Original Article

Indian Journal of Agriculture Business
Volume 10 Number 2, July - December 2024
DOI: http://dx. doi. org/10. 21088/ijab.2454.7964.10124.1

Development of Chicken Meat Mince Enriched Biscuits and their Cost Economics: Benefit Ratio

Raj Kumar Berwal[1], Rekha Berwal[2]

How to cite this article:

Raj Kumar Berwal, Rekha Berwal. Development of Chicken Meat Mince Enriched Biscuits and their Cost Economics: Benefit Ratio. Ind. J Agri Busi 2024;10(3):65–72.

Abstract

Chicken (broiler) meat mince was utilized as a source of protein in the current investigation. Chicken meat mince was added at 10, 20, 30, 40, and 50% levels in addition to other items that were added as controls.

Based on a sensory examination, the chicken biscuits containing twenty percent CMM were the most favored. No reports of chicken-infused biscuits have been made, either in India or beyond. Since cereal (refined wheat flour) has relatively little protein and lacks the important amino acids tryptophan, lysine, and threonine, the majority of biscuits on the market are made using this flour. When eaten in place of cereal biscuits made from refined wheat flour, the biscuits thus created can provide a high amount of nutrients, particularly protein. The items that have been produced have the potential to be utilized in feeding programs at institutions, schools, and for older individuals who are more vulnerable to malnutrition, especially when it comes to deficiencies in critical amino acids and protein. Threonine, tryptophan, and lysine are also abundant in chicken meat.Making chicken-incorporated biscuits with wheat flour and chicken flesh would therefore result in a wholesome, practical, and ready-to-eat food item. The purpose of the current study was to create biscuits using chicken meat.

It was determined that the biscuits made with 20% chicken meat mince and wheat flour would offer a convenient, ready-to-eat food item that is healthy and contains enough important amino acids (lysine, tryptophan, and threonine). The cost per kg of biscuits produced with 20 percent CMM came to ₹ 82.40

Keywords: Biscuits, Chicken meat mince, Refined wheat flour, Essential amino acids, Cost economics.

INTRODUCTION

The Latin term "panisbiscoctus," which meaning "twice cooked bread," is considered to be the source of the name biscuit. These miniature cakes are called biscuits in Britain, albeit English biscuits are often crispier than their North American counterparts and smaller in size. In India, biscuits are a commonly consumed snack, often paired with

Author's Affiliation: [1]Officer-in-Charge, Department of Livestock Products Technology, College of Veterinary & Animal Science, Rajasthan University of Veterinary & Animal Sciences, Bikaner, Rajasthan, India, [2]Associate Professor, Department of Home Science, Ch. BRG. Govt. Girls College, Sri Ganganagar, Rajasthan, India.

Corresponding Author: Raj Kumar Berwal, Officer-in-Charge, Department of Livestock Products Technology, College of Veterinary & Animal Science, Rajasthan University of Veterinary & Animal Sciences, Bikaner, Rajasthan, India.

E-mail: drberwalraj@gmail.com

Received on: 16-08-2024 **Accepted on:** 13-11-2024

tea. According to Majeed M. Abu Khader (2015), children quickly consume these baked goods, moms use them as pacifiers, and sick patients frequently choose biscuits to other foods.

Throughout human history, convenience meals have been essential to survival. Convenience food production has revolutionized itself in response to the needs, preferences, and dietary needs of a sizable portion of the population. This is especially true of technological advancements in the fields of processing equipment, procedures, and packaging materials. According to Sharma and Bawa (2003), convenience meals such as breads, biscuits, cakes, chapattis, and other ethnic cuisines are greatly appreciated and have shown to be beneficial. Shelf-stable snack foods are becoming more and more popular among processed goods.A snack is a small meal that is consumed in between larger meals and can consist of a variety of goods. Food intake is becoming more erratic, frequently without set meal times, away from home, and in between meals due to changes in work responsibilities, family structure, and lifestyle (Poulain, 2002 and Mestdog, 2005).

In addition to having all the essential amino and fatty acids and providing vitamin B and minerals like Cu, Zn, Na, K, Fe, and P, chicken is a good source of easily digested protein. There are many different kinds of biscuits on the market, but the majority of them solely contain vegetarian components. As a result, a high-protein biscuit that contains iron, fatty acids, and necessary amino acids was created. Being a high-protein snack, it can address children's protein-calorie malnutrition and meet the needs of the armed forces and civilian sectors. Sharma, R. K. (2017). A large number of people in underdeveloped nations live off of cereal grains, which frequently contain insufficient amounts and types of protein. One of the most common nutritional deficits is a lack of high-quality proteins. The more protein that is needed to maintain the nitrogen balance, the lower the quality of the protein. Because gelatin protein lacks necessary amino acids, it cannot provide nitrogen balance at any feeding quantity. good grade protein blends can be ingested in less total food intake than lower quality protein products to offer required nutrition, since it has been frequently shown that there is a lesser requirement of protein if the quality is good.

Cereal and grain-based snacks have low nutrient density, high calorie and fat content, and lack certain key amino acids such as lysine, tryptophan, and threonine. Wheat protein is also regarded as having low nutritional value (Jean *et al.*, 1996). As a result, there is now more interest in creating protein-rich, energy-dense cookies with acceptable value addition, particularly to address the issue of protein energy malnutrition, which is rather common among children from low-income families in India. Nutritionally, cookies are easily combined with flours high in protein to create a quick and easy meal to complement diets of low quality.

Although there is documented evidence of the use and functionality of wheat flour fortified with legume flour, defatted soya flour, corn or rice flour, textured soy protein, fish meat, fish and milk protein concentrates, cotton seed, or other protein-rich additives in the preparation and enhancement of the nutritional value of biscuits and cookies (Suknark*et al.*, 1998, Singh *et al.*, 2000, Gupta, 2001, Garg, 2001, and Lovis, 2003), there is comparatively little systematic research and information available on chicken meat mince incorporated cookies, both in India and overseas.

MATERIALS AND METHODS

Broiler chickens

Broiler birds of same age (six weeks) reared under similar feeding and manage- mental conditions were obtained from the Poultry Department, College of Veterinary & Animal Science, Rajasthan University of Veterinary and Animal Sciences (RAJUVAS), Bikaner.

Refined wheat flour

The study's fresh refined wheat flour (RWF), also known as maida, was purchased from the neighborhood market and stored in airtight containers for later use.

Shortening / dehydrogenated fat

The refined vegetable oil of brand Amrit Banaspati Co. Ltd, Chandigarh Road, Rajpura (Punjab), free of argemon (labeled as Gagan) was purchased from the neighborhood market.

Sugar powder

Sugar powder was procured from the local market and stored in air tight jar for subsequent use.

Milk

Fresh buffalo milk was obtained from the department of ILFC, COVS. RAJUVAS - Bikaner for use in the preparation of biscuits.

Eggs

Fresh hen eggs were obtained from the layer farm of Department of Poultry Science. COVAS, RAJUVAS - Bikaner

Salt

Purchased at the neighborhood market, Iodized table salt (2%) (Tata salt, Tata Chemicals Ltd., Mumbai) was kept for later use in a moisture-free PET (polyethylene terephthalate) container.

Table 1: Spice mix formulation

Sr. No.	Name of ingredient	Percentage (w/w)
1	Caraway seeds	10
2	Black pepper	10
3	Cumin seeds	15
4	Coriander	15
5	Aniseeds	10
6	Cloves	5
7	Mace	7
8	Cardamom dry	5
9	Cardamom dry/ Badi Elaichi	3
10	Capsicum	7
11	Dry ginger powder	5
12	Cinnamon	5
13	Nutmeg	3
	Total	**100**

Spice mix

In order to make the spice mix, various fresh spice items were purchased from the nearby market, washed, and then heated for two hours at 50±2°C in a hot air oven. After that, the components were processed through a U.S. 30 mesh filter and ground using an Inalsa grinder. The powdered spices were combined according to the recipe provided in *Table 1* to create the spice mix, which was then kept in a PET (polyethylene terephthalate) jar for later use.

Packaging material

Low density polyethylene (LDPE) pouches were used for anaerobic packaging for the storage studies.

Slaughter of birds

After stunning the birds with a forceful blow to the head, they were killed in the department of Poultry Science in accordance with the protocol described by Panda (1995). The feathers and skin were manually removed after the skin had been bleeding for 1.5 minutes. The birds were carefully cleaned and decapitated. The deboned meat was packaged in low density polyethylene (LDPE) bags and kept in a deep freezer at -18 ± 1˚C for future research after the carcasses were carefully dissected. The amount of frozen meat needed for the experiment was removed, and it was left at 4± 1˚C for the night to partially defrost before being minced in a meat mincer and used.

Preparation of Chicken Meat Mince (CMM)

To make chicken meat mince-incorporated biscuits, the deboned frozen meat was minced using an electrical meat mincer and then properly kneaded.

Table 2: Formulation of biscuits made with different levels of chicken meat mince (CMM)

Ingredients (g)	CB
	Control
Refined wheat flour	100
Chicken meat mince	0
Shortening/Veg.ghee	40
Sugar powder	25
Whole egg	15
Spice mix	0.6
Table salt	1.5
Baking powder	1
Vanilla essence	5 drops
Coloring agent (orange red sol.1%)	3 ml

CB = control biscuits ,BM = Biscuits with chicken meat mince

*(Dough sheet could not be madebecause of loose consistency)

Preparation of chicken incorporated biscuits with different levels of CMM

Different amounts of chicken meat mince (CMM), sugar, shortening, and other ingredients listed in *Tables 2* were used to produce three different kinds of biscuits. The formulation shown in Table 1 was followed when using the spice mixture. For two to three minutes, all the ingredients were combined in a bowl mixer to create a uniform dough.The prepared dough was rolled out using Chakla and Belan to the ideal thickness, and then a biscuit die (cutter) was used to cut it into the required shape—a heart. regarding biscuits produced using CMM. Due to its loose nature, the dough sheet made with 30% CMM

could not be rolled. Therefore, as indicated in Table 2, the dough sheet could only be prepared up to 20% CMM level. Raw chicken meat biscuits (CMB) are made with different levels of CMM, placed in stainless steel pans, and baked at 160°C for 15 to 20 minutes, or until golden brown in the bakery. After baking, the cookies were cooled, sorted, sealed in LDPE thin bags, and stored in pearl pet airtight jars for later sensory analysis to ascertain the ideal CMM content in the most developed biscuits.

Chicken Meat Mince Incorporated Biscuits

Biscuits with 10% CMM
BM10

Biscuits with 20% CMM
BM20

RESULTS AND DISCUSSION

Selection of optimum level of chicken meat minces in the developed biscuits.

Sensory scores of chicken incorporated biscuits with different levels of chicken meat mince are presented in Table 3.

Table 3: Sensory characteristics of chicken incorporated biscuits with different levels of chicken meat mince (CMM)

Sensory Parameter	Chicken meat mince (CMM) incorporated biscuits		
	CB	BM 10	BM 20
	Control	10% CMM	20% CMM
Color and appearance	7.75b ± 0.09	7.73b ± 0.12	8.47a ± 0.11
Flavor	7.33b ± 0.12	7.53b ± 0.16	8.31a ± 0.11
Texture / Crispness	7.55ab ± 0.13	7.93a ± 0.06	7.21b ± 0.16
Taste	7.55b ± 0.13	7.80ab ± 0.10	8.11a **± 0.11**
Overall acceptability	7.67 b **± 0.12**	7.60 b ± 0.16	8.67 a ± 0.12

Mean ± S.E. with different small letter superscripts in a row within each parameter differ significantly (P ≤ 0.05); n =6.

The average color and attractiveness score for the control biscuits was 7.75, but when 20% CMM was added, it dramatically raised to 8.47. The flavor score of the cookies containing 20% CMM rose dramatically from 7.33 (the control) to 8.31 (the integrated cookie). The crispness score of the biscuits containing 10% CMM increased non-significantly from 7.72 (control) to 7.93 (biscuits with 10% CMM); however, a substantial decline was noted at the addition of 20% CMM, with scores falling from 7.93 to 7.21, respectively. The average flavor rating for the control biscuits was 7.55, but adding 20% CMM dramatically raised it to 8.11. Taste and overall acceptability ratings increased considerably from 7.67 to 8.67 for 20% CMM. Given that the biscuits (BP20) containing 20% CMM scored higher than the biscuits including CMM (Table 3). It was chosen for additional research.

When comparing the color scores of biscuits containing 10% chicken meat mince (CMM), there was no discernible variation. After adding an additional 20% CMM, the color scores dramatically improved. The casing hardening at a high temperature (160˚C) during baking could be the cause of this. This result was consistent with observations made by Bate Smith *et al.* (1943).

The higher the level of CMM inclusion, the more the biscuits' flavor scores increased. This could be because the strength of the meat flavor grows as the amount of meat increases. When 20% or more CMM was incorporated into the biscuits, the crispiness scores dramatically dropped; nonetheless, the biscuits' texture score dropped to 7.21 from 7.55 at that point. Meat's higher water activity than the control's (refined flour) could be the cause of that. The crispiness or texture of a food, such as biscuits, is one of the key elements influencing consumer approval. Depending on the product, snack foods lost their crispness when their water activity went over 0.35 to 0.5 (Kartz and Labuza, 1981).

The biscuits' taste and general acceptability scores declined somewhat up to 10% CMM but then sharply increased to 8.68 at the 20% CMM level of inclusion, which is the most acceptable. The general acceptability of biscuits containing CMM was found to be optimal up to a 20% level based on sensory evaluation.

Proximate composition of raw ingredients used for making chicken meat mince incorporated biscuits

The moisture content, crude protein, crude fat and ash content of the raw material usedin thestudyhasbeenpresented in *Table 4*.

Table 4: Proximate composition (per cent, on fresh basis) of developed chicken incorporated biscuits

Treatments	Biscuits			
	Moisture	Crude protein	Crude fat	Ash
CB Control biscuits	1.35 c **± 0.03**	9.57 c **±0.01**	20.58c **± 0.04**	0.84c **±0.03**
BM 20 Biscuits made with 20%CMM	2.56 a **±0.02**	12.98 b **±0.05**	21.75 b **±0.06**	1.13 ab **±0.01**

Mean ± S.E. with different small letter superscripts in a column within each parameter (within each product) differ significantly (P ≤ 0.05); n = 6

CMM = Chicken meat mince

When the amount of CMM increased, the moisture content of the control biscuits, which was 1.35 percent, increased significantly (P ≤0.05). The biscuits BM20 (2.56 percent) with a 20% level of chicken meat mince integration had the highest moisture content.

Proximate composition of selected biscuits incorporated with different levels of chicken meat mince (CMM)

The control biscuits' crude protein content was determined to be 9.57%, and it raised considerably (P ≤0.05) when the amount of chicken meat integration increased (*Table 4*). The biscuits created with 20 percent chicken meat mince had the highest crude protein level, measuring 12.98 percent.

Comparably, the crude fat and ash content of the control biscuits was 20.58 percent fat and 0.84 percent ash, respectively, and these values increased considerably (P ≤0.05) when the amount of CMM increased. The biscuits BM20 had a crude fat level of 21.75 percent.

Cost benefit ratio of biscuits incorporated with chicken meat mince

The processing costs of biscuits containing 20% CMM and control biscuits were computed. With depreciation of ₹ 25395, the capital investment for the annual production of 15000 kg of cookies infused with 20% chicken meat mince was Rs. 253750 (*Table 5*).

Table 5: Major capital investment with cost and annual depreciation for preparation of 50 kg of biscuits incorporated with chicken meat mince (CMM) per day

S. no.	Items	Particulars	Qty.	Estimated cost (₹)	Rate of depreciation (%)	Annual depreciation (₹)
1	Weighing balance	10 Kg	1	2000	10	200
2	Oven for baking &drying	Big rotary type (20tray capacity)	1	15000	10	15000
3	Stainless steel patila	40 lit.	2	2000	10	200
4	Dough making machine	Big (25 Kg capacity)	1	25000	10	2500
5	Stainless steel biscuit cutter	One set each	1	150	10	15
6	Baking trays (iron)	Big	50	2500	10	250
7	Stainless steel bucket	10 lit.	1	300	10	30
8	Chopping knives	-	2	200	10	20
9	Chopping board	-	1	100	10	10
10	Cookies dropping bag (cotton)	1kg capacity	2	200	20	40
11	Refrigerator	300 lit.	1	15000	10	1500
12	Deep freezer	110 lit.	1	25000	10	2500
13	Pressure cookers	20 lit.	2	4000	10	400
14	LPG connection	-	1	2500	10	250
15	Burner brass	-	2	800	10	80
16	Electronic lighter	-	1	50	10	5
17	Electric meat mincer	-	1	20000	10	2000
18	Stainless steel spoon	Big	2	150	10	15
19	Sealing machine	-	1	3500	10	350
20	Measuring vessels	1 lit.	2	100	10	10
21	Ceiling fan	-	1	1200	10	120
22	Miscellaneous items	-	-	1000	-	-
	Total			**253750**		**25395**

Table 6: Detailed breakup of the production cost of 50 kg biscuits incorporated with chicken meat mince (CMM)

Sr. No.	Component	Rate (₹)	Requirement (Kg. per annum)	Expenditure (Rs. Per annum)
	Manufacturing cost Direct product cost			
I. Raw material				
1.	Refined wheat flour	20/kg	15,000 kg	3,00000
2.	Broiler meat (without deboning)	120 /kg	5446 kg for BM20	653520 = BM20
3	Deboned meat (55% of whole meat)	218 /kg	BM20= 3000 kg	-
5.	Common salt	10/kg	225 kg	2250
6.	Sugar (powder)	35/kg	3750 kg	131250
7.	Spice mix	600/kg	90 kg	54000
8.	Shortening / Oil	100/kg	6000 kg	600000
9.	Milk (buffalo)	30/kg	3750 kg	102500
10	Printed poly packs (capacity –200 g)	0.30/pack	30000 packs	9000
11.	Baking powder	100/kg	150 kg	15000
12	Vanilla essence	400/ ltr	120 ltr	48,000
13	Colouring agent	450/ kg	4.5 kg	20200

Sr. No.	Component	Rate (₹)	Requirement (Kg. per annum)	Expenditure (Rs. Per annum)
Subtotal (I)				
II. Operating labour and supervision				
1.	Supervisor	12,000/month	One	1,44,000
2.	Labour	6,000/month	Two	1,44,000
Sub-total (II) 2,88,000				
III. Power and utility				
1	Electricity power for drying chicken meat	6/KWH	10800 KWH	64800
2.	Electricity power (general)	5/KWH	900 KWH	5400
3.	Water	1/100 lit	2,50,000	2,500
III. Sub-total 72,700				
IV	Maintenance/Laboratory charges	1000/month		12,000
V	Cleaning material (detergent)	20/kg.	300	6,000
VI	LPG Cylinder	1,300/19 kg	15x19 kg	19,500
Sub-total (a) = I+II+III+IV+V+VI) for CB 1491800				
(b) Fixed charges				
1.	Rent for building	5,000/month		60,000
2.	Depreciation on capital investment (10%)			25395
3.	Insurance and taxes @ 2% of capital investment			5074
Sub-total (b) 90469				
(A)	**Sub-total A = a+b 1165343**			
(B)	**General expenses** Interest on investment @ 12% per annum	11,274		
(B) Product cost (A+B)				

Product	Total cost (Rs./ Annum)	Total raw material (kg)	Yield (%)	Final product (kg)	Cost (Rs./ kg)
CB	1593543	25219.5	85.88	21058.5	**75.67**
BM20	1725100	25144.5	83.26	20935.31	**82.40**

In *Table 5*, the processing cost, fixed charges, and general expenses are broken down in detail. The total amount of deboned broiler meat processed for cookies in a year, adding 20 percent CMM, was estimated to be 1500 kg, or 50 kg per day annually. The ultimate cost of each product was determined by factoring in the price and weight of all additional ingredients, including baking soda, essence, sugar, common salt, refined wheat flour, vegetable ghee, spice mix, and milk.

Table 6 pre sents the calculated final cost per kg for each product. The cost of biscuits with 20% CMM was computed to be ₹ 82.40 per kg, while the cost of control cookies was ₹ 75.67.

CONCLUSION

The production cost of ready to eat, convenient, self-stable Chicken Biscuits with 20 per cent chicken meat mince having good sensory/ organoleptic attributes was 82.40 per kg.

REFERENCES

1. Bate-Smith, E.C., Lea, C.H. and Sharp, J.D. (1943). Dried Meat. *Journal of the Society of Chemical Industry*.**62(7):**100-104.

2. FAO. (1970). Food and Agriculture organization. Amino acids content of foods and biological data on protein. Rome: Food and Agriculture Organization.
3. Garg, R. (2001). Development of nutritional evaluation of some novel food products of wheat and legume blends. MSc. Thesis, Haryana Agricultural University, Hisar , India.
4. Gupta, V. (2001). Nutritional and sensory evaluation of value added bakery products, MSc. Thesis, CCS. HAU. Hisar, India.
5. Hooda, S. (2002). Nutritional evaluation of fenugreek supplemented wheat products. MSc. Thesis, CCS. HAU. Hisar, India.
6. Jean, I.J., Work, R., Camire, M.E., Bril,and Bushway, A.A. (1996). Selected properties of extruded potato and chicken meat. *J. Food Sci.* **61(4):** 783-789.
7. Jorfi, R., Mustafa, S., Che Man, Y.B., Mat Hashim, D.B., Sazili, A.Q., Farjam, A.S., Nateghi, I. and Kashiani, P. (2012). Differentiation of por from beef, chicken, mutton and chevon according in their primary amino acids content for halal authentication. *African Journal of Biotechnology.* **11 (32):** 8160-8166.
8. Kartz, E.E. and Labuza, T.P. (1981). Effect of water activity on the sensory crispiness and mechanical deformation of snack food products. *J. Food Sci..*, **40:** 403-409.
9. Kondaiah, N., Panda, B., Anjaneyulu, A.S.R. and Singh, R.P. (1988). Utilization of whole meat components from spent Hens for chicken sausage production. *Indian J. Poult. Sci.*, **23:** 135-141.
10. Lorenz, K. (1983). Protein fortification of cookies, *Cereal Foods World*, **28(8)**; 449-452.
11. Lovis, L.J. (2003).Alternatives to wheat flour in baked goods, *Cereal Foods World*, **48(2)**;61-63.
12. Lunven, P., Clement, C.L., Carnovale, E. and Fratoni, A. (1973). Amino acid composition of hen's egg. *Br. J. Nutr.*, **30:** 189-190.
13. Majed M. AbuKhader (2015).Snack foods and beverages for children: Eat or not to eat? Mediterranean Journal of Nutrition and Metabolism 8 (2015) 155–163.
14. Mestdag, I. (2005). Disappearance of the traditional meal, tempura, social andspatial De- structuration.. *Appetite,* **45:** 62-74.
15. Padhye, V.W. and Salunkhe, D.K. (1978). Biochemical studies on black gram *(Phaseolus mungo* L) II Fermentation of black gram and rice blend and its influence on the in vitro digestibility of the proteins. *J. Food Biochemistry.* **2:**327-347.
16. Panda, P.C. (1995). Slaughtering techniques. In "Text book on egg and poultry technology". Vikas Publications, New Delhi, India.
17. Poulain, J.P. (2002). The contemporary diet in France. "De-structuration" or from commensalism to "vagabond feeding". *Appetite,* **45:** 43-55.
18. Sharma, R.K.(2017). Food Products and Technologies Developed by DRDO September-October 2017 :11
19. Sharma, B.D. and Nanda, P.K. (2002). Studies on the development and storage stability of chicken chips. *Indian Journal of Poultry Sci.* **37(2):** 155
20. Sharma, G.K. and Bawa, A.S. (2003). DFLE in the services of specific consumers- convenience foods and operational rations, *IFCON*, December, 5-8, 2003.
21. Singh, R., Singh, G. and Chauhan, G.S.(2000). Nutritional evaluation of soy fortified biscuits. *J. Food Sci.Technol.* **37:** 162-164.
22. Surender, Kumar (2009). Development and quality evaluation of chicken enriched noodles. M.V.Sc. Thesis, CCSHAU, Hisar, Haryana, India.
23. Suknark, K., Phillips, R.D., Huang, Y.W.(1998). Development of high protein, tapioca- based snacks from minced fish and partially defatted peanut flour using twin- screw extrusion. Unpublished data. Center for Food Safety and Quality Enrichment. The University of Georgia, Griffin, G.A.