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Proxiamte Composition of Minced Meat Patties Incorporated with Soy-Protein–Isolate

Abstract

Protein, the most valuable component of food can be of plant origin or animal origin but animal proteins have advantage of more digestibility, higher biological value and presence of essential amino acids, which are usually absent or lacking in plant proteins. Amongst various sources of proteins of animal origin we have egg, milk, beef, mutton, chevon, fish etc. Besides egg and milk, which are considered to be complete food, are differentiated into vegetarian foods in comparison to the non-vegetarian foods in accordance with the Indian classification, though eggs are classified into both vegetarian and non-vegetarian foods depending upon whether egg is fertilized or not. Mutton and chevon are found to be rich in amino acids specially argenine, lucine and isolucine (Srinivasan and Moorjani,1974).

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Introduction

Amongst the proteins of plant origin, cereals, beans and pulses are the best sources. These proteins are considered to be partially incomplete because partial or complete absence of some of the essential amino acids. Therefore, for the vegetarian segment it is usually recommended to supplement their one section of cereal/pulse with other section of cereal/pulse to overcome this deficiency. With the food scientists, nutritionists and technologists being more concerned about the prevailing deficiencies, recommend the supplementation/ fortification/ complementation of the cereal based foods with other rich sources of amino acids. This complementation can be achieved by mixing two plant based ingredients, such as wheat-flour and soy-flour; fortifying meat based products with vegetable proteins as fillers or extenders etc.

For many years rapid growth in meat based fast food industry has resulted in an increased utilization of plant proteins as binders, fillers and extenders in comminuted form. Preparation of functional meat emulsion is the foremost step for the manufacture of good quality products. Extenders such as non-fat-dry-milk-solids, texturized vegetable proteins and plant starches have been used to maximize quality and minimize cost. Non-meat ingredients are useful in emulsified meat products because of their functional properties (emulsification, water and fat binding capacity,

improvement of texture and appearance). Addition of non-meat ingredients to meat products reduces fat and cholesterol content by dilution. In some instances, they decrease cooking losses with little effect on texture. These products are usually referred to as binders or extenders, fillers, emulsifiers or stabilizers are added to meat formulations to reduce formulation costs, to improve cooking yield, to improve slicing characteristics, to improve flavour, to increase the protein content, to improve the emulsion stability, to improve fat binding, to increase water binding and to reduce shrinkage during cooking.

Material and Methods

Keeping in view the importance of proteins in Indian diets, the present study was conducted in Department of Food Science and Nutrition, College of Home science, CSKHPKV Palampur. The main objective of the present study was the development of meat based food product with added Soy-proteins to improve the nutritional quality of the end product. For this, soy-protein-isolate (SPI) in hydrated form (mixed with water in the ratio of 1:4) was mixed with minced meat and molded patties were prepared in the laboratory. Proximate analysis of the final product was done to evaluate the effect of SPI supplementation in the ratio of 90:10, 80:20 and 70:30, keeping the 100 per cent minced meat patties as control.

The freshly slaughtered mutton for the development of patties was refrigerated for a full day and the next day the ice-cool mutton was minced in an electrical minecr (Reimi Co.) using the plate with the apertures of 8 mm thickness followed by passing it again through the palte of 4 mm thickness to get a finely minced mutton.

The patties were moulded in a Petri dish after weighing the emulsion. The moulded emulsion was spread over the greased surface and kept in pre-heated oven at 200^{O}C for 15 min. The patties were turned occasionally after slight browning, which took approximately 5 min for one side. Care was taken to ensure that the emulsion did not stick to the cooking surface. The end-point was recorded when the fat stops oozing out of the emulsion. The steps followed in the preparation of patties are illustrated in Figure I

Results and Discussion

In the present investigation, an attempt was made to blend mutton with soy-isolate as extender to the basic commodity, i.e. the mutton. The soy-protein-isolate was utilized as extenders for the preparation of patties in the ratios of 90:10, 80:20 and 70:30. The products developed were analyzed for their proximate composition. The patties were packed in polyethylene bags and stored in refrigerated conditions for 21 days. During the storage period also, the products were analyzed for their proximate composition as fresh and after a weekly interval up to 21 days.

The moisture content of the patties significantly increased with increase in the ratio of soy-protein-isolates. The control or the whole mutton patties had 55.04 per cent moisture, which significantly increased up to 55.87 per cent when extended with 30 per cent of soy-isolate (Table 1). There was no significant effect of storage on the moisture content of the patties, which otherwise decreased with storage in patties extended with soy-isolate. In whole mutton patties the per cent moisture content was 56.89 per cent which after the storage of 21 days decreased to 55.13 per cent..

Berry and Wergin (1993) reported an increase in moisture content of meat patties replaced with 5 – 20 per cent of Modified Pre-gelatinzed Potato Starch (MPPS) crumbles. They attributed this to the high water binding properties of MPPS, which allowed fat to cook more effectively out of the patties. Miller *et al* (1986) reported that restructured steaks containing 20 per cent Texturized Soy Protein (TSP) or Vital Wheat Gluten (VWG) were higher in moisture content than the control and the steaks extended with 10 per cent TSP or VWG. Huffman and Powell (1970), Vidyarathi (1987), Chodhury *et al* (1992), claimed that incorporation of soy-proteins did not affect the moisture content of the meat product. Jindal and Bawa (1988) and Chodhury (1992) reported a decrease in the moisture content due to incorporation of Soy-flour in poultry meat sausages and goat meat balls respectively. Yetim *et al* (1992) found an increase in moisture content up to 20 per cent level of TSP in Turkish style sausages.

The increase in moisture content of the patties with simultaneous blending with soy-isolate can be attributed to the hydration of soy-proteins which was done in the ratio of 1:4 (soy-protein: water). It tended to increase the moisture content of the final product. Also, as stated by Kotula (1976), Egbert *et al* (1991) and Faller *et al* (1999), addition of soy-proteins/ vegetable proteins increased the water binding capacity of products. The results of the present study were in conformation with the results of Miller *et al* (1986), Yetim *et al* (1992) and Berry and Wergin (1993).

The protein analysis of the products revealed that, the protein content of the patties increased significantly with increase in the ratio of soy-isolates(Table 1). The initial protein content of the patties prepared from whole mutton was 17.82 per cent, which after blending with soy-isolates increased to 23.64 and 29.09 per cent after the incorporation of 20 and 30 per cent soy-isolates respectively. The storage period of 21 days, in general, had no significant effect on the protein content of patties. However the protein content of 20 and 30 per cent blend of mutton : soy-isolate significantly reduced up to 7 days.

Miller *et al* (1986) reported that restructured steaks extended with TSP contained less protein, as compared to control, on the contrary, an increase in protein content was reported by Huffman and Powell (1970), Jindal and Bawa (1988) and Yetim *et al* (1992). Minerich *et al* (1991) prepared beef patties by incorporating *minnerata* rice and reported that protein content decreased significantly. Chin *et al* (1998) while studying functional, textural and micro-structural properties of low fat bologna with konjac blends reported that the incorporation of konjac blends decreased the protein content when added as dry powder and increased when added as hydrated mixture.

The results of the present study are in accordance with the results of Huffman and Powell (1970), Jindal and Bawa (1988), Yetim *et al* (1992).

Minerich *et al* (1991) and also, supported by Chin *et al* (1998). The latter used the blends of soy-isolate and soy-concentrate as also in the present investigation in hydrated form. The reason for the increased protein contents in the products can be due to the higher protein content of the raw material (soy-isolate) itself, which were used for blends and contained 90 per cent and 70 per cent proteins respectively. The reduced content of proteins during storage could be due to the thawing losses and collection of it in dripped water, when the samples were taken out after the required period of storage for quality evaluation (Protein estimation).

From the foregoing, it can be derived that the products prepared after blending mutton with soy-protein-isolates (in 10, 20 and 30 per cent) contained a higher concentration of total proteins than in the products exclusively prepared by mutton. However, this concentration minimized after storage, to a milder but statistically significant degree which might be ascribed to leaching of the same on thawing subsequent to freezing while in storage. Therefore, it can be deduced that addition of the soy-proteins in meat products, increased the nutritional quality of the products, which was only mildly affected after storage at refrigerated temperature after 21 days.

The analysis for the ash content of the samples revealed that there was a significant decrease in the ash contents of patties (Table 2). The mean values of ash in whole mutton patties was 11.03 and 10.63 per cent, which decreased to 8.50 per cent with 30 per cent incorporation of soy-isolate. The storage at refrigerated temperature had no statistically significant effect on the ash content of the whole mutton patties. In fresh patties the ash content recorded was 9.90 which on refrigerated storage decreased to 9.44 per cent in mutton : soy isolate blended patties.

Jindal and Bawa (1988) and Yetim *et al* (1992) also reported a decrease in the total ash content in the (meat) products prepared, after incorporation of soy-proteins at 20 and 30 per cent levels. Minerich *et al* (1991) prepared patties by incorporating rice and reported that ash content of the patties decreased considerably as compared to control patties. Ash contents of the rice and turkey blended *papads* decreased with increase in turkey proportions in it (Berwal *et al* 1996).

The present results are in conformity with the results of Jindal and Bawa (1988), Minerich *et al* (1991), Yetim *et al* (1992), Chin *et al* (1998) and Berwal *et al*, (1996). The decrease in ash contents of the products can be suggested by the fact that the addition of soy-proteins was done in hydrated form which consequently increased the bulk of the product but reduced the ash contents as compared to the whole mutton patties. An increase in ash content during storage can be due to the decrease in moisture content of the products.

In the analysis of the patties prepared from whole muton and after blending with the soy-isolates at the rate of 10, 20 and 30 per cent concentrations revealed that the fat content significantly decreased with the increase in the concentration of soy-isolate. In patties prepared from whole mutton, the per cent fat content was 18.86 per cent which after incorporating 30 per cent soy-isolate decreased to 16.20 per cent (Tables 2). The fat content of patties decreased significantly on storage (up to 21 days). In fresh patties the fat content was 17.72 per cent which after 7 days of storage reduced to 17.54 per cent and after 21 days of storage, the fat content reduced to 17.09 per cent in mutton : soy-isolate blend patties.

A significant decrease in the fat content of different meat products has also been reported (Huffman and Powell, 1970; Thomas *et al*, 1978; Jindal and Bawa, 1988 and Yetim *et al* 1982) due to incorporation of various types of soy-proteins at different concentrations. Lin and Zayas (1987) reported a decrease in fat content of the patties at 4 per cent incorporation of maize germ protein. Trout *et al* (1992) reported no effects from the use of potato starch on fat content of cooked patties. Minnerich *et al* (1991) reported that in the patties which contained the rice flour, the fat content decreased with increasing proportion of rice flour. Chin *et al* (1998) observed that incorporation of hydrated konjac blends to bologna reduced its fat content as compared to which was prepared by incorporating powdered konjac.

The results of the present investigation are in agreement with those of Huffman and Powell (1970), Thomas *et al* (1978), Jindal and Bawa (1988), Yetim *et al* (1982), Trout *et al* (1992), Minnerich *et al* (1991) and Chin *et al* (1998). Hydration of the added soy-proteins in the products could be the reason for its reduced fat content, which ultimately reduced the absorption of extra fat during the cooking process. However, during storage, the increase in fat content of the mutton : soy-protein blended products, could be due to an overall decrease in its moisture content. Similar conclusions have been made in the literature on various preparations of meat (products) after addition of vegetable proteins (Pearson and Tauber, 1984; Minnerich *et al*, 1991; Keeton, 1993 and Mandal *et al*, 1995).

Refrences

1. *Berry, B.W. and Wergin, W.P. 1993. Modified pregelatinized potato starch in low fat ground beef ptties. Journal of Muscle Foods. 4: 305-320*
2. *Berwal, J.S., Dhanda, J.S. and Berwal, R.K. 1996. Studies on rice and turkey meat blend papads. Journal of Food Science an dTechnology. 33:237-239*
3. *Chin, K.B., Keeton, J.T., Longnecker, M.T. and Lamkey, J.W. 1998. Functional, textural and microstructural properties of low fat bologna (model system) with konjac blend. Journal of Food Science.63:801-807*
4. *Chodhury, J., Kumar, S and Keshri, R.C. 1992. Physico-chemical and organoleptic properties of chicken patties incorporating TSP. Proceedings of ICFOST. AFST(I), Mysore.*
5. *Chodhury, J.1992. Studies on incorporation of texturized soy proteins and fat levels on the quality of mutton patties. M.V.Sc Thesis. IVRI. Izzatnagar.*
6. *Egbert, W.R., Huffman, D.L, Chen, C. and Dylenski, D.P. 1991. Development of low fat ground beef. Food Technology. 45: 64-67*
7. *Faller, JY., Klein, BP., and Faller,JF. 1999. Acceptability of extruded maize snacks as affected by inclusion of soy protein. Journal of Food Science. 84:183-188*
8. *Huffamn, D.L. and Powell, W.E. 1970. Fat content and soy level effect on tenderness of ground beef patties. Food Technology.24:1418-1419*

9. Jindal, V.S. and Bawa, A.S.1988. Utilization of spent hens and soya flour in the preparation of poultry sausages. Indian Journal of Meat Science and Tecnology.1:23-27
10. Keeton, J.T. 1993. Low fat meat products: Technological problems with processing. Meat Science.36:261-276
11. Kotula, A.W. 1976. Evaluation of beef patties containing soy protein during 12 months frozen storage. Journal of Food Science.41: 1142-1145
12. Lin,C.S., and Zayas, J.1987. Influence of maize germ protein on yield and quality characteristics of communited meat products in model system. Journal of Food Science.52:545-548
13. Mandal, P.K., Kumar, S., and Wani, S.A. 1995. Use of non-meat protein extenders in meat products. Indian Food Packer.3: 51-58
14. Miller, M.F., Davis, G.W., Williams, A.C. (Jr.)., Ramsey, C.B. and Galyean, R.D. 1987. Palatability and appearance traits of beef/pork meat patties. Journa of Food Science. 52:886-889
15. Miller,M.F., Davis, G.W., Seideman, S.C., Wheeler, T.L. and Ramsey, C.B. 1986.Extending beef bullock restructured steaks with soy-protein, wheat gluten or mechanically separated beef. Journal of Food Science. 51:1169-72
16. Minnerich, P.L., Addis, P.B., Epley, R.J. and Singh, C.1991. Properties of wild rice/ground beef mixtures. Journal of Food Science.56:1154-1157
17. Pearson, A.M. and Tauber, F.W. 1984. Binders and extenders. *In* Processed meats.pp262-267
18. Srinivasan, K.S. and Moorjani, M.N. 1974. Essential amino acid content of goat meat in comparison with other meats. Journal of Food science and Technology.11:123-124
19. Thomas, M.A., Mc Brido, R., Turner, A.D. and Abad, G.H. 1978. Effect of extending beef patties with milk co-precipitates. Journal of Food Science.43:162-164
20. Trout, E.S., Hunt, M.C., Johnson, D.E., Claus, J.R., Kastner, C.L. and Kropf, D.H.1992. Characteristics of low fat ground beef containing texture modifying ingredients. Journal of Food Science.57:19-24
21. Vidyarathi, V.K. 1987. Studies on organoleptic and physico-chemical properties of goat meat patties incorporating texturized soy proteins. M.V.Sc Thesis IVRI Izzatnagar.
22. Yetim,H., Gokalp, H.Y., Kaya, M., Yanar, M. and Ockerman, H.W. 1992. Physical, chemical and organoleptic characteristics of Turkish style frankfurters made with an emulsion containing Turkish soy flour. Meat Science.31:43-56

Table 1

Effect of mutton : soy-isolate blends on the per cent residual moisture and protein contents of patties at different storage intervals

Mutton :soy-isolate	Storage (days)				
	0	7	14	21	**Mean**
Per cent residual moisture					
100:0	55.72	55.25	54.84	54.34	**55.04**
90:10	58.08	57.82	57.42	56.42	**57.43**
80:20	56.58	56.05	55.90	55.21	**55.94**
70:30	57.17	56.19	55.57	54.54	**55.87**
Mean	**56.89**	**56.33**	**56.93**	**55.13**	**56.07**
Per cent protein content					
100:0	17.96	17.84	17.70	17.79	**17.82**
90:10	19.95	19.29	19.50	18.28	**19.26**
80:20	24.26	23.53	23.48	23.27	**23.64**
70:30	30.49	29.15	28.73	28.02	**29.09**
Mean	**23.17**	**22.45**	**22.35**	**21.84**	**22.45**

CD	***at 5 per cent level* (for moisture)**	***at 5 per cent level* (for protein)**
Between blends	*0.44*	*0.60*
Between storage intervals	*0.44*	*0.60*

Table 2

Effect of mutton : soy-isolate blends on the per cent ash and fat contents of patties at different storage intervals

Mutton :soy-isolate	Storage (days)				
	0	7	14	21	**Mean**
Per cent ash content					
100:0	11.29	11.20	10.86	10.79	**11.03**
90:10	9.94	9.89	9.83	9.62	**9.82**
80:20	9.65	9.28	9.18	9.19	**9.32**
70:30	8.72	8.64	8.49	8.16	**8.50**
Mean	**9.90**	**9.75**	**9.59**	**9.44**	**9.67**
Per cent fat content					
100:0	19.39	19.00	18.73	18.31	**18.86**
90:10	17.60	17.39	17.36	17.11	**17.37**
80:20	17.55	17.47	17.41	16.96	**17.35**
70:30	16.33	16.30	16.17	16.01	**16.20**
Mean	**17.72**	**17.54**	**17.42**	**17.09**	**17.44**

CD	***at 5 per cent level* (for ash)**	***at 5 per cent level* (for fat)**
Between blends	*0.15*	*0.19*
Between storage intervals	*0.15*	*0.19*