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Cost analysis of pumpkin seed powder and chia seed powder incorporated chicken meat nuggets

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Abstract

Present study was planned to estimate the cost of production of healthier chicken nuggets by incorporating pumpkin seed powder (PSP) and chia seed powder (CSP). Initially pre experimental trials were conducted based on sensory evaluation with incorporation of different levels of pumpkin seed powder and chia seed powder to optimize and finalize the experimental treatments. Finally, the selected level of incorporation for pumpkin seed powder (PSP) was 3% (3P), 6% (6P) and 9% (9P) and chia seed powder (CSP) was 2% (2C), 4% (4C) and 6% (6C). Then the cost of the products was calculated on the basis of cost of raw materials, depreciation in the equipment cost, overhead charges including wages or payment given to the workers. Finally, the cost of production of control and treated chicken meat nuggets was calculated in the range of Rs 252.05/kg to 273.06/kg. Lowest cost of production was found in 6% chia seed powder treated nuggets.

Keywords: Pumpkin seed powder, chia seed powder, chicken nuggets, cost economics

Introduction

Poultry meat as well as chicken products have a key role in human diet, because of their positive nutritional features like low lipid content, proteins of high biological value, essential amino acids and a natural source of vitamins B₂, B₃, and B₆ and minerals such as Fe, P, K, Zn, and Se (Bedca/Aesan, 2019) [1]. Now a day, a huge amount of chicken meat and chicken products are consumed in the form of “fast food” or “ready-to-eat” products, such as chicken nuggets, because of their reduced preparation time, low cost, and long shelf life under frozen storage. Chicken nuggets are an important food served at almost all fast food restaurant chains and is the favorite dish for children. This increase in demand for chicken nuggets led to the development of “value” nuggets, which includes incorporation of healthy ingredients to increase the nutritional value and to decrease the cost of production (Yeater *et al.*, 2017) [2]. Value added meat products formulations include adding non-meat proteins to boost the water binding, stabilization of fat, and to minimize the formulation cost (Hsu and Sun, 2006) [3]. So to improve the nutritional characteristics of chicken products, these foods can be restructured with health-promoting ingredients, like fiber and vegetables, and harmful components like fat and additives can be reduced or eliminated (Fernandez-Gines *et al.*, 2005) [4].

Pumpkin (*Cucurbita maxima*) seeds are generally considered as an agro waste. But, the seeds are amazingly rich source of bioactive compounds (Patel, 2013) [5]. When ripe, fruit is rich in carotenoids and ascorbic acid (Sirohi *et al.*, 1991) [6]. Alfawaz (2004) [7] found that crude protein, crude oil, ash and crude fibre content in pumpkin seeds were 39.25%, 27.83%, 4.59% and 16.84% respectively. Besides being nutritionally rich, pumpkin also possess many medicinal properties. Pumpkin seeds are rich source of proteins (24 to 36.5%), unsaturated oil (31.5 to 51%) and minerals (Rezig *et al.*, 2012) [8].

Chia seeds boost energy and exercise performance, build stronger bones, aid in weight loss by decreasing hunger and cutting calorie intake, fight cancer growth due to richness of alpha linolenic acid, enhance oral health due to their antibacterial effect and by inhibiting tartar formation (Rachael, 2019) [9]. Total dietary fibre content of seeds is about 47.1 to 59.8% (Weber *et al.*, 1991) [10] and contain 40% of oil with high percentage of unsaturated fatty acids, out of which alpha linolenic acid is 68% (Ayerza, 1995; Taga *et al.*, 1984) [11, 12]. Also, they are a good source of proteins (19.0–26.5%), dietary fibre (18-30%), vitamins, minerals and antioxidants (Bushway *et al.*, 1981) [13].

The importance of pumpkin seed and chia seed in human diet and their cost effectiveness and their proper utilization in meat products may open an avenue for newer products development. So this present study was undertaken to determine the cost of production of pumpkin seed powder and chia seed powder incorporated chicken nuggets.

Materials and Methods

Raw pumpkin seed and chia seeds were purchased from the local market and then were dried in hot air oven at 50-55 °C for 24 h. After that they were ground to fine powder in a grinder, packed in a polythene bag for further use. Birds were

slaughtered and dressed as per standard procedure in the experimental slaughter house of the Department. Levels of pumpkin seed powder and chia seed powder were selected on the basis of preliminary trials and available literature. Finally, selected treatments were as follows:

Table 1: Composition of chicken meat emulsion (per 100 g minced meat)

Name of ingredients	Weight (g)
Sodium chloride	2
Sodium tripolyphosphate	0.4
Sodium nitrite	0.015
Spice mix	2
Condiments	3
Semolina	2
Water	10
Fat	7

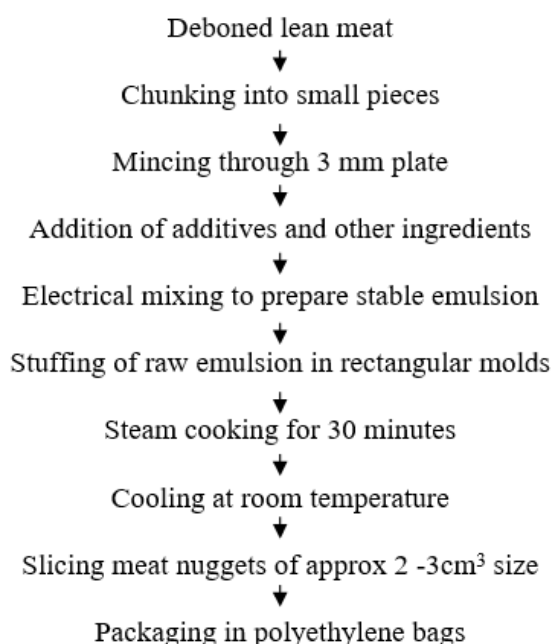


Fig 1: Flow diagram for preparation of chicken meat nuggets

Final treatments

1. Control: Chicken nuggets without pumpkin seed powder and chia seed powder
2. 3P: Chicken nuggets with 3% pumpkin seed powder (3 g PSP/100 g minced meat).
3. 6P: Chicken nuggets with 6% pumpkin seed powder (6 g PSP/100 g minced meat).

4. 9P: Chicken nuggets with 9% pumpkin seed powder (9 g PSP/100 g minced meat).
5. 2C: Chicken nuggets with 2% chia seed powder (2 g CSP/100 g minced meat).
6. 4C: Chicken nuggets with 4% chia seed powder (4 g CSP/100 g minced meat).
7. 6C: Chicken nuggets with 6% chia seed powder (6 g CSP/100 g minced meat).

Analytical procedures:

Cost analysis of developed product. The cost of the products was calculated on the basis of cost of raw materials, depreciation in the equipment cost, overhead charges including wages or payment given to the workers.

Results and Discussion

Cost economics

Production cost of control, pumpkin seed powder and chia seed powder treated chicken meat nuggets was estimated by keeping in view the various types of costs involved in a small scale meat processing plant. Prevalent rates of all the ingredients in local market of Hisar at the time of study were taken into account. In a year, 300 days were presumed as total working days. The processing capacity of the plant was taken as 50 kg deboned meat per day. Based on the above assumptions 15000 kg of chicken meat would be required to be processed in a year. Taking into consideration the deboned meat per cent of about 55%, about 27273 kg of dressed meat will be required to obtain 15000 kg of deboned meat (Table 3). The major capital investment required to process 50 kg chicken meat/day was around Rs 1,26,710/-.

Table 2: Major capital investment with cost and annual depreciation for processing of 50 kg of chicken meat per day for preparation of pumpkin seed powder and chia seed powder incorporated chicken meat nuggets

Sr. No.	Items	Particulars	Qty.	Estimated cost (Rs.)	Rate of (%) depreciation	Annual depreciation (Rs.)
1	Weighing balance	10 kg	1	5000	10	500
2	Sealing machine	--	1	4000	10	400
3	Stainless steel patila	40 lit	2	2200	10	220
4	Stainless steel spoons	Big	6	480	10	48
5	Stainless steel trays	Big	4	800	10	80
6	Stainless steel buckets	20 lit.	2	1500	10	150
7	Chopping knives	--	2	300	10	30
8	Chopping board	--	1	100	10	10
9	Tubs plastic	--	2	400	20	80
10	Refrigerator	300 lit	1	35000	10	3500
11	Rectangular steel moulds	2×4×5 cm	20	1400	10	140
12	Pressure cooker	20 lit.	1	5000	10	500
13	Measuring vessels	1 lit	2	50	10	5

14	Electric mixer		1	8000	10	800
15	Electric meat mincer	--	1	58500	10	5850
16	LPG connection (DBC)	--	1	1900	--	-
17	Burner brass	--	2	2000	10	200
18	Lighter electronic	--	1	80	10	8
	Total			126710		12521

Table 3: Detailed break up of product cost for the manufacture of pumpkin seed powder and chia seed powder incorporated chicken meat nuggets

Sr. No.	Component	Rate per kg (Rs.)	Requirement (per annum)	Expenditure (per annum) Rs.						
				Control	3P	6P	9P	2C	4C	6C
A)	Manufacturing cost									
a)	Direct product cost									
I	Raw material									
	Meat without deboning	120	27273							
1	Deboned meat for control (55% of whole meat)	218	15000	3270000						
2	Deboned meat for 3P (55% of whole meat)	218	15000		3270000					
3	Deboned meat for 6P (55% of whole meat)	218	15000			3270000				
4	Deboned meat for 9P (55% of whole meat)	218	15000				3270000			
5	Deboned meat for 2C (55% of whole meat)	218	15000					3270000		
6	Deboned meat for 4C (55% of whole meat)	218	15000						3270000	
7	Deboned meat for 6C (55% of whole meat)	218	15000							3270000
9	Sodium chloride (2%)	16	300	4800	4800	4800	4800	4800	4800	4800
10	Sodium tripolyphosphate	280	60	16800	16,800	16,800	16,800	16,800	16,800	16,800
11	Sodium nitrite	240	2.3	552	552	552	552	552	552	552
12	Spice mix	450	300	135000	135000	135000	135000	135000	135000	135000
13	Bread crumb powder	30	300	9000	9000	9000	9000	9000	9000	9000
14	Ground nut Oil	80	1050	84000	84000	84000	84000	84000	84000	84000
15	Condiments	50	450	22500	22500	22500	22500	22500	22500	22500
16	Control									
17	Pumpkin for 3% incorporation level	400	450		180000					
18	Pumpkin for 6% incorporation level	400	900			360000				
19	Pumpkin for 9% incorporation level	400	1350				540000			
20	Chia for 2% incorporation level	350	300					105000		
21	Chia for 4% incorporation level	350	600						210000	
22	Chia for 6% incorporation level	350	900							315000
23	Printed polypacks (Capacity – 500 g)	0.50/pack	36000 packs	18,000	18,000	18,000	18,000	18,000	18,000	18,000
	Sub Total (I)			3560652	3740652	3920652	4100652	3665652	3770652	3875652
II	Operating labour and supervision									
1	Skilled Labour					10000/month		Two		2,40,000
	Sub-total (II)									2,40,000
III.	Power and utility									
1	Power					6.2/KWH		840 KWH		5,208
2	Water					2/100 lit		150000		3000
	Sub-total (III)									8,208
IV	Maintenance/Laboratory charges					1000/month				12,000
V	Cleaning material (detergent)					80/kg.		300		24,000
	Sub-total (a) = (I+II+III+IV+V)									
	For control									3884860
	For T1									4024860
	For T2									4204860
	For T3									4384860
	For T4									3949860
	For T5									4054860
	For T6									4159860
(b)	Fixed charges									
1	Rent for building					3500/month				42,000
2	Depreciation on capital investment (10%)									12521
3	Insurance and taxes @ 4% of capital investment									5068
	Sub-total (b) =									59589
	Sub-total A = a + b									
	For control									3944449
	For T1									4084449
	For T2									4264449
	For T3									4444449
	For T4									4009449
	For T5									4114449

	For T6		4219449
B	General expenses Interest on investment @ 15% per annum		19007
c)	Product cost (A+B)		
	Product cost per annum for meat nuggets (control)		3963456
	Product cost per annum for meat nuggets 3P		4103456
	Product cost per annum for meat nuggets 6P		4283456
	Product cost per annum for meat nuggets 9P		4463456
	Product cost per annum for meat nuggets 2C		4028456
	Product cost per annum for meat nuggets 4C		4133456
	Product cost per annum for meat nuggets 6C		4238456

To arrive at accurate production cost of chicken meat nuggets under commercial conditions, the expenditure incurred in terms of recurring and non-recurring costs including labour charges, power and utility, maintenance charges, depreciation

on machinery were taken as overhead expenditure in addition to the cost of ingredients. Handling and other losses were considered as nil. Disposal of finished product was considered as cent per cent.

Table 4: Cost of chicken meat nuggets per kg

	Total raw material (kg)	Cooking yield (%)	Final product (kg)	Cost/kg (Rs.)
1. Product cost per kg for chicken meat nuggets (control)	17462	83.37	14558.06	272.25
2. Product cost per kg for chicken meat nuggets (3P)	17912	84.38	15114.14	271.49
3. Product cost per kg for chicken meat nuggets (6P)	18362	85.43	15686.65	273.06
4. Product cost per kg for chicken meat nuggets (9P)	18812	87.61	16481.19	270.82
5. Product cost per kg for chicken meat nuggets (2C)	17762	85.07	15110.13	266.60
6. Product cost per kg for chicken meat nuggets (4C)	18062	87.20	15750.06	262.44
7. Product cost per kg for chicken meat nuggets (6C)	18362	91.58	16815.91	252.05

Cost of production of control and treated chicken meat nuggets ranged from Rs 252.05/kg to 273.06/kg (Table 4). Lowest cost of production was found in 6% chia seed powder treated nuggets. Lower cost of production of chia seed powder treated nuggets was due to their higher cooking yield.

Conclusion

It is concluded that healthier chicken nuggets with low cost can be produced by incorporating pumpkin seed powder and chia seed powder. It was noticed that 6% chia seed powder incorporated nuggets had lowest cost of production as compared to control nuggets.

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