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Cost economics of chevon patties incorporated with poppy seed (*Papaver somniferum)* extracts

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Abstract
The present study was intended to standardize processing protocol of chevon patties with the incorporation of animal fat and with poppy seed antioxidant and to evaluate cost of production of final developed product. Three treatments were prepared with the incorporation of 2% poppy seed extract (T_1), 3% poppy seed extract (T_2) and 4% poppy seed extract (T_3) in products by replacing of animal fat from formulation to evaluate economics of chevon patties. All treatment and control group were cooked in hot air oven at 180^0C for 40 minutes to make the product. In the cost economics, cost of formulation was found highest for group T3. The break-even point was estimated as ₹ 921038.77 for control while ₹ 964670.95, ₹ 988074.52 and ₹ 1012642.28 for T1, T2 and T3 respectively. The cost benefit ratio was found highest for control and lowest for T3. The estimated details of economics of the developed product concluded that a viable enterprises can be established by keeping rate ₹555.82 for control and herbal extract was ₹ 566.46 for T1, ₹569.21 for T2, ₹572.05 for T3 incorporated products respectively.

Keywords: break-even point, cost benefit ration, animal fat, poppy seed

Introduction
Diet and nutrition play important role in the promotion and maintenance of health throughout life. Chevon is a rich source of nutrients and micronutrients that are needed for good health throughout life. The percentage of saturated fat in goat meat is lower than chicken, beef, pork or lamb (Banskalieva *et al*., 2000) [3]. Chevon is red meat that is almost universally acceptable and free from cultural, traditional, social and economic conditions (Xazela *et al*., 2011) [10]. Economic pressure to minimize cost, maximize product utilization through value addition provides incentive for processing goat meat (Chevon) into consumer oriented convenience meat products (Agnihotri, 2000) [1]. Development of processed meat products involves the incorporation of non-meat ingredients or additives for enhancing the quality attributes, sensory profile and shelf life. Lipid oxidation and auto-oxidation are major causes of quality deterioration and reduced shelf life of meat products. This may produce changes in meat quality parameters such as colour, flavour, odour, texture and nutritional value (Fernandez, Perej-Alvarez and Fernandez–Lopez, 1997) [6]. The rate of oxidative deterioration or lipid oxidation can be reduced through various means like curing, vacuum packaging, modified atmosphere packaging and most importantly adding synthetic or natural antioxidants. 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) [8]. Although synthetic antioxidants such as butylated hydroxytoluene (BHT) and butylated hydroxy anisole (BHA) have been used extensively, recent studies have implicated them to have toxic effects (Shahidi *et al*., 1992) [9]. Due to the potential toxicological effects of synthetic antioxidants, the use of alternative natural additives has become widespread due to consumer demands. These findings together with consumer interest in natural food additives have reinforced the need for effective antioxidants from natural sources as an alternative to prevent deterioration of meat products during processing and storage.
Patty is a cooked and fried product suitable as a snack food as well as an adjunct to the routine meals. It is a ready to eat food with reasonably good shelf life under refrigerated and frozen storage conditions. It would be one of the better choices to cater the needs of commercial lines. Herbs, spices, fruits and vegetables and their powders, oils and extracts were found to be a good source of natural antioxidants and antimicrobials to extend food quality and stability. 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) [7]. 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]. These plant extracts are prepared from the plant materials by using different solvents and extraction methods. These extracts are rich in phenolics and So, they provide a viable alternative to synthetic antioxidants, further extract of poppy seed have been demonstrated to a strong antioxidant property when analyzed by different method i.e. DPPH radical-scavenging assay, SO2-scavenging activity, NO2-radical scavenging activity and OH-scavenging activity etc.

*Papaver somniferu*m (poppy) is widely grown as an annual crop consists of approximately 73% of linoleic acid, 10% of palmetic acid and 13% of oleic acid. These se unsaturated fatty acid help in lowering serum cholesterol level (Bozen and Tameli, 2003) [4]. These also contain poly- phenols like tannic acid, ellagitannin that act as potential antioxidant.

Poppy Seeds (*Papaver somniferum*) with good taste, are nutritious oilseeds used in Indian cuisine in the form of Khus Khus (white small size granules) and historically, it has been utilized for the treatment of several diseases like asthma, stomach disorder and eyesight improvement. The functional potentials of poppy seeds its less studied and only a few reports are available in this regards. In some studies poppy seed have been demonstrated to have lower total plate count as compair to other very common extract like clove buds and cinnamon bark. The aqueous extracts from spices exhibit antioxidant activity due to their high phenolic contents (Chan *et al*., 2011) [5].

Material and Method

Frozen chevon was partially thawed overnight, cut into small cubes and double minced with meat mincer. Meat emulsion was prepared in a bowl chopper (Hakimi, India). Pre-weighed quantity of minced chevon, 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. Animal fat was slowly incorporated while chopping till it was completely dispersed in the batter. Condiment paste, dry spice mix, and other ingredients *viz*: poppy seed 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 ^{0}C for 40 minutes.

Formulas used for estimation of economics of the products

Cost of production for 100 Kg chevon 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

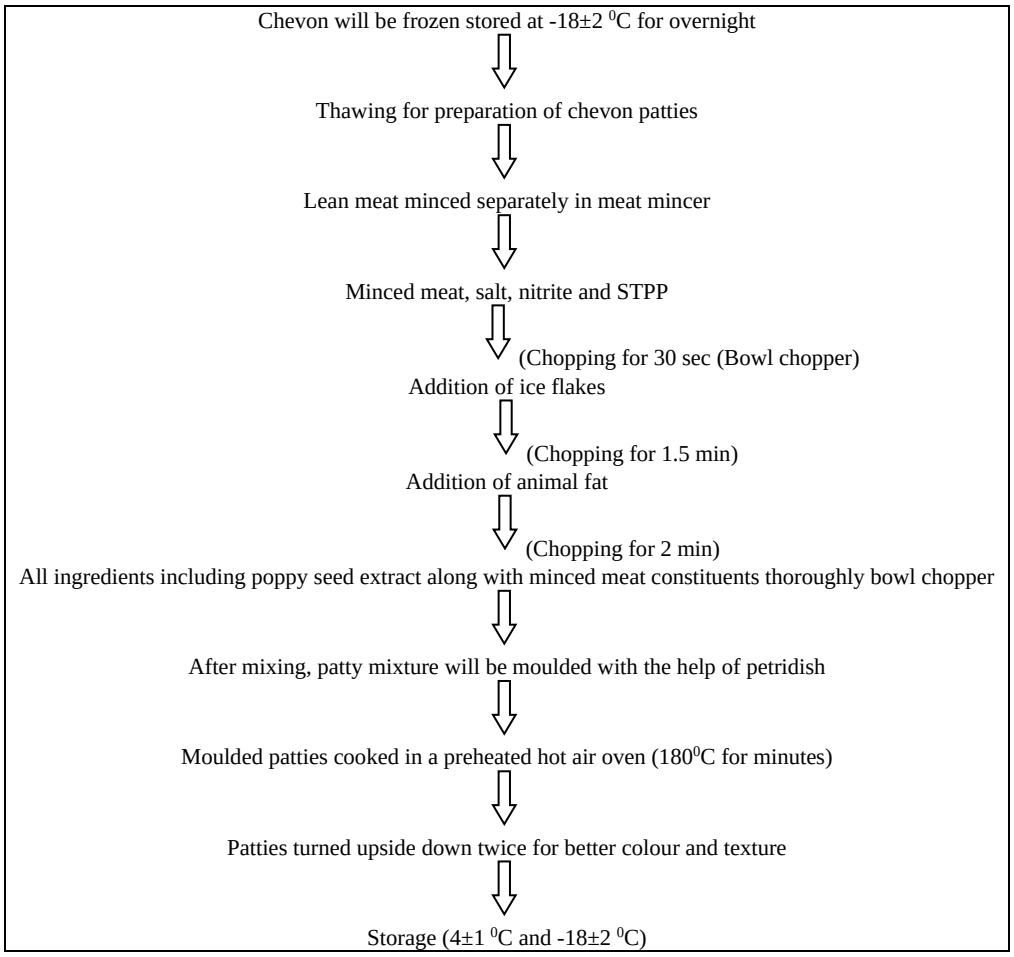
Cost for 1 kg chevon patties = (Production cost of 100 Kg formulation/% cooking yield)

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 chevon patties

Result and Discussion

The total cost of formulation for spice mix. Was calculated ₹ 400 /kg are mentioned in the Table 1. The equipment cost required during this work is cited in the Table 2 and their annual deprecation was calculated as ₹ 27,750 /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 ₹45,544. Cost of production for antioxidant treated group, i.e. for T1, T2 and T3 were ₹ 46,844, ₹47,494 and ₹ 48,144 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 ₹48,101.08 and antioxidant treated groups, i.e. for T1, T2 and T3 were ₹ 49,401.08, ₹50,051.08 and ₹50,701.08 respectively. Total profit and income from sale of product was calculated of all the product groups presented in Table 6 and it was around ₹ 21261/day, ₹20197 /day, ₹19922 /day and ₹19638 /day 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 ₹ 3,92,601.08, ₹3,93,901.08 , ₹3,94,551.08 and ₹3,95,201.08 for control, T1, T2 and T3 groups respectively. The break-even point for control and antioxidant extract incorporated product was calculated in Table 9 and it was estimated around ₹921038.77 for control, ₹964670.95, ₹988074.52 and ₹1012642.28 for T1, T2 and T3 groups respectively. The maximum cost benefit ratio was found for control and T1 groups due to lowest formulation cost. The overall cost for the production of 1 kg of chevon patties incorporated with poppy seed extract was ₹ 566.46 for T1, ₹ 569.21 for T2, ₹ 572.05 for T3 and ₹ 555.82 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 chevon patties incorporated with poppy seed extract was ₹ 566.46 for T1, ₹ 569.21 for T2, ₹ 572.05 for T3 and ₹ 555.82 for control.

Table 1: Spice mix used in preparation of chevon patties

S. 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 (Haldi)	05
11	Nutmeg (Jaiphal)	1
12	Dried ginger	13
	Total	100

Table 2: Fixed expenditure for chevon patties

Equipments	Price (in rupee)
Meat mincer	60,000
Oven	75,000
Refrigerator (2)	50,000
Deep freezer	40,000
Bowl chopper	1,00000
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 chevon patties

S. No.	Ingredients	Per cent in mix
1	Annual depreciation Daily depreciation cost per day	@ 10% = ₹ 27,750 /Annum @ 25 working day = ₹ 77.08 /day
2	Rent of building Money paid for rent per day	₹ 3500 /month @ ₹ 25 working days /month = ₹ 140 /day
3	Labour cost:- Trained labour Untrained labour	@ ₹ 300 (2) = ₹ 600 /day @ ₹ 250 (3) = ₹ 750 /day Total= ₹ 1350 /day
4	Cost of electricity	₹ 45 unit @ 8.00/Unit= ₹ 360 /day
5	Maintenance	₹ 100 /day
6	Water charge (approx)	₹ 30 /day
7	Cost of packaging	@ ₹ 1.25/Packet= ₹ 500 /day

Table 4: Formulation cost for 100 kg chevon patties

Ingredients	(in rupees)			
	C(₹)	T1(₹)	T2(₹)	T3(₹)
Meat	39,050	39,050	39,050	39,050
Fat	4950	3850	3300	2750
Ice	10	10	10	10
Salt	20	20	20	20
Sodium Nitrite	4	4	4	4
STPP	280	280	280	280
Condiment	130	130	130	130
Whole egg	500	500	500	500
Poppy seed	-	2400	3600	4800
Spice Mix	600	600	600	600
Total	45,544	46,844	47,494	48,144

Table 5: Per day expenditure for 100 kg chevon patties

Groups	C (₹)	T_1 (₹)	T_2 (₹)	T_3 (₹)
Rent	140	140	140	140
Depreciation	77.08	77.08	77.08	77.08
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	48,101.08	49,401.08	50,051.08	50,701.08
Rate for 1 Kg formulation	555.82	566.46	569.21	572.05

Profit @ 35%= ₹ 199.22
MRP on the product= ₹ 768.43

Table 6: Income and total profit from control and poppy seed extract incorporated chevon patties

Groups	C (₹)	T_1 (₹)	T_2 (₹)	T_3 (₹)
Income/Kg	212.61	201.97	199.22	196.38
Income/100 Kg	21261	20197	19922	19638
Total profit/day	21261	20197	19922	19638

Table 7: Calculation of variable cost and total project cost for control and poppy seed extract incorporated chevon patties

Groups	Fixed cost (₹)	Variable cost (₹)	Total project cost (₹)
C	3,44,500	48,101.08	3,92,601.08
T_1	3,44,500	49,401.08	3,93,901.08
T_2	3,44,500	50,051.08	3,94,551.08
T_3	3,44,500	50,701.08	3,95,201.08

Total project cost = ₹ 450000
Loan amount = ₹ 410000
Margin money = ₹ 40,000
Amount of interest @12% /annum = ₹45,900
Amount of loan payment/month= 3825 (for 12 months month only)
Amount of loan payment/day = ₹ 153

Table 8: Net profit/day after payment of loan control and poppy seed extract incorporated chevon patties

Group	Total sales/day (₹)	Variable Cost (₹)	Total cost of production/day (₹)	Net profit/day (After payment of loan 136/day) (₹)
C	76843	48101.08	55582	21125
T_1	76843	49,401.08	56646	20061
T_2	76843	50,051.08	56921	19786
T_3	76843	50,701.08	57205	19502

Table 9: Calculation of break even point and cost benefit ratio for control and poppy seed extracts incorporated chevon patties

Group	Break Even Point	Cost benefit ratio
C	3,44,500×76843/76843-48101.08=921038.77	21261/55582=0.38 or 38.25%
T_1	3,44,500×76843/76843-49401.08=964670.95	20197/56646=0.35 or 35.65%
T_2	3,44,500×76843/76843-50051.08=988074.52	19922/56921=0.34 or 34.99%
T_3	3,44,500×76843/76843-50701.08=1012642.28	19638/57205=0.34 or 34.32%

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