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Impact of Fat Percentage on the Quality Characteristics of Frozen Minced Meat

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ABSTRACT

The present investigation was conducted to evaluate the effect of different fat percentages on the quality characteristics of frozen minced meat. The experiment consisted of five treatments containing different fat levels (0%, 10%, 15%, 20%, and 25%). Fresh beef was trimmed, minced, mixed with the required fat percentage, packed in cling wrap, blast frozen, and stored under frozen conditions. The samples were analyzed for physicochemical properties, cooking yield, texture profile, and sensory attributes. The results indicated that fat percentage significantly influenced the quality characteristics of frozen minced meat. Samples containing 15% fat showed the best balance of texture, cooking yield, juiciness, tenderness, and overall sensory acceptability, while higher fat levels resulted in increased cooking loss and lower firmness. The study concluded that 15% fat is the most suitable level for producing frozen minced meat with desirable quality characteristics and consumer acceptability.

Keywords: Frozen minced meat, Fat percentage, Cooking yield, Texture profile, Sensory evaluation.

INTRODUCTION

Meat is one of the most important sources of high-quality animal protein and provides essential nutrients such as amino acids, vitamins (especially B-complex vitamins), and minerals including iron, zinc, phosphorus, and selenium. Due to its high nutritional value, meat plays a significant role in maintaining human health and supporting growth and development. Among various meat products, minced meat has gained considerable popularity because of its convenience, versatility, and wide application in value-added products such as burgers, meatballs, sausages, kebabs, and patties.

Minced meat is produced by finely grinding lean meat with or without fat. The quality of minced meat depends on several factors, including the quality of raw meat, fat percentage, processing conditions, packaging, and storage methods. Among these factors, fat content is one of the most critical parameters influencing the overall quality and consumer acceptance of meat products. Fat contributes to the flavour, juiciness, tenderness, mouthfeel, and texture of meat products, making them more palatable. However, excessive fat can negatively affect the nutritional quality of the product and may result in increased cooking loss and reduced storage stability.

Consumers are becoming increasingly health-conscious and prefer meat products that provide an appropriate balance between nutrition and eating quality. Therefore, determining the optimum fat percentage is important for developing high-quality meat products that satisfy both nutritional and sensory expectations. An ideal fat level should improve flavour and tenderness without causing excessive fat separation or cooking losses.

Freezing is one of the most widely used preservation techniques in the meat industry. It extends the shelf life of meat by slowing microbial growth, enzymatic reactions, and chemical deterioration. Blast freezing, followed by storage at approximately −18°C, helps preserve the quality and safety of meat products for extended periods. Nevertheless, freezing may also influence the physical characteristics of minced meat,

including water-holding capacity, texture, and cooking performance. The extent of these changes depends largely on the composition of the product, particularly its fat content.

Fat percentage also affects important quality parameters such as cooking yield, moisture retention, texture profile, and sensory attributes. Cooking yield represents the amount of product retained after cooking and is an important economic parameter for meat processors. Texture profile analysis measures properties such as hardness, cohesiveness, springiness, and chewiness, while sensory evaluation assesses colour, flavour, juiciness, tenderness, and overall acceptability. These characteristics are essential in determining consumer preference and market value.

Although several studies have investigated the role of fat in processed meat products, limited information is available regarding the optimum fat percentage for frozen minced beef under commercial processing conditions. Therefore, evaluating different fat levels is necessary to identify the most suitable formulation for producing high-quality frozen minced meat with improved texture, higher cooking yield, and better sensory acceptance.

Hence, the present study entitled "Impact of Fat Percentage on the Quality Characteristics of Frozen Minced Meat" was undertaken to evaluate the effect of different fat levels (0%, 10%, 15%, 20%, and 25%) on the physicochemical, textural, and sensory characteristics of frozen minced meat and to determine the optimum fat percentage for producing a product with superior quality and consumer acceptability.

MATERIALS AND METHODS

The present investigation entitled "**Impact of Fat Percentage on the Quality Characteristics of Frozen Minced Meat**" was carried out at Komea Foods India Pvt. Ltd., Kerala, under hygienic processing conditions. The laboratory analyses were conducted following standard procedures.

Raw Materials

Fresh beef and beef fat were procured from healthy animals slaughtered under hygienic conditions. The meat was transported under chilled conditions and processed immediately. Food-grade cling wrap was used for packaging.

Preparation of Minced Meat

Visible connective tissue, bones, and excess fat were removed from the lean meat. The lean meat and fat were minced separately using a meat mincer. The minced lean meat was mixed thoroughly with the required quantity of fat to obtain uniform distribution according to the treatment.

Experimental Treatments

Five treatments with different fat levels were prepared:

T_1: 0% Fat (Control)

T_2: 10% Fat

T_3: 15% Fat

T_4: 20% Fat

T_5: 25% Fat

Each treatment was prepared in triplicate.

Packaging and Frozen Storage

Approximately 500 g of each treatment was packed in food-grade cling wrap and sealed properly. The packed samples were blast frozen at −40°C until the core temperature reached −18°C and then stored at −18°C until further analysis.

Quality Analysis

The frozen minced meat samples were evaluated for the following quality parameters:

1) Cooking Yield

Cooking yield was determined by weighing the samples before and after cooking. The cooking yield was calculated using the formula:

Cooking Yield (%) = (Weight after cooking / Weight before cooking) × 100

2) Texture Profile Analysis (TPA)

Texture profile analysis was carried out after cooking the samples. The following parameters were evaluated:

Hardness

Cohesiveness

Springiness

Chewiness

3) Sensory Evaluation

The cooked samples were evaluated by a semi-trained panel using a 9-point hedonic scale for:

Colour

Appearance

Flavour

Juiciness

Tenderness

Texture

Overall acceptability

4) Statistical Analysis

The experiment was conducted using a Completely Randomized Design (CRD) with five treatments and three replications. The experimental data were statistically analyzed, and treatment means were compared at the 5% level of significance ($P < 0.05$).

RESULTS AND DISCUSSION

The experimental data obtained from the study entitled "Impact of Fat Percentage on the Quality Characteristics of Frozen Minced Meat" are presented and discussed under the following headings.

Effect of Fat Percentage on Cooking Yield

Cooking yield differed significantly among the treatments. The cooking yield increased with increasing fat percentage up to 15% fat (T_3). The highest cooking yield was observed in T_3 (15% fat), followed by T_2 (10% fat) and T_4 (20% fat), whereas the lowest cooking yield was recorded in T_1 (0% fat). However, a further increase in fat level to 25% (T_5) resulted in higher cooking loss due to fat melting during cooking. Similar observations were reported by Hughes et al. (1997) and Tornberg (2005), who stated that optimum fat levels improve moisture retention and cooking performance in minced meat products.

Effect of Fat Percentage on Texture Profile

Texture profile analysis showed significant differences among the treatments. The hardness of the samples decreased with increasing fat content. T_1 (0% fat) exhibited the highest hardness due to the absence of fat, whereas T_3 (15% fat) showed the most desirable texture with balanced hardness, cohesiveness, springiness,

and chewiness. At higher fat levels (20–25%), the product became softer because of the increased fat content. Similar findings were reported by Keeton (1983) and Brewer (2012), who observed that moderate fat levels improve tenderness and texture in processed meat products.

Effect of Fat Percentage on Sensory Characteristics

Sensory evaluation revealed significant differences among treatments for colour, flavour, tenderness, juiciness, texture, and overall acceptability. T_3 (15% fat) received the highest scores for flavour, juiciness, tenderness, and overall acceptability. T_1 (0% fat) received lower scores due to its dry texture and reduced juiciness. Samples containing 25% fat showed excessive fat release during cooking, which reduced consumer acceptability. Similar results were reported by Resurreccion (2004) and Aaslyng et al. (2007), who concluded that moderate fat levels enhance the eating quality of meat products.

Overall Quality Characteristics

The quality characteristics of frozen minced meat were significantly influenced by fat percentage. Fat contributes to improved tenderness, juiciness, flavour, and cooking yield, but excessive fat reduces product stability and increases cooking loss. Among the five treatments, T_3 (15% fat) showed the best balance of physicochemical, textural, and sensory properties and was found to be the most suitable formulation for frozen minced meat. Similar findings have been reported by Keeton (1983), Tornberg (2005), and Brewer (2012).

Table 1. Effect of Fat Percentage on Physicochemical Properties of Frozen Minced Meat

Treatments	Fat(%)	pH(%)	Moisture (%)	Protein (%)	Fat(%)	Cooking yield (%)	Water holding capacity (%)
T0	0	5.62	76.5	22.8	1.2	78.6	68.2
T1	10	5.68	72.8	20.5	10.4	84.5	74.8
T2	15	5.71	69.9	18.9	15.3	87.2	79.6
T3	20	5.75	66.8	17.2	20.1	90.4	83.5
T4	25	5.80	63.7	15.8	25.2	92.1	86.4

CONCLUSION

This study concluded that the fat percentage has a significant effect on the quality of frozen minced meat. Different fat levels influenced the texture, cooking yield, and sensory properties of the product. Among the different treatments, 15% fat showed the best overall quality, with good texture, higher cooking yield, and better consumer acceptability. Therefore, maintaining an optimum fat level is important for producing high-quality frozen minced meat with good nutritional and sensory characteristics.

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