, color, aroma etc. but also upon its nutritive value and cost of production. So, the economics of production of egg cutlets has been calculated.

Calculation of economics of production

The economics was worked out with the following technical assumptions:

1. Per day production of egg cutlets is 100 kg.
2. The unit remains in production for 25 day in a month therefore monthly production target of egg cutlets is 100 × 25 = 2500 kg/ month.
3. Cost of ingredients is calculated on the basis of prevalent market rate in the local market.
4. To estimate accurate cost of production of egg cutlets 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, had to be taken into consideration.
5. Receipt is from the sale of egg cutlets and not from by-product.
6. Disposal of finished product is sent percent and handling and other charges are nil.

Table 4: Cost of production of spice mix

Name of ingredients	Quantity (g)	Rate (₹/Kg)	Approx Cost (₹)
Aniseed (Soanf)	100	150.00	15.00
Black pepper (Kalimirch)	100	750.00	75.00
Caraway seeds (Ajwain)	100	200.00	20.00
Cardamom dry (Badi Elaichi)	50	1200.00	60.00
Cardamom dry (Chhoti Elaichi)	20	900.00	18.00
Cinnamon (Dalchini)	50	180.00	9.00
Cloves (Laung)	50	1100.00	55.00
Coriander (Dhania)	150	150.00	22.50
Cumin seeds (Zeera)	150	200.00	30.00
Capsicum powder (mirch powder)	80	140.00	11.20
Dry ginger powder (Soanth)	80	300.00	24.00
Mace (Javitri)	50	1200.00	60.00
Nutmeg (Jaifal)	20	900.00	18.00
Total	1000	—	417.70 (418)

Table 5: 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 Egg = ₹ 20.00/100 Eggs

The cost of production of spice mix was estimated on basis of ingredients used and its average market price (Table 4). On that basis the total cost of formulation of spice mix for one kg was ₹ 18. The cost of the condiments used in the preparation of the egg cutlets was also calculated on the basis of the market price of onion, ginger and garlic listed in the Table 5 and was computed as ₹ 44/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 6. The cost of formulation of 100 kg control egg cutlets was ₹ 7674.50, whereas for T1, T2 and T3 it was ₹ 6964.50, ₹ 6639.50 and ₹ 6314.50, respectively.

Table 6: A. Cost of formulations for 100 Kg Egg cutlets

Ingredients	Rate ₹/Kg	Control		Boiled potato (10%)		Boiled Potato (15%)		Boiled Potato (20%)	
		Qt (Kg)	₹	Qt (Kg)	₹	Qt. (Kg)	₹	Qt (Kg)	₹
Whole egg liquid	319	70.0	5660.00	60.00	4800.00	55.00	4400.00	50.00	4000.00
Condiment mix (2:1:1)	44.00	12.0	440.00	12.00	440.00	12.00	440.00	12.00	440.00
Spice mix	418.00	2.00	836.00	2.00	836.00	2.00	836.00	2.00	836.00
Potato	15.00	—	—	10.00	150.00	15.00	225.00	20	300.00
TSPP	200.00	2.50	500.00	2.50	500.00	2.50	500.00	2.50	500.00
Salt	15.00	1.50	22.50	1.50	22.50	1.50	22.50	1.50	22.50
Binder (Refined wheat flour)	18.00	12.0	216.00	12.00	216.00	12.00	216.00	12.00	216.00
Total (₹)	—	—	**7674.50**		6964.50		6639.50		6314.50

The variation in price is mainly due to replacement of egg liquid with comparatively cheaper mashed potato. For enrobing, the total cost incurred on 100 kg basis was found to be ₹ 2513.25 and for frying it was ₹ 255.00. The labour charges for 100 kg egg cutlets' preparation were computed on the basis of five daily paid laborers for six days. So, on the basis of the market labour rates, charges were assumed as ₹ 220 per day (Verma *et al.,* 2015). Hence the labour cost for five labourers was calculated as ₹ 1320.00 per day. Electric charges were calculated on basis of utilization of electricity by various equipments which were estimated as 29.80 KWH per day. The total expenditure was calculated as ₹ 178.80/day considering the cost of one unit of electricity is ₹ 6.0. The cost of the all the equipment required was computed to be ₹ 69,000.00 and their annual deprecation was calculated as ₹ 18.90 per day on the basis of 10% annual rate of depreciation. The total overhead cost after taking into consideration water, gas, packaging charges, room rent and miscellaneous was computed as ₹ 2278.00. The production cost of 100 kg egg cutlets was computed separately for control and all the treatments by adding formulation cost, breading cost, frying and overhead cost (Table 8). It was found lowest for T3. Further, the production cost of 1 kg egg cutlets was found lowest for T3 (Table 10). The total project cost was estimated on basis of summation of fixed and variable cost and was found to be ₹ 3.53, 012.50 and net profit per month was found to be ₹ 1, 35,167.00.

Table 7: Formulation cost of enrobing the Egg Cutlets

Rate of bread @ ₹ 20/250 g	₹ 80/ Kg
Recovery of bread crumbs (%)	70 ± 1.58
Price of 1 Kg bread crumb	₹ 115.00
Average requirement of bread crumbs/Kg of product	170 g
Requirement for 100 Kg cutlets	17.00 Kg
Total price of bread crumbs	₹ 1955
Average requirement of whole egg liquid/Kg of product	70g
Whole egg liquid cost/Kg (25 egg required @ ₹ 3.20/ egg)	₹ 79.75
Quantity required/ 100Kg	7.00 Kg
Cost for enrobing 100 Kg cutlet	₹ 558.25

B: Cost of enrobing (breading) 100 Kg Egg cutlets = ₹ 2513.25

C: Cost of deep frying 100 Kg Egg Cutlets (refined oil 3 Kg× ₹ 85/ Kg) = ₹ 255.00

D: Over head production cost for 100 Kg Egg Cutlets

a. Labour charges: Unskilled worker (5-daily paid labourers) (₹ 220.00/day × 6) = ₹ 1320

b. Electricity charges

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

c. Equipment depreciation

Equipment	Watt × hrs	KWH Unit
Refrigerator (2No.s)	2 ×200 × 24	9.60
Hot air oven (2No.s)	2000 × 8.00	16.000
Packaging machine	100 × 2.0	0.200

Light, fan etc.	400 × 10	4.00
Total		29.80

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
Depreciation cost per day	= ₹ 18.90
Water charges (1000lit)	= ₹ 30.00/day
Gas charges	= ₹ 200.00/day
Cost of packaging material (pack 250g each)	= ₹ 160.00
(8"×6" LDPE Pouches @ ₹ 0.4/pouch) (400 × 0.40)	
g. Room rent (₹ 3000/ month)	= ₹ 120.00 per day
h. Miscellaneous (Detergent, transportation etc.)	= ₹ 250.00 per day
Total over head cost (a+ b+ c+ d+ e+ f +g +h)	**= ₹ 2277.70/ (≈₹ 2278/-)**

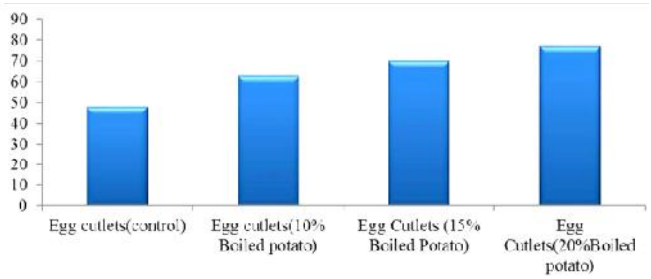

Fig. 3: Total income from production of egg cutlets

Table 8: Production cost (₹) of Egg Cutlets

Total cost of production obtained from 100 Kg formulation	Formulation cost (A) + Breading cost (B)+ frying cost (C) overhead production cost (D)
Total cost of production of control Egg Cutlets	7674.50+2513+255+2278 = 12,720.50/-
Total cost of production of Egg cutlets (with 10% Boiled potato)	6964.50+2513+255+2278 = 12,010.50/-
Total cost of production of Egg cutlets (with 15% boiled potato)	6639.50+2513+255+2278 = 11,685.50/-
Total cost of production of Egg cutlets (with 20% boiled potato)	6314.50+2513+255+2278 = 11,360.50/-

Table 9: Total cost of production of Egg Cutlets

Cooking yield of control Egg cutlets (84.16±0.85%)	= 84.16 Kg
Cooking yield of Egg cutlets (with 10% Boiled Potato)	= 87.86 Kg
Cooking yield of Egg cutlets (with 15% Boiled Potato)	= 90.17Kg
Cooking yield of Egg cutlets (with 20% Boiled Potato)	= 92.74Kg

Table 10: Production cost of 1 Kg Egg Cutlets

Egg Cutlets control (12,720.50/84.16)	= ₹ 151.14 /- (≈₹ 152/-)
Egg Cutlets(with 10 % Boiled Potato) (12,010.50/87.86)	= ₹ 136.70 /- (≈₹ 137 /-)
Egg Cutlets (with 15% Boiled Potato) (11,685.50/90.17)	= ₹ 129.59 /- (≈₹ 130 /-)
Egg Cutlets (with 20% Boiled Potato) (11,360.50/92.74)	= ₹ 122.76 /- (≈₹ 123 /-)

Total income = Total sale price – Total cost of production

Total profit

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

Total profit/day = 7700 – 800
= ₹ 6900.00

Total profit/Month = 6900×25 = ₹ 172,500.00

I. Variable cost = 11,360.50×25
= ₹ 284,012.50

II. Fixed Cost = 69000.00

Total project cost = ₹ 353,012.50

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 = ₹ 172,500 – 37,333= ₹ 135,167

Break Even Point

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

$$\frac{\text{Rs.69000} \times 24000}{24000 - 11{,}360.50}$$

= ₹ 131,017.84

Cost benefit ratio

$$\text{Break Even Point (₹ sales)} = \frac{\text{Total profit}}{\text{Total cost of production}}$$

$$\frac{6900}{12{,}300}$$

= 0.56 or 56%

Return of Investment (ROI)

$$\text{ROI} = \frac{\text{Net profit per year}}{\text{Working capital + Fixed cost}}$$

$$\frac{135{,}167 \times 12}{11{,}360.50 \times 25 \times 12 + 69000}$$

= 0.46 or 46% for the first year

CONCLUSION

On the basis of physico chemical, proximate, textural, colour and sensory properties, 20% incorporation level of mashed boiled potato was found to be most suitable for development of whole egg liquid egg cutlets. On cost analysis, the cost of production of Egg Cutlets varied as ₹ 152, ₹ 137, ₹ 130 and ₹ 123 for control, T1, T2 and T3 respectively. Thus, it can be concluded that incorporation of potato not only improves above mentioned parameters but also decreased overall price of production of egg cutlets.

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