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Cost economics of fish patties incorporated with pomegranate and sapodilla peel extracts

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Abstract

The present study was intended to standardize processing protocol of fish patties with the incorporation of olive oil and rice flour with different antioxidants and to evaluate cost of production of final developed product. Three treatments were prepared with the incorporation of pomegranate peel extract (T1), sapodilla peel extract (T2) and their 1:1 combination (T3) in products by replacing of meat (1%) from formulation to evaluate economics of fish patties. All treatment and control group were dry heat cooked for 40 min to make the product. In the cost economics, cost of formulation was found highest for group T1. The break-even point was estimated as Rs. 6,93,718.08 for control while Rs. 7,50,323.24, Rs. 7,27,429.08 and Rs. 7,38,731.30 for T1, T2 and T3 respectively. The cost benefit ratio was found highest for control and lowest for T1. The estimated details of economics of the developed product concluded that a viable enterprises can be established by keeping rate Rs. 243 for control and Rs. 257, Rs. 248, Rs. 255 for pomegranate peel, sapodilla peel and their 1:1 combination incorporated products respectively.

Keywords: Break-even point, cost benefit ratio, olive oil, pomegranate peel, sapodilla peel

1. Introduction

Fish is a highly nutritious, tasty and easily digestible food commodity comparable to meat and dairy products. It is an important dietary constituents of several population groups with significant nutritional value comprising quality protein, vitamins, minerals and lipids, besides being the largest source of omega-3 series polyunsaturated fatty acid especially the eicosapentaenoic acid (EPA) and docosahexaenoic acid (DHA) which bring several benefits to human health (Goncalves and Passos, 2010) [8].

Novel and attractive preparations are constantly being provided to the market with a variety of presentations in order to stimulate consumers purchase. Accordingly we can find different examples of convenience fish products: fish fingers, fish patties, fish balls, ready-prepared battered fillets and other products.

Patty one of the popular comminuted meat products have higher degree of preference among the consumers due to its typical characteristics such as flavor and pronounced chew ability (Keeton, 1983; Berry and Leddy, 1984) [11, 3].

The presence of high amounts of poly unsaturated fatty acids (PUFAs) in seafood products makes them more prone to lipid oxidation and that lead to development of an offensive odour and loss in quality (Frankel 1998) [7]. To prevents these type of deterioration and extend the shelf life of fish patties the antioxidant can be added. Antioxidants can inhibit the oxidation process through breaking the oxidative free radical chain reaction, decomposing peroxides, deactivating singlet oxygen, chelating metal ions, absorbing ultraviolet radiation and scavenge oxygen (Shah *et al.*, 2014) [14]. Natural antioxidants extracted from herbs and spices exhibit various degrees of efficacy when used in different food applications (Bowser *et al.*, 2014). There are a number of studies on the use of natural antioxidants in meat products and it appears that these antioxidants have been extracted from different plant parts such as leaves, roots, stems, fruits and seeds (Rather *et al.*, 2016) [13]. The extracts of rosemary, grape seed, ginger, cinnamon, garlic, pomegranate, broccoli, onion, myrtle, mint, nettle and green tea have been widely studied for their antioxidant potential (Banerjee *et al.*, 2012) [2]. The antioxidant effect of Echinacea, Mysore thorn, mango seed, cranberry and strawberry, citrus peel, coffee, olive leaf, oregano, adzuki bean and carob fruits extracts were also investigated in broiler meat, beef patties, bologna type-mortodella, rabbit meat, raw chicken drumettes, pork patties, pork sausages (Falowo *et al.*, 2014) [6].

The shelf life may be enhanced by incorporating of various kinds of fruits and their by-products in meat and meat products (Ahmad *et al.*, 2015) ^[1]. Pomegranate peel is an inedible part obtained during processing of pomegranate juice and rich source of tannins, flavonoids and other phenolic compounds (Li *et al.*, 2006) ^[12]. Sapodilla pulp and peel have the potential as natural antioxidant sources for food industry application. The fruit and its peel contain high amounts of saponin which has astringent properties that similar to tannin. Aqueous extract of sapodilla fruit peel has higher reducing power and DPPH activity. (Jamuna *et al.*, 2010) ^[10].

Pomegranate peel powder extract was effective in terms of lowering TBARS in beef patties (Ibrahim *et al.*, 2012) ^[9]. Siddiqui *et al.* (2012) ^[15] found that pomegranate peel powder extract was found to be effective antimicrobial agent against food borne pathogens at the concentration 1-5mg/ml. Devatkal *et al.* (2014) ^[5] stated that pomegranate peel extract (concentration 1 %) used in ground goat meat and goat nuggets for vacuum packaging 4°C, 9 days storage shows that the reducing the lipid oxidation in both ground goat meat and nuggets. Devatkal *et al.* (2014) ^[5] founded that banana and sapodilla peel extracts significantly reduced the lipid oxidation in chicken meat during refrigerated storage and antioxidant effect was comparable to that of BHT, therefore extracts of these fruits by-products could be successfully added to meat to function as antioxidant.

Material and Method

Frozen meat was thawed, cut into small pieces and minced

with meat mincer. Meat emulsion was prepared in a bowl chopper (Hakimi, India). Pre-weighed quantity of minced fish meat, salt, sodium tripolyphosphate and sodium nitrite were added and chopped for about 2-3 minutes. It was chopped again for 2 minutes after the addition of ice flakes. Olive oil was slowly incorporated while chopping till it was completely dispersed in the batter. Refined rice flour, condiment paste, dry spice mix and other ingredients viz: gram flour, pomegranate peel and sapodilla peel extracts were added. Chopping was continued till uniform dispersion of all the ingredients and desired consistency of the emulsion was achieved. Weighed quantity of emulsion was taken, patties moulded in shape and cooked in hot air oven at 180°C for 40 minutes. Core temperature of cooked patties was recorded by using probe thermometer that should reach to 80°C.

Formulas used for estimation of economics of the products

Cost of production for 100 Kg fish patties = Cost of formulation + cost of overhead production

Cost of overhead production = Daily depreciation cost + Rent of building + Labour cost + Cost of electricity + Maintenance cost + Water charge + Cost of packaging

Cost for 1 kg fish patties = (Production cost of 100 Kg formulation/% cooking yield)

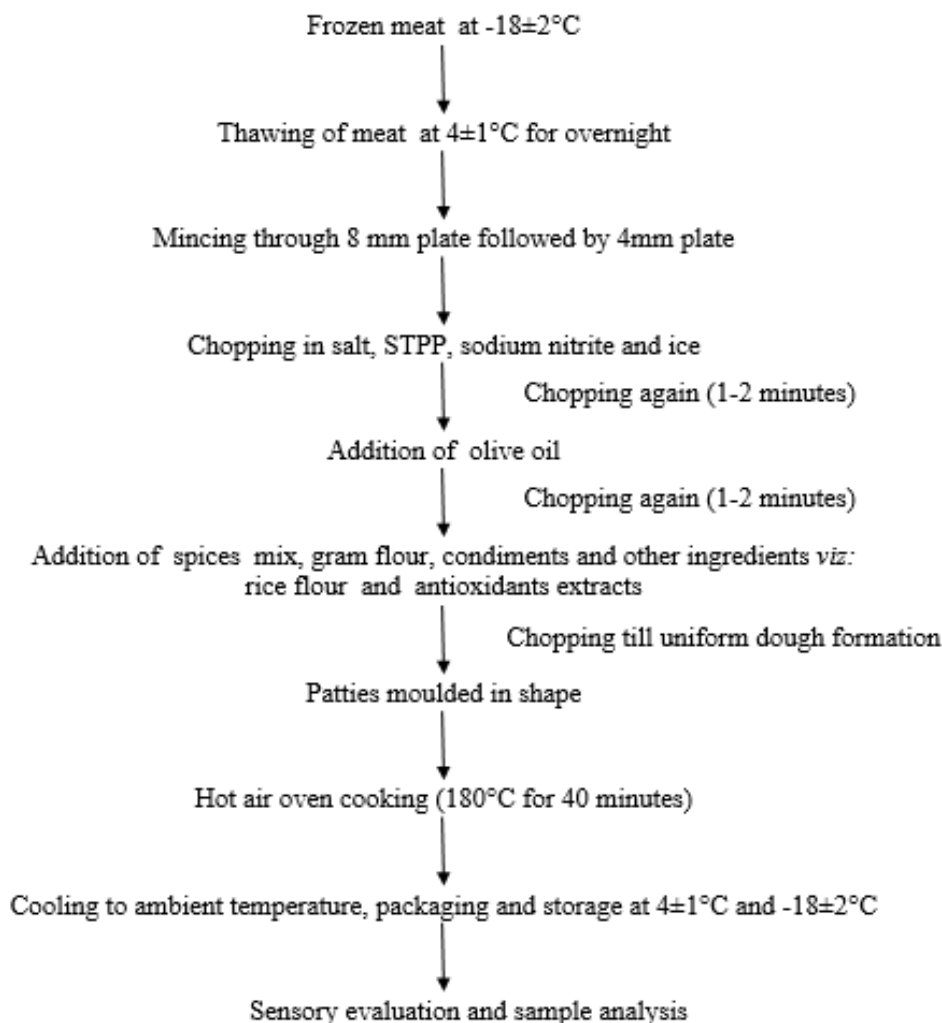
Income = total sale price - total cost of production

Break-Even point = Fixed cost × Total sales/Total sales - Variable cost

Cost-benefit ratio = Total profit/Total cost of production

Net profit/day = Total profit- amount of loan payment/day

Flow diagram for preparation of Fish patties



Result and Discussion

The total cost of formulation for spice mix. was calculated Rs. 400 /kg are mentioned in the Table 1. The equipment cost required during this work is cited in the Table 2 and their annual depreciation was calculated as Rs. 34,450 /Annum on the basis of 10% annual rate of depreciation. The overhead production cost of 100 kg product was mentioned in Table 3 which includes daily depreciation cost, rent on building per day, labour cost, electricity cost, maintenance cost, water charge and packaging cost.

The formulation cost for 100 kg product was calculated of all the product groups presented in Table 4. It was found that the cost of production of 100 kg product for control group Rs. 17,468. Cost of production for antioxidant treated group, i.e. for T1, T2 and T3 were Rs. 18,768, Rs. 18,268 and Rs. 18,518 respectively. Per day expenditure cost for 100 kg product was calculated for all the treated and control group are presented in Table 5. It was estimated that per day expenditure cost for the control group was Rs. 20,044 and antioxidant treated groups, i.e. for T1, T2 and T3 were Rs. 21,334, Rs. 20,844 and Rs. 21,094 respectively. Total profit and income from sale of product was calculated of all the product groups

presented in Table 6 and it was around Rs. 10400/day, Rs. 9000/day, Rs. 9900 and 9200 for control, T1, T2 and T3 groups respectively. The total project cost of the product was calculated by summation of the fixed cost and variable cost in Table 7 and was it calculated as Rs. 3, 61, 968, Rs. 3, 63, 268, Rs. 3, 62, 768 and Rs. 3,63,018 for control, T1, T2 and T3 groups respectively. The break-even point for control and antioxidant extracts incorporated product was calculated in Table 9 and it was estimated around Rs. 6, 93, 718.08 for control, Rs. 7, 50, 323. 24, Rs. 7, 27, 429.08and Rs. 7, 38, 731. 30 for T1, T2 and T3 groups respectively. The maximum cost benefit ratio was found for control and T2 groups due to lowest formulation cost. The overall cost for the production of 1 kg of fish patties incorporated with peel extract was Rs. 257 for T₁, Rs. 248 for T₂, Rs. 255 for T₃ and Rs. 243 for control. It can be suggested from the study that the development and adaptation of the technology by the entrepreneurs as a liveness proposal for profitable speculation and hence has an ample opportunity for the employment generations. The overall cost for the production of 1 kg of fish patties incorporated with peel extract was Rs. 257 for T₁, Rs. 248 for T₂, Rs. 255 for T₃ and Rs. 243 for control.

Table 1: Spice mix used in preparation of fish patties

Sl. No.	Ingredients	Per cent in mix
1	Aniseed (Soanf)	10
2	Black pepper (Kalimirch)	10
3	Capsicum (Mirch powder)	9
4	Caraway seed (Ajwaen)	11
5	Cardamom (Bada Elaichi)	5
6	Cinnamon (Dal Chini)	5
7	Cloves (Laung)	3
8	Coriander powder (Dhaniya)	13
9	Cumin seed (Jeera)	15
10	Turmeric (Haladi)	05
11	Nutmeg (Jaiphal)	1
12	Dried ginger	13
	Total	100

Table 2: Fixed expenditure for fish patties

Equipments	Price (in rupee)
Meat mincer	60,000
Deep freeze	40,000
Refrigerator (2)	50,000
Oven (1)	75,000
Bowl chopper	1,00,000
Balance	1,500
Furniture	6,000
Grinder	4,000
Packaging machine	3,000
Miscellaneous	5,000
Total fixed expenditure	₹3,44,500

Table 3: The overhead production cost of 100 kg fish patties

Sl. No.	Ingredients	Per cent in mix
1	Annual depreciation Daily depreciation cost per day	@ 10% = Rs. 34,450 /Annum @ 25 working day = Rs. 95.69 /day
2	Rent of building Money paid for rent per day	Rs. 3500 /month @ Rs. 25 working days /month = Rs.140 /day
3	Labour cost:- Trained labour Untrained labour	@ Rs. 300 (2) = Rs. 600 /day @ Rs. 250 (3) = Rs. 750 /day Total= Rs. 1350 /day
4	Cost of electricity	Rs. 45 unit @ 8.00/Unit= Rs. 360 /day
5	Maintenance	Rs. 100 /day
6	Water charge (approx)	Rs. 30 /day
7	Cost of packaging	@ Rs. 1.25/Packet= Rs. 500 /day

Table 4: Formulation cost for 100 kg fish patties

Ingredients	(in rupees)			
	C (Rs.)	T ₁ (Rs.)	T ₂ (Rs.)	T ₃ (Rs.)
Fish meat (75%)	15,000	14,800	14,800	14,800
Olive oil (6%)	990	990	990	990
Ice flakes (7%)	14	14	14	14
Salt (1%)	16	16	16	16
Gram flour (2%)	120	120	120	120
Spice mix (1.69%)	676	676	676	676
Condiments (3%)	120	120	120	120
STPP (0.3%)	210	210	210	210
Sodium nitrite (.01%)	2	2	2	2
Rice flour (4%)	320	320	320	320
Pomegranate Peel (1%)	-	1500	-	-
Sapodilla Peel (1%)	-	-	1000	-
Combination (1: 1)	-	-	-	1250
Total	17,468	18,768	18,268	18,518

Table 5: Per day expenditure for 100 kg fish patties

Groups	C (Rs.)	T ₁ (Rs.)	T ₂ (Rs.)	T ₃ (Rs.)
Rent	140	140	140	140
Depreciation	95.69	95.69	95.69	95.69
Labour charge	1350	1350	1350	1350
Electricity	360	360	360	360
Maintenance	100	100	100	100
Water charge	30	30	30	30
Packaging	500	500	500	500
Total cost of production for 100 kg formulation	20,044	21,334	20,844	21,094
Rate for 1 Kg formulation	243	257	248	255

Profit @ 35%= Rs. 90

MRP on the product= Rs. 347

Table 6: Income and total profit from control and peel extract incorporated fish patties

Groups	C (Rs.)	T ₁ (Rs.)	T ₂ (Rs.)	T ₃ (Rs.)
Income/Kg	104	90	99	92
Income/100 Kg	10400	9000	9900	9200
Total profit/day	10400	9000	9900	9200

Table 7: Calculation of variable cost and total project cost for control and peel extract incorporated fish patties

Groups	Fixed cost (Rs.)	Variable cost (Rs.)	Total project cost (Rs.)
C	3,44,500	17,468	3,61,968
T ₁	3,44,500	18,768	3,63,268
T ₂	3,44,500	18,268	3,62,768
T ₃	3,44,500	18,518	3,63,018

Total project cost = Rs. 450000

Loan amount = Rs. 382500

Margin money= Rs. 70,000

Amount of interest @12% /annum= Rs. 45,900

Amount of loan payment/month= 3825 (for 12 months month only)

Amount of loan payment/day = Rs. 153

Table 8: Net profit/day after payment of loan control and peel extract incorporated fish patties

Group	Total sales/day (Rs.)	Variable Cost (Rs.)	Total cost of production/day (Rs.)	Net profit/day (After payment of loan 153/day) (Rs.)
C	34,700	17,468	24,300	10,247
T ₁	34,700	18,768	25,700	8,847
T ₂	34,700	18,268	24,800	9,747
T ₃	34,700	18,518	25,500	9,047

Table 9: Calculation of break-even point and cost benefit ratio for control and peel extracts incorporated fish patties

Group	Break Even Point	Cost benefit ratio
C	$3,44,500 \times 34,700 / 34,700 - 17,468 = 6,93,718.08$	$10,400 / 24,300 = 0.427$ or 42%
T ₁	$3,44,500 \times 34,700 / 34,700 - 18,768 = 7,50,323.24$	$9000 / 25,700 = 0.350$ or 35%
T ₂	$3,44,500 \times 34,700 / 34,700 - 18,268 = 7,27,429.08$	$9900 / 24,800 = 0.399$ or 39%
T ₃	$3,44,500 \times 34,700 / 34,700 - 18,518 = 7,38,731.30$	$9200 / 25,500 = 0.360$ or 36%

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