ASSESSMENT OF THE QUALITY OF TENDERIZED CHICKEN MEAT PICKLE

By

MURUGAN. M.

THESIS

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DECLARATION

I hereby declare that the thesis entitled **"ASSESSMENT OF THE QUALITY OF TENDERISED CHICKEN MEAT PICKLE"** is a bonafide record of research work done by me during the course of research and that the thesis has not previously formed the basis for the award to me of any degree, diploma, associateship, fellowship or other similar title, of any other University or Society.

Mannuthy

M. MURUGAN

CERTIFICATE

Certified that the thesis entitled "**ASSESSMENT OF THE QUALITY OF TENDERISED CHICKEN MEAT PICKLE**" is a record of research work done independently by **M. Murugan**, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

Dr. K. Narayanankutty
(Chairman, Advisory Committee)
Associate Professor
Department of Poultry Science
College of Veterinary &
Animal Sciences, Mannuthy

Mannuthy

CERTIFICATE

We, the undersigned members of the Advisory Committee of **M. Murugan**, a candidate for the degree of Master of Veterinary Science in Poultry Science, agree that the thesis entitled "**ASSESSMENT OF THE QUALITY OF TENDERISED CHICKEN MEAT PICKLE**" may be submitted by M. Murugan, in partial fulfilment of the requirement for the degree.

Dr. K. Narayanankutty
(Chairman, Advisory Committee)
Associate Professor
Department of Poultry Science

Dr. A.K.K. Unni
Director
Centre for Advanced Studies
in Poultry Science
(Member)

Dr. P.A. Peethambaran
Associate Professor
Department of Poultry Science
(Member)

Dr. P. Kuttynarayanan
Associate Professor
Meat Technology Unit
(Member)

External Examiner

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Dedicated to my Guide

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Introduction

INTRODUCTION

Chicken is gaining importance as a source of most affordable and widely acceptable meat to non-vegetarians in the country. This can be attributed to competitive price of poultry meat compared to other meats and its use in the preparation of fast foods. As the efforts to boost egg production gain momentum, incidentlly more quantity of spent poultry meat also become available. Consumer preference for broiler meat is hampering the marketing of the spent birds. Hence there is necessity for the poultry industry to enhance the utilization of spent poultry meat. To make layer industry more profitable spent hens meat has to be marketed efficiently and economically by further processing into comminuted products, which are preferred by the consumers.

A large variety of chicken is available comprising chicken of different breeds of broilers, spent hens and spent cocks. It provides an opportunity as well as challenge to develop a variety of products. Spent hens and cocks of both layer and broiler industries form major source of chicken for processing into products while broilers are largely processed as table birds.

Normally meat from spent hens is tough and fatty to use as table birds. The present availability of spent layer hens

is estimated to be 100 million and spent broiler hens four million producing about 110 thousand metric tonnes of dressed chicken (Kondaiah and Anjaneyelu, 1996).

Conversion of dressed chicken into cut-up-parts which are seasoned, battered, breaded and pre-cooked, sausages, nuggets, patties, pickles etc. The term 'convenience food' is frequently used for such products. Processes such as portioning, deboning, seasoning, tenderization, tumbling, reforming, emulsion, and variety of cooking methods are utilized to produce a variety of convenience food products.

The per capita availability of poultry meat in India is only 517 g (Anon, 1994). One of the reasons for the low consumption may be due to the lack of range of convenience food items. Therefore preparation of wide variety of value added products from poultry meat could probably lead to an increased per capita consumption of poultry meat and extend the facility to purchase the preferential ready-to-cook or ready-to-eat products instead of whole poultry.

The old and culled birds after completion of economic production are sold in the market at a cheaper price. Meat from such birds are generally tough with low organoleptic acceptability. More over the meat can be made more tender by proper tenderization methods and made more acceptable by comminution.

Recently attempts are being made to develop ready-to-eat products from chicken meat. Some of the products included chicken pickles, chicken sausages and the like. The above mentioned products have gained commercial recognition and popularity as the house wife, school children or the office going workers can have a ready-to-eat and nutritious snack at a reasonable cost.

A good possibility for increasing poultry meat consumption is through the development of new convenience marketable food items. The present investigation was therefore taken up to examine the feasibility of preparing chicken pickles from tenderized spent hen meat by using a recipe to suit Indian palate and to evaluate the consumer acceptability, nutritional characteristics conditions of storage without deterioration of quality and its shelf life.

Review of Literature

REVIEW OF LITERATURE

This study involves preparation of spent chicken pickle using untenderized and tenderized spent chicken meat. The evaluation of various characteristics of the products include shelf-life under storage, chemical composition, bacteriological quality and organoleptic evaluation during the periods of storage. In addition, attempts were made to study the processing yields and losses of broiler breeder spent hens. A brief review of the more recent and relevant literature on the above aspects is presented below.

Processing yields and losses

Review of literature reveals several reports on meat yields and losses of broilers, as well as spent chicken. On the other hand reports on broiler spent breeder hen are scanty.

The net yield of meat from processed poultry is reported to be related to a variety of factors such as body conformation of the bird (Jaap and Penquite, 1938), the nutritional status of the bird (Harkin *et al.*, 1960) and sex, age and strain (Fry *et al.*, 1962).

Souri *et al.* (1972) observed that the percentages of yield, blood, feather and inedible offal averaged 76.3, 3.6, 8.4 and 15.5 respectively for desi chicken.

Narayanankutty *et al.* (1982) studied the processing yields and losses of the broiler spent hens and observed that the average percentages of ready-to-cook yield, blood, feather, inedible offal were 74.25, 2.57, 5.9 and 14.48 respectively.

Kutty *et al.* (1983) reported that ready-to-cook yield of spent hen, cock, broiler, White Leghorn male (14 weeks old) were 63.92, 70.5, 67 and 63.61 per cent respectively and observed that the ready to cook yield in cock was highest followed by broiler.

Kondaiah and Panda (1988) studied the effect of live weight on the yields of carcass components from spent hens. They found that dressing and total edible percentages of light (<1400 g), medium (1401-1700 g) and Heavy (>1700 g) spent hens were 68.10, 67.50, 69.20; 55.32, 56.29 and 47.90 respectively.

Cooking loss

Glen[illegible] *et al.* (1960) reported that the mean per cent cooking losses varied from 18.8 to 24.9 in chicken broilers.

Kondaiah and Panda (1987) conducted a study on physico-chemical properties of spent hen meat components and observed that per cent cooking loss of breast, leg, wing and back, skin, gizzard and heart were 21.72, 22.18, 21.73, 23.04, 27.42 and 39 respectively.

Tenderization of spent chicken meat

Antemortem injection of plant proteases was considered one of the most effective methods for tenderizing meat (Beuk *et al.*, 1959).

Sundararasu *et al.* (1977) observed that intravenous administration of papain had a tenderization effect on chicken muscle. Highly significant tenderization was encountered in 25 ppm, and 50 ppm of papain in White Leghorn carcasses. Fifty ppm of papain was found to be better than 25 ppm in Rhode Island Red carcasses.

Bawa *et al.* (1981) injected enzyme solution of papain and bromelin 50, 75 and 100 ppm into vascular system of bird five minutes prior to slaughter and observed that tenderness increased with increased enzyme and papain resulted in greater tenderization than bromelin.

Devitre and Cunningham (1984) observed that breast fillets of White Leghorn spent hens soaked in 0.002 per cent

papain solution were significantly more tender than those soaked in 0.003 per cent bromelin or 0.002 per cent ficin solution.

Perusal of literature on poultry products technology shows a gap in our knowledge in respect of many information on new marketable meat products especially spent chicken meat pickle which suit Indian palate.

Shelf-life

Chatterjee *et al.* (1973) formulated and developed poultry pickle product and studied its shelf-life. He reported that poultry pickle could be stored for 120 days at ambient temperature (26°C) without any deterioration in its quality.

Singh *et al.* (1982) developed quail pickle by using whole dressed quail carcass and reported that the product could remain nutritionally, microbiologically and organoleptically acceptable upto a period of two months, when stored at ambient temperature (26°C) or refrigeration temperature (5°C).

Singh and Panda (1984) prepared quail pickle and studied the nutritional and microbiological qualities. They concluded that dressed quails could be conveniently pickled and could be stored for 150 days without much loss in its nutritional microbiological and sensory characters.

Panda (1985) formulated a standard recipe for oil based poultry pickle and reported that it could be stored for five months at ambient temperature without much loss to its quality.

Puttarajappa *et al.* (1996) prepared poultry pickle using broiler chicken meat and studied its nutritional, microbiological and sensory qualities. It was opined that the product was microbilogically safe and acceptable from the point of sensory properties and it could be stored for a period of six months at ambient temperature (26°C).

Prabhakara Reddy and Eswara Rao (1997) studied the influence of pickling and storage on the quality of spent chicken cut-up-parts for a period of 80 days at ambient temperature. Based on the findings they concluded that pickled spent chicken cut-up-parts could be stored upto 80 days at ambient temperature.

Proximate composition

Moisture

Poultry meat consists of 75, 18, 3 and 0.7 per cent moisture, protein, fat and total ash respectively (Varadarajulu, 1973).

Chatterjee *et al.* (1973) reported that moisture content of fresh and pickled broiler meat was 72.28 and 53.20 per cent at zero and 120 days respectively.

Singh and Panda (1984) opined that irrespective of storage conditions there was gradual but significant decrease in the moisture content of pickled meat during storage and found that per cent moisture content of fresh quail meat was 73.56 and that of pickled quail meat was 59.96, 59.32, 58.85 and 58.35 at zero, 30, 90 and 150 days of storage respectively.

Kondaiah and Panda (1987) studied the physico-chemical and functional properties of spent hen components and reported that moisture content of spent hen breast, leg, back, gizzard and heart was 72.69, 62.7, 52, 72 and 70 per cent respectively.

Prabhakara Reddy and Eswara Rao (1997) opined that irrespective of formulation used pickled spent hen meat cut-up-parts had significantly lower moisture content than freshly cooked meat. Authors also reported that moisture content of pickled spent hen meat was 64.46, 62.51 and 50.41 at zero, 20 and 80 days of storage respectively. He also stated that pickling and storage caused significant but gradual decrease in the moisture content.

Protein

Harshaw (1942) found that edible portions of the fowl contained 19.9 per cent protein.

Laurie (1966) opined that the quality of any meat depends on its physico-chemical properties, level of protein and fat contents and other chemical constituents present in the meat.

Chatterjee (1973) reported that protein per cent of poultry pickle were 24.35 and 24.20 respectively at zero and 120 days of storage at ambient temperature.

Singh *et al.* (1982) reported that crude protein content in pickled quail meat ranged from 25.3 to 26.3 per cent during storage and crude protein in pickle solutions increased from 0.62 to 1.02 per cent during storage.

Singh and Panda (1984) observed a singificant increase in protein content of pickled quail meat during storage and reported that protein content of pickled quail meat was 27.52, 27.60, 27.58 and 27.12 during zero, 30, 90 and 150 days of storage respectively. The authors also opined that breast meat had higher protein content than leg meat, irrespective of storage conditions and periods.

Kondaiah and panda (1987) reported that protein contents of meat, breast, leg, back, skin, gizzard and heart were 23.07, 19.52, 17.71, 15.17, 20.28 and 17.55 respectively.

Prabhakara Reddy and Eswara Rao (1997) stated the pickled spent chicken meat had significantly higher protein per cent than the fresh cooked meat. It was also opined that storage of pickled spent chicken meat from 20 days to 60 days had caused significant but gradual increase in protein content and the protein contents of pickled spent chicken meat were found to be 22.38, 23.52 and 27.29 for zero, 20 and 80 days of storage respectively.

Fat

Besides age, sex and species of poultry, the parts of carcass from which meat is taken are reported to influence the fat content considerably (Meechi *et al.*, 1956).

Chatterjee (1973) reported that fat content of poultry pickle were 20.68 and 21.06, at zero and 120 days of storage respectively.

Singh and Panda (1984) found that pickling increased the ether extract content of quail meat and the values were 4.73, 4.68, 4.96 and 4.92 at zero, 30, 90 and 150 days of storage respectively.

Kondaiah and Panda (1987) found that fat content of breast, leg, back, skin, gizzard and heart of the spent hen were 3.42, 8.79, 17.79, 31.91, 6.43 and 10.74 respectively.

Puttarajappa *et al.* (1996) reported that fat content of pickled broiler meat were 18.8, 16.8, 17.2, 16.8 and 16 at zero, one, two, three, four, five and six months of storage at ambient temperature respectively.

Prabhakara Reddy and Eswara Rao (1997) opined that pickled spent hen meat have high fat content than fresh cooked meat, and pickling caused gradual increase in fat content. It was also reported that the fat content of pickled spent chicken meat was 11.59, 12.21 and 14.09 at zero, 20 and 80 days of storage at ambient temperature respectively.

Total ash

Singh *et al.* (1982) reported that total ash content of pickled quail meat was 4.66 after seventh day of storage.

Singh and Panda (1984) stated that there was significant increase in total ash content of pickled quail meat than raw meat. It was found that raw quail meat had 1.6 per cent and pickled quail meat had 4.58, 4.60, 4.61 and 4.76 at zero, 30, 90 and 150 days of storage.

Kondaiah and Panda (1987) reported the total ash content of breast, leg, back, skin, gizzard and heart was 1.21, 0.98, 0.73, 0.44, 0.94 and 0.82 respectively.

Puttarajappa *et al.* (1996) found that salt content of pickled broiler meat ranged from 7.2 to 8.3 at zero to 180 days of storage respectively.

Rancidity

The estimation of 2-thiobarbituric acid number (TBA number) helps to detect the extent of rancidity in meat during storage.

Dawson (1975) observed that minimum lipid oxidation can be achieved by low temperature preservation and it was assumed that TBA values above two may be associated with development of rancidity in meat sample.

Rejikumar *et al.* (1991) conducted studies on the chicken meat balls under frozen condition and reported that the TBA numbers increased with increase of storage time. The TBA numbers of chicken meat balls stored at -15°C were reported to range from 0.54 to 1.21 for recipe I and from 0.58 to 1.18 for recipe II.

Puttarajappa *et al.* (1996) found that TBA values of pickled broiler meat were 0.57, 0.61, 0.62, 0.65, 0.75, 0.78

and 0.78 at zero, one, two, three, four, five and six months of storage at ambient temperature.

Prabhakara Reddy and Eswara Rao (1997) reported that pickled spent chicken meat cut-up-parts developed rancidity during storage at ambient temperature and values were 0.25, 0.31 and 2.12 for solution I, 0.25, 0.43 and 3.49 for solution II and 0.25, 0.39 and 3.06 for solution III at 0, 20 and 80 days of storage respectively.

Total bacterial count

It has been recognised fact that the microbial load of poultry meat prior to or during the storage has a profound implication from the public health point of view.

Mechanically deboned poultry meat was known to have a microbial count ranging from $10x10^4$ to $10x10^5$ per gram of meat (Maxcy *et al.*, 1973).

At 0°C or lower temperatures most of the organisms in meat failed to grow (Sahoo, 1973).

Chatterjee (1973) reported that the total plate count of pickled poultry were $3.1x10^3$ and $2.3x10^4$ per gram of meat for zero and 120 days of storage respectively.

Singh *et al.* (1982) found that the total plate count of fresh quail meat was $6.6x10^5$ and those for pickled quail meat were $8x10^1$ and $205x10^2$ for zero, eight and 15 days of storage at ambient temperature respectively.

Singh and Panda (1984) reported that total plate count of pickled quail (count per sq.cm) were $18.5x10^2$, $54x10^2$, $6.2x10^3$ and $48x10^3$ at zero, 30, 90 and 150 days of storage respectively.

Puttarajappa *et al.* (1996) observed that total plate counts of pickled broiler meat were $5.8x10^4$, $1.x10^4$, $4.5x10^4$, $4.8x10^4$, $5x10^4$ and $4.8x10^4$ for at zero, one, two, three, four, five and six months of storage at ambient temperature.

Prabhakara Reddy and Eswara Rao (1997) found that aerobic mesophilic counts (log/g) of pickled spent chicken cut-up-parts were 2.74, 2.34 and 3.5 for solution I, 2.74, 2.61 and 3.55 for solution II and 2.74, 1.69, 3.47 for solution III at zero, 20 and 80 days of storage respectively at ambient temperature.

Organoleptic evaluation of spent chicken meat pickle

Mouth feel is affected by firmness, softness, tenderness and juiciness (Amerine *et al.*, 1965).

Narayanankutty *et al.* (1983) conducted storage studies on chicken steaks and reported that steaks prepared from deboned minced meat of spent hen were acceptable in terms of sensory point of view.

Singh and Panda (1984) observed no significant differences in the overall acceptance score of pickled quail meat stored either at room temperature or refrigeration temperature except at 90th day of storage, where refrigerated meat pickle scored significantly more than that held at ambient temperature. The authors also observed that the product was organoleptically acceptable upto 150th day of storage even at ambient temperature.

Puttarajappa *et al.* (1996) conducted studies with pickled broiler meat and observed that sensory evaluation of the product was acceptable even at the end of six months of storage.

Prabhakara Reddy and Eswara Rao (1997) observed that pickled spent chicken cut-up-parts had the highest flavour scores at all periods of storage than freshly cooked meat, due to the presence of additives. The authors also reported that pickled meat had significantly lower juiciness scores than fresh cooked meat.

Materials and Methods

MATERIALS AND METHODS

An experiment was designed and carried out in the Department of Poultry Science, College of Veterinary and Animal Sciences, Kerala Agricultural University, Mannuthy to study the feasibility of preparing chicken meat pickles from tenderized spent hen meat and to compare the nutritional and keeping quality parameters of tenderized and untenderized chicken pickle prepared from spent chicken meat.

Spent broiler breeder hens (New Hampshire) in the age group of 72 weeks were used in the study. Data on processing yields and losses were collected from seven spent hens. Boned meat made into pieces was used for the preparation of chicken meat pickle.

Processing yields and losses

The spent hens were slaughtered and processed as per procedure described by Bureau of Indian Standards (ISI, 1973) and processing yields and losses were determined.

Preparation of spent chicken meat pickle

The boned meat from spent chicken was made into pieces of 2.5 to 3.5 cm size and used for the preparation of chicken

meat pickle. A recipe was developed for the chicken pickle (Table 1) to suit Indian palate.

Boned meat pieces were divided into two portions. One half was soaked in the papain enzyme solution having a strength of 0.002 per cent for 60 minutes and the other half served as the control.

Before cooking the ingredients turmeric and salt were pasted over the pieces of meat and kept aside for 15 minutes. Then along with some water these pieces were boiled until it was half done dripped, seived and fried well in small quantity of oil. The fried pieces were kept aside. The other quantity of oil was then used for browning the other ingredients except vinegar. To this chicken pieces already fried were added and mixed thoroughly. After cooling vinegar was added. The pieces along with the ingredients were put into glass bottles.

The chicken pickle was prepared separately by using meat of papain treated and control group and filled in glass bottles each for treatment and control group (Net weight was 500 g in each bottle). The bottles were kept at room temperature for a period of 64 days and subjected to the following evaluation at weekly intervals.

The cooking yield in weight was expressed in terms of per cent of cooking yield as follows:

Cooking yield (%) = 100 - cooking loss

$$\text{Cooking loss (\%)} = \frac{\text{Initial weight - weight after cooking}}{\text{Initial weight}} \times 100$$

The samples from control and treatment were analysed for moisture, protein, fat and total ash by A.O.A.C. (1990) methods.

Rancidity was evaluated by 2-thiobarbituric acid (TBA) as described by Witte *et al.* (1970).

Total bacterial counts estimated by plate count method, described by ISI (1980) and expressed in log numbers per gram of meat sample.

Besides evaluation of the product for the above parameters, organoleptic evaluations were also carried out. A taste panel consisting of six members was constituted for the organoleptic evaluation. A seven point hedonic scale for flavour, tenderness, juiciness and overall acceptability was used. The score card used for this purpose is presented in Table 2.

The shelf-life of the product was evaluated in terms of proximate analysis, oxidative rancidity, total bacterial count and organoleptic evaluations at each stage of storage period at room temperature.

Cost structure of the product was calculated based on the prevailing cost of the meat and other ingredients used for the preparation.

Statistical analysis of the data was carried out according to Snedecor and Cochran (1980).

Table 1. Chicken meat pickle - Recipe

Ingredients	Quantity
Chicken meat with bone	1000 g
Garlic	25 g
Ground black pepper	10 g
Salt	To taste (approx. 30 g)
Vineger	200 ml
Red chilli powder	30 g
Cumin seed	5 g
Minced ginger	10 g
Spices mixture	20 g
Refined gingely oil	200 ml
Turmeric powder	10 g
Water	100 ml

Note: Spices mixture contains Clove (1 g), Cinnamon (5 g), Cardamom (2 g) and Anise (12 g)

Table 2. Score card for evaluating cooked poultry products

Name :
Date :
Product name:

Pr.No.	Tenderness	Juiciness	Flavour	Overall Acceptability
1.				
2.				

Quality grade description	Score
Excellent	9-10
Good	6-8
Fair	4-5
Poor	1-3

II. Acceptance score sheet

	Points	
	Pro.1	Pro.2
Like very much	7	7
Like moderately	6	6
Like slightly	5	5
Neither like nor dislike	4	4
Dislike slightly	3	3
Dislike moderately	2	2
Dislike very much	1	1

* Please encircle the point at which you rate the quality

Results

RESULTS

Results obtained in the present investigation are described in this section.

Meat yields and losses

The per cent ready to cook yield and total losses obtained during the processing of broiler breeder spent hens (New Hampshire) used for the study are presented in Table 3 and graphically represented in Figure 1 and 2. The mean live weight was 2100±0.33 g. The per cent ready-to-cook yield and total loss averaged 70.50±0.34 and 29.5±0.32 respectively. The components of total loss during processing of spent hens were partitioned as loss of blood, feather and inedible offal and the mean per cent contributions of the above were 2.60±0.95, 7.80±0.80 and 19.10±0.24 respectively.

Cooking yield

The per cent cooking loss of spent hen meat for control and papain added treatment group were 23.20 and 28.30 respectively. Thereby per cent cooking yield were 76.80 and 71.70 for control and treatment respectively.

Table 3. Mean per cent meat yields and losses of broiler breeder spent hens

Live weight at the time of slaughter (g)	2100.00 ± 0.33
Shrinkage	3.20 ± 0.12
Blood loss	2.60 ± 0.95
Feather loss	7.80 ± 0.80
Dressing yield	89.50 ± 0.10
Eviscerated yield	65.40 ± 0.34
Ready-to-cook yield	70.50 ± 0.34
Giblet yield	5.05 ± 0.09
Head	3.90 ± 0.08
Feet	4.50 ± 0.05
Total loss	29.50 ± 0.32
Inedible offal	19.10 ± 0.24

Fig. 1 READY TO COOK YIELD IN BROILER BREEDER SPENT HENS

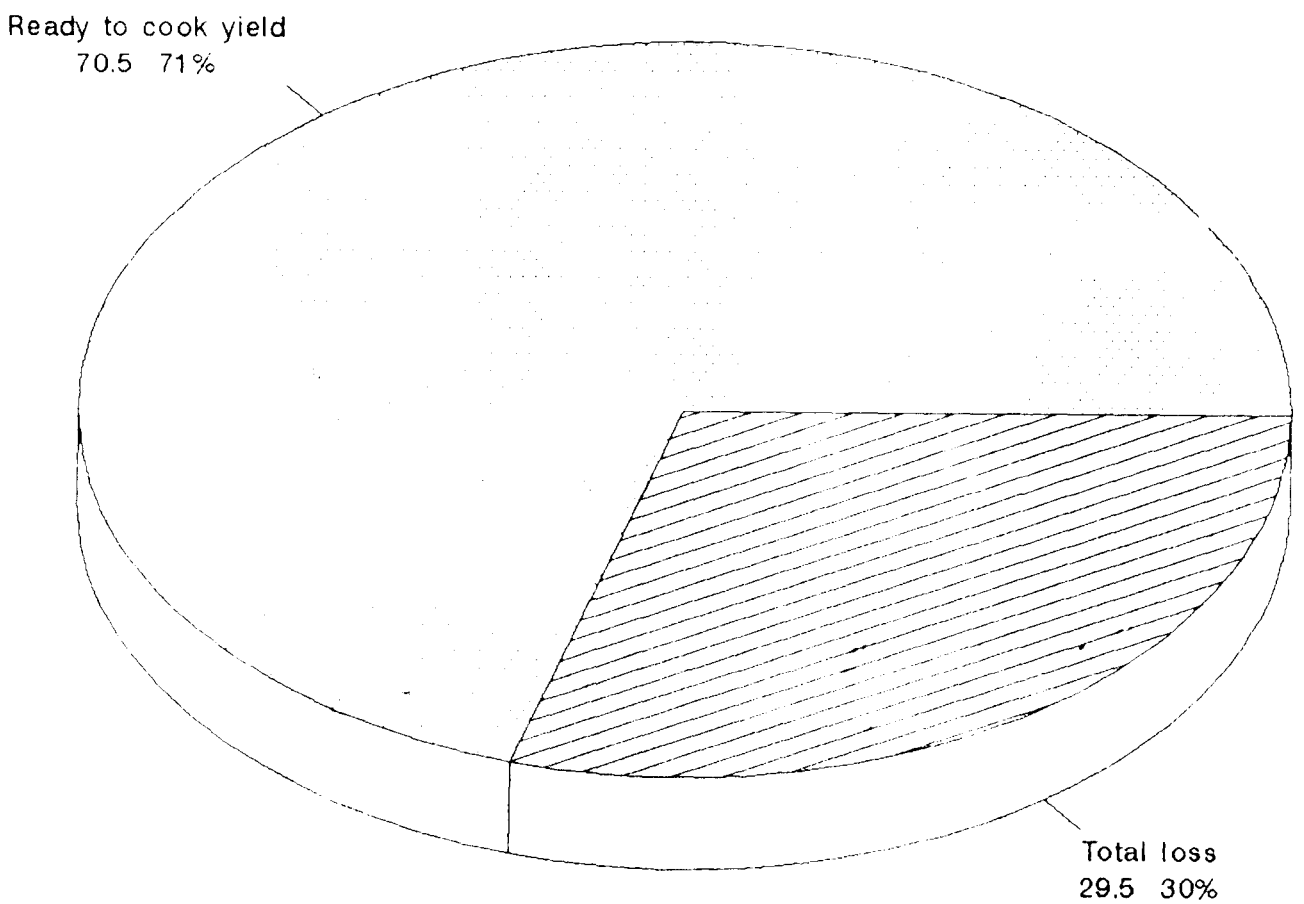
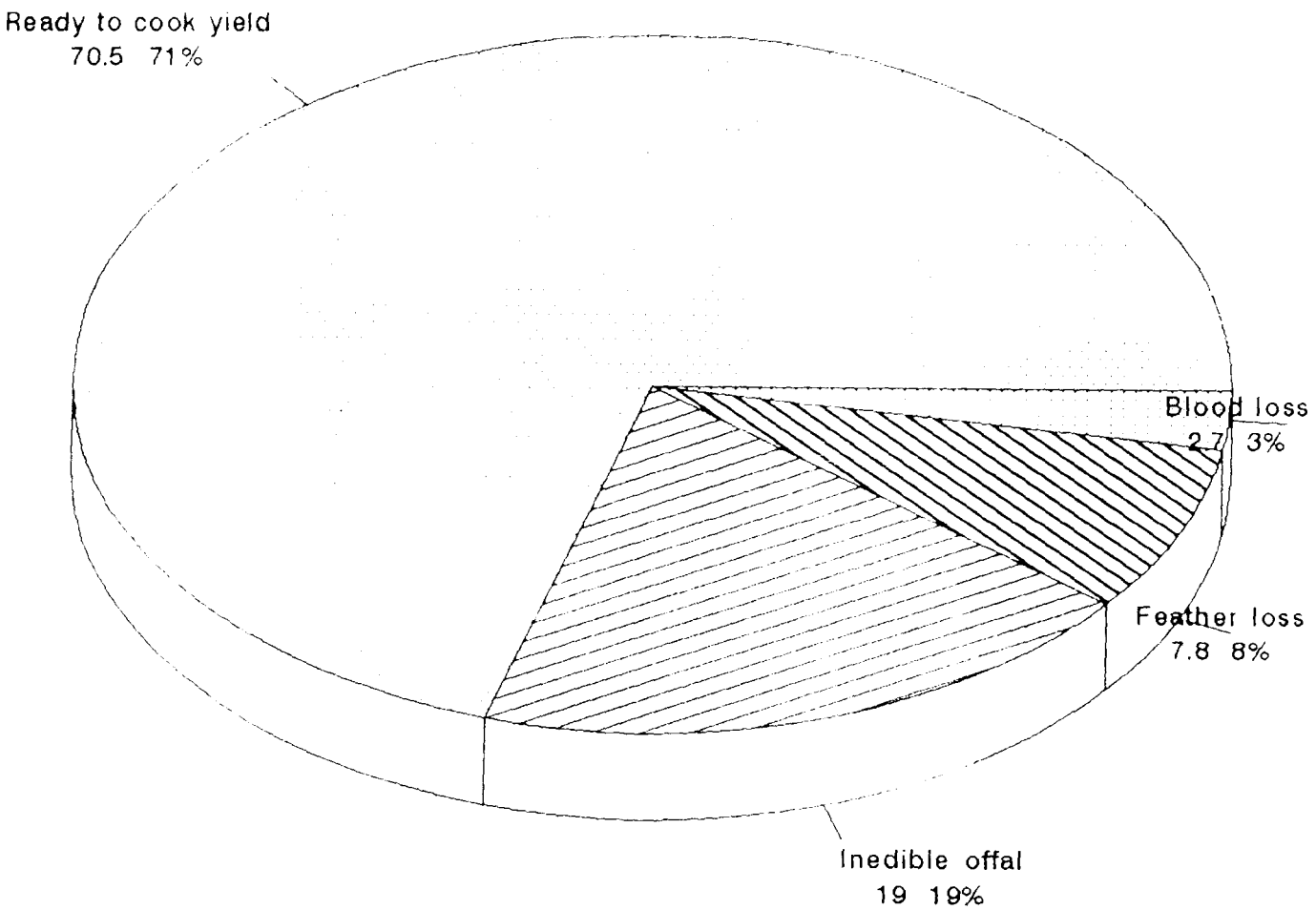


Fig. 2 TOTAL YIELDS AND LOSSES IN BROILER BREEDER SPENT HENS



Quality characteristics and shelf-life of chicken meat pickle

The moisture, protein, fat and total ash contents of chicken meat pickle prepared by using tenderized and untenderized spent chicken meat and stored at ambient temperature for 64 days were determined (Table 4).

The proximate components of ready to eat chicken meat pickle prepared using tenderized and untenderized spent chicken meat were not statistically significant between the same period of storage. But within control and treatment groups between periods the proximate components were found to be significant statistically ($P<0.01$). The proximate components of chicken meat pickle were affected by the storage period irrespective of the groups.

The moisture contents of control group averaged 64.59± 0.49 for fresh product and the value was not significant statistically with that for eight days of storage (63.78± 0.34). The difference in the moisture between zero and all other days of storage were found to be significant ($P<0.01$) except eight.

The moisture content of chicken meat pickle prepared using tenderized chicken meat averaged 64.97±0.20 for zero day (fresh) and was found to be significantly ($P>0.01$) different from any other days of storage.

In both untenderised and tenderised meat groups the moisture content decreased as storage periods increased, and the decrease in values in both the groups was found to be different statistically ($P<0.01$). In control group the moisture content decreased from zero day (64.59±0.49) to 64 days (54.31±0.50) of storage. Similarly the values for moisture on zero day decreased from 64.97±0.20 to 54.59±0.15 on 64 days storage for treatment group.

Protein

The protein content of chicken pickle prepared using untenderized chicken meat averaged 21.80±0.45 for zero days of storage and the above value was not found to be differ significantly with those obtained for eight, 16 and 24 days of storage.

After that it was influenced by the storage periods upto 64 days.

The protein content increased with increased period of storage and was found significant statistically ($P<0.01$). The mean protein per cent obtained for zero day (21.80±0.45) increased to (26.65±0.34) on 64 days of storage.

The protein content of chicken meat pickle prepared using tenderized chicken meat averaged 21.23±0.26 for zero day and

increased to 24.42±0.29 on 64 days of storage, and the increase was found to be significant statistically (P<0.01). The protein content between zero day and that for 24, 32, 40, 48, 56 and 64 days of storage was found to be significant statistically (P<0.01).

Fat

The per cent fat averaged 11.71±0.31 and 11.60±0.25 for pickle prepared using untenderized and tenderized chicken meat respectively at zero day. The fat content increased as the days of storage increased. On 64th day of storage, the values averaged 14.58±0.27 and 14.46±0.37 respectively. The fat content between zero and 24, 32, 40, 48, 56 and 64 days of storage was found to be different statistically (P<0.01) in the control group and that in treatment group between zero day and any other days except eight days of storage were different statistically (P<0.01).

Total ash

The total ash content increased as the days of storage increased both in tenderized and untenderized meat pickle groups. The mean per cent total ash content was 1.21±0.05 for control group and that for treatment group was 1.16±0.07 for fresh pickle. The ash content obtained for control group, between zero day and any other days of storage except for

Table 4. Influence of duration of storage on the proximate composition of spent chicken meat pickle

Days of storage	Moisture %		Protein %		Fat %		Total ash %	
	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment
0	a 64.59± 0.49	a 64.97± 0.20	a 21.80± 0.45	a 21.23± 0.26	a 11.71± 0.31	a 11.60± 0.25	a 1.21± 0.05	a 1.16± 0.07
8	ab 63.78± 0.34	b 63.44± 0.31	a 21.92± 0.23	ab 21.56± 0.19	ab 12.14± 0.48	ab 12.10± 0.29	a 1.47± 0.06	b 1.99± 0.04
16	bc 62.61± 0.08	bc 62.20± 0.51	a 22.53± 0.33	ab 22.12± 0.33	ab 12.47± 0.21	b 12.51± 0.09	a 1.53± 0.03	c 2.41± 0.06
24	c 61.96± 0.40	c 61.87± 0.30	a 22.38± 0.52	bc 22.33± 0.52	bc 12.86± 0.29	b 12.67± 0.26	b 2.13± 0.01	cd 2.46± 0.05
32	d 59.65± 0.47	d 59.22± 0.78	b 24.22± 0.67	d 24.22± 0.63	cb 13.23± 0.14	bc 13.20± 0.13	b 2.32± 0.07	de 2.80± 0.07
40	ef 57.33± 0.53	e 57.83± 0.33	c 25.61± 0.33	e 25.27± 0.24	ed 13.47± 0.43	c 13.42± 0.31	bc 2.61± 0.08	de 2.89± 0.03
48	fg 56.68± 0.40	e 56.80± 0.29	c 26.22± 0.32	ef 25.75± 0.23	ed 13.69± 0.34	c 13.55± 0.17	bcd 2.87± 0.03	ef 3.01± 0.18
56	g 55.58± 0.46	ef 55.81± 0.24	c 26.42± 0.61	ef 26.10± 0.45	e 13.90± 0.22	cd 13.83± 0.20	de 3.21± 0.06	g 3.37± 0.04
64	h 54.31± 0.50	f 54.59± 0.15	c 26.65± 0.34	f 24.42± 0.29	e 14.58± 0.27	de 14.46± 0.37	ef 3.66± 0.02	h 3.61± 0.07

Note: The values in a column sharing any one common superscript did not differ significantly ($P<0.01$)

eight and 16 days of storage was found to be different statistically ($P<0.01$). In the treatment group the total ash content between zero and any other days of storage was different statistically ($P<0.01$).

Rancidity

The oxidative rancidity of fat in terms of malonaldehyde per kilogram of sample prepared by using tenderised and untenderised meat and stored for varying periods at room temperature are presented in Table 5.

The 2-TBA numbers of chicken meat pickles prepared using untenderized chicken meat ranged from 0.26 ± 0.01 to 0.89 ± 0.01 and that for tenderized chicken meat ranged from 0.22 ± 0.00 to 0.86 ± 0.00 from zero to 64 days of storage.

The differences in TBA values between zero and any other days of storage were found to be significant ($P<0.01$) in both groups. The TBA numbers were found to be increased with advancement in storage periods and the increment was significant statistically ($P<0.01$). TBA values were not found to be significant statistically ($P<0.01$) between control and treatment groups.

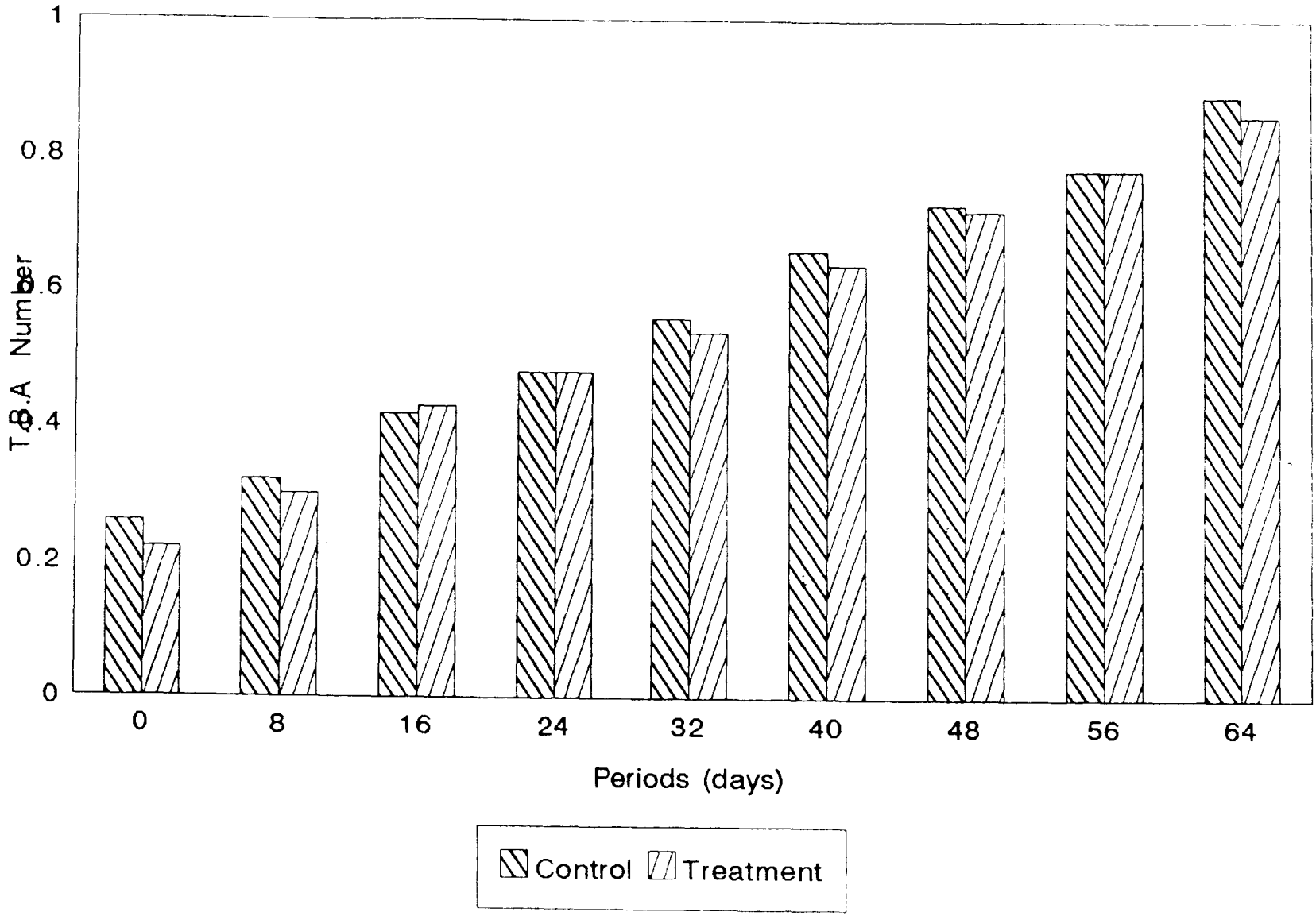
The trend of changes in the 2-TBA number during storage at ambient temperature was depicted in Fig.3.

Table 5. Influence of duration of storage on the oxidative rancidity of chicken meat pickle

Days of storage	TBA number (mg malonaldehyde/kg of sample)	
	Control	Treatment
0	0.26 ± 0.01[a]	0.22 ± 0.00[a]
8	0.32 ± 0.01[b]	0.30 ± 0.00[b]
16	0.42 ± 0.01[c]	0.43 ± 0.00[c]
24	0.48 ± 0.00[d]	0.48 ± 0.01[d]
32	0.56 ± 0.01[e]	0.54 ± 0.01[e]
40	0.66 ± 0.01[f]	0.64 ± 0.02[f]
48	0.73 ± 0.00[g]	0.72 ± 0.00[g]
56	0.78 ± 0.01[h]	0.78 ± 0.02[h]
64	0.89 ± 0.01[i]	0.86 ± 0.00[i]

Note: The values bearing the same superscript in a row or column did not differ significantly ($P<0.01$)

Fig. 3 INFLUENCE OF DURATION OF STORAGE IN THE OXIDATIVE RANCIDITY OF CHICKEN MEAT PICKLE



Total bacterial count

The total bacterial count of chicken meat pickle prepared using untenderized and tenderized chicken meat groups and stored at ambient temperature for different periods are presented in Table 6.

The total bacterial load in both groups (control and treatment) increased with duration of storage and the increase in counts was significant statistically ($P<0.01$) except eight and 16 days of storage.

The total bacterial counts (expressed as CFU/g) of chicken meat pickle prepared using untenderized chicken meat averaged 2.60 ± 0.04 for the fresh sample which increased to 4.43 ± 0.04 on 64th day storage. For the tenderised meat group the counts averaged 2.60 ± 0.03 on zero day which increased to 4.20 ± 0.06 on 64th day of storage at room temperature. However significant differences were not found between control and treatment groups for varying periods of storage.

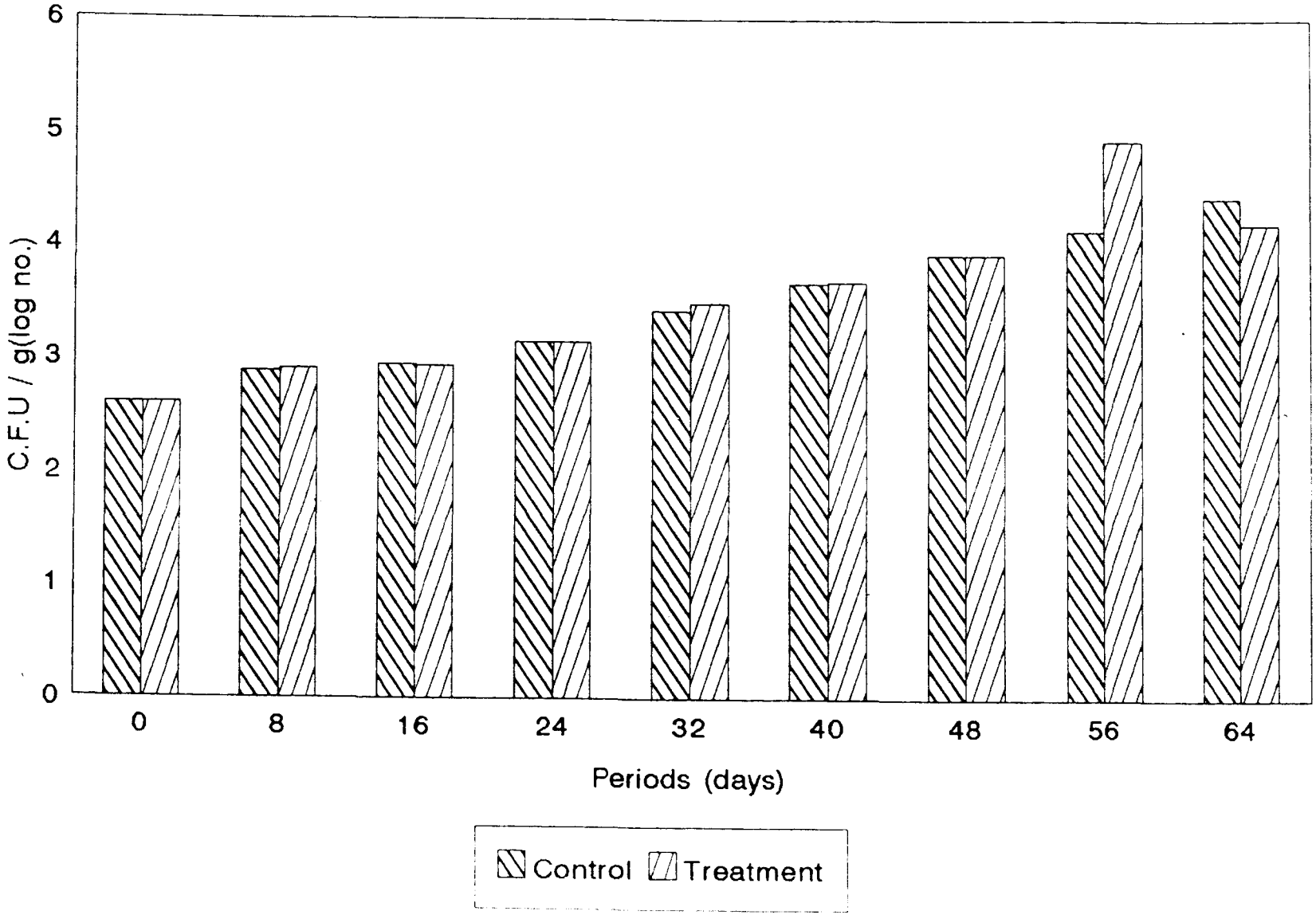
Irrespective of groups, the bacterial load was influenced by duration of storage and the differences in total bacterial count between zero and any other days storage were significant statistically ($P<0.01$). The trend of changes in the total bacterial counts during different storage periods is represented graphically in Fig.4.

Table 6. Influence of duration of storage on the total bacterial counts of chicken meat pickle

Days of storage	Total bacterial count (C.F.U./g of sample) log No.	
	Control	Treatment
0	2.60 ± 0.04 [a]	2.60 ± 0.03 [a]
8	2.88 ± 0.02 [b]	2.90 ± 0.01 [b]
16	2.95 ± 0.01 [b]	2.94 ± 0.02 [b]
24	3.15 ± 0.02 [c]	3.15 ± 0.02 [c]
32	3.43 ± 0.04 [d]	3.50 ± 0.05 [d]
40	3.67 ± 0.03 [e]	3.69 ± 0.03 [e]
48	3.93 ± 0.01 [f]	3.93 ± 0.01 [f]
56	4.14 ± 0.02 [g]	4.93 ± 0.01 [g]
64	4.43 ± 0.04 [h]	4.20 ± 0.06 [h]

Note: The values bearing the same superscript in a row or column did not differ significantly ($P<0.01$)

Fig. 4 INFLUENCE OF DURATION OF STORAGE IN TOTAL BACTERIAL COUNT OF CHICKEN MEAT PICKLE



Organoleptic evaluation of chicken meat pickle

The organoleptic evaluation of ready-to-eat chicken meat pickle prepared using untenderized and tenderized chicken meat was conducted by a taste panel and evaluation scores are shown in Table 7.

The differences in scores for flavour, tenderness, juiciness and overall acceptability of the product prepared using untenderized and tenderized chicken meat were not found to be significant statistically. Within control and treatment groups the scores were not influenced by different storage periods.

In case of untenderized meat group, the scores for tenderness ranged from 6.66±0.21 to 6.50±0.72 and that for tenderized meat group ranged from 7.66±0.21 to 7.66±0.21. In both cases the scores for zero and any other days of storage were not found to be different statistically.

The differences in juiciness scores of the product were not found to be significant statistically between zero and any other days of storage for the pickle prepared using untenderized and tenderized chicken meat. The scores varied from 7.33±0.49 to 7.50±0.43 and 7.50±0.42 to 7.16±0.31 for control and treatment groups respectively irrespective of the days of storage.

Table 7. Organoleptic scores of chicken meat pickle as influenced by duration of storage at ambient temperature

Days of storage	Tenderness		Juiciness		Flavour		DAA	
	Control	Treatment	Control	Treatment	Control	Treatment	Control	Treatment
0	6.66± 0.21	7.66± 0.21	7.33± 0.49	7.50± 0.42	6.50± 0.22	6.50± 0.34	7.16± 0.16	7.00± 0.36
8	6.50± 0.34	7.66± 0.33	7.17± 0.30	7.33± 0.49	6.33± 0.42	6.83± 0.30	7.33± 0.21	7.16± 0.30
16	6.50± 0.22	7.50± 0.56	7.50± 0.42	7.17± 0.16	6.83± 0.40	6.50± 0.22	7.00± 0.36	7.16± 0.30
24	6.33± 0.33	7.33± 0.33	7.17± 0.30	7.50± 0.42	6.50± 0.22	6.66± 0.21	7.167 0.30	7.33± 0.21
32	6.33± 0.42	7.50± 0.43	7.16± 0.31	7.16± 0.31	6.33± 0.21	6.50± 0.22	7.33± 0.21	7.50± 0.22
40	6.33± 0.56	7.33± 0.49	7.33± 0.49	7.16± 0.31	6.50± 0.22	6.66± 0.21	7.17± 0.31	7.16± 0.31
48	6.50± 0.62	7.33± 0.67	7.33± 0.21	7.50± 0.22	6.67± 0.21	6.33± 0.42	7.00± 0.36	7.00± 0.36
56	6.66± 0.67	7.50± 0.43	7.50± 0.43	7.33± 0.21	6.83± 0.17	6.50± 0.43	7.33± 0.36	7.33± 0.42
64	6.50± 0.72	7.66± 0.21	7.50± 0.43	7.16± 0.31	6.50± 0.34	6.83± 0.31	7.17± 0.40	7.00± 0.36

In the case of flavour there was no significant difference between the scores for fresh sample and that for stored samples in both the groups. The scores varied from 6.33±0.42 to 6.83±0.17 and 6.33±0.42 to 6.83±0.31 for control and treatment groups respectively, irrespective of days storage.

Irrespective of duration of storage the overall acceptability of chicken meat pickle prepared using untenderized and tenderized chicken meat were not found to be different statistically and the values ranged from 7.00 ± 0.36 to 7.33±0.36 and 7.00±0.36 to 7.33±0.42 for control and treatment groups respectively.

Cost structure of ready-to-eat chicken pickles

The cost structure for the preparation of ready-to-eat chicken pickles using tenderized and untenderized chicken meat was calculated and presented in Table 8. The calculation was based on the costs of boned chicken meat, total additives, glass bottles and papain enzyme. According to this the cost of 1000 g chicken pickle prepared using untenderized and tenderized meat were Rs.60.27 and Rs.60.45 respectively.

Table 8. Cost structure of spent chicken meat pickles prepared from untenderized and tenderized meat

Ingredients	Weight (g)	Cost Rs.Ps.	Weight (g)	Cost Rs.Ps.
Boned spent chicken meat	1000	46.15	1000	46.15
Total additives	640	28.70	640	28.70
Papain enzyme	-	-	-	0.30
Glass bottles (Nos.)	-	24.00	-	24.00
Total	1640	98.85	1640	99.15
Unit cost/kg		60.27		60.45

Discussion

DISCUSSION

The results of the study conducted to determine the feasibility of using tenderized and untenderized spent hen meat for the preparation of the chicken pickle, its various characteristics and shelf life are discussed below.

The per cent ready-to-cook yield and total loss in broiler breeder hens used for the study averaged 70.50±0.34 and 29.50±0.32 (Table 3). The per cent loss of blood, feather and inedible offal were 2.60±0.95, 7.80±0.80 and 19.10±0.24 respectively.

Body conformation of bird (Japp and Penquite, 1938), the previous nutritional status of the bird (Harkin *et al.*, 1960) and sex, age, strain (Fry *et al.*, 1962) are known to influence the yield percentage.

Souri *et al.* (1972) reported that the percentage of ready-to-cook, blood, feather, inedible offal, averaged 76, 3.6, 8.4 and 15.5 respectively. Narayanankutty *et al.* (1982) studied the processing yield and losses of broiler spent hens and reported that the percentages of ready-to-cook yield, blood, feather and inedible offal were 74.25, 2.57, 5.9 and 14.48 respectively.

The values obtained in the present study for ready-to-cook yield, blood, feather and inedible offal percentages are fairly in agreement with those reported by the above authors.

Quality characteristics and shelf life

Cooking yield

The per cent cooking loss of spent hen meat in untenderized and tenderized meat groups were 23.20, 28.30 respectively. This finding had a close agreement with those of Glen *et al.* (1960) for broiler, Synder and Orr (1964) for female pekin ducks and Kondaiah and Panda (1987) for cooking loss of different components for spent hens.

Kondaiah and Panda (1987) observed that cooking loss of breast, leg, wing and back, skin, gizzard and heart were 21.72, 22.18, 21.73, 23.04, 24.72 and 39 per cent respectively.

However, the per cent cooking yield of untenderized and tenderized meat groups were 76.80 and 71.70 respectively. The spent hen meat treated with papain enzyme solution showed a low cooking yield when compared to that of control group.

Proximate composition

The proximate composition of spent chicken meat pickle prepared by using untenderized and tenderized spent hen meat revealed that the mean per cent moisture, protein, fat and total ash ranged from 64.59±0.49 to 54.31±0.50, 21.80±0.45 to 26.65±0.34, 11.71±0.31 to 14.58±0.27, 1.21±0.05 to 3.66±0.02 for control and 64.97±0.20 to 54.59±0.15, 21.23±0.26 to 24.42±0.29, 11.60±0.25 to 14.46±0.37, 1.16±0.07 to 3.61±0.07 for treatment respectively (Table 4). These values are almost in agreement with those reported by Chatterjee (1973) for curing of poultry meat, Puttarajappa *et al.* (1996) for broiler meat pickle and Prabhakara Reddy and Eswara Rao (1997) for pickling of spent chicken cut-up-parts.

The proximate components of chicken meat pickle prepared using tenderized and untenderized spent chicken meat were not statistically significant between the same period of storage. But with in control and treatment groups, the proximate components were found to be significant statistically ($P<0.01$) between the periods.

In control group the per cent moisture content decreased from 64.59±0.49 on zero day to 54.31±0.50 on 64 days of storage. Similarly in treatment group the value for moisture per cent on zero day decreased from 64.97±0.20 to 54.59±0.15 on 64 days of storage.

Storage of pickled meat of control and treatment groups had caused gradual but significant ($P<0.01$) reduction in moisture content.

Storage of pickled meat caused significant increase in the protein and fat content of untenderized and tenderized meat groups. Prabhakara Reddy and Eswara Rao (1997) found similar effect in storage of pickled chicken parts.

Reduction in moisture content of the chicken meat on pickling and during further storage contributed to the higher levels of protein and ether extractives of pickled meat (Singh and Panda, 1984).

There was significant ($P<0.01$) increase in total ash content of pickled meat both in untenderized and tenderized meat groups. This is also in agreement with the findings of Singh and Panda (1984) for quail meat. It was due to diffusion of salt in the recipe resulted in an increase in the total ash contents of pickled meat than fresh meat.

The proximate composition of pickle prepared by using tenderized and untenderized chicken meat were not affected by varying periods of storage between groups.

Rancidity

The 2-thiobarbituric acid (TBA) numbers of untenderized and tenderized meat groups ranged from 0.26±0.01 to 0.89±0.01 and 0.22±0.00 to 0.86±0.00 for zero to 64 days storage at ambient temperature (Table 5).

The TBA numbers between untenderized and tenderized meat groups were not found to differ statistically. The TBA values increased as duration of storage increased both in control and treatment groups.

The statistical analysis revealed that the TBA number of the product was influenced by storage periods and differences in TBA numbers between zero and any other days of storage was statistically significant ($P<0.01$).

Dawson (1975) observed that minimum lipid oxidation can be achieved by low temperature preservation and it was assumed that TBA values above two may be associated with development of rancidity in meat sample.

The results of the present study were in agreement with those of Puttarajappa *et al.* (1996) for broiler meat pickle and Prabhakara Reddy and Eswara Rao (1997) for pickled spent chicken cut-up-parts.

Puttarajappa *et al.* (1996) observed an increasing trend of TBA number during storage of broiler meat pickle and the values ranged from 0.57 to 0.78 for zero to six months of storage and stated that rancidity was not a problem in the case of chicken pickle, although there was slight increase in TBA values during storage at ambient temperature. Prabhakara Reddy and Eswara Rao (1997) observed an increasing trend in TBA values in pickled spent chicken cut-up-parts during storage and the values ranged from 0.25 to 2.12 for solution I containing mustard oil, 0.25 to 3.49 for solution II containing groundnut oil and 0.25 to 3.0 for solution III containing groundnut oil and vinegar.

Total bacterial count

The total bacterial counts in untenderized meat group ranged from 2.60±0.04 at zero to 4.43±0.04 at 64 days of storage. In tenderized meat group it ranged from 2.60±0.03 at zero to 4.20±0.06 at 64 days of storage (Table 6). These observations in the present study showed a close agreement with those of Chatterjee (1973), Singh and Panda (1982), Singh and Panda (1984), Puttrajappa *et al.* (1996) and Prabhakara Reddy and Eswara Rao (1997).

The normal range of total bacterial counts of fresh deboned meat was reported to range from $10x10^4$ to $10x10^5$ per gram of meat (Maxcy, 1973).

Chatterjee *et al.* (1973) observed the total plate count value ranged from $3.1x20^3$ to $2.3x10^4$ for zero to 120 days of storage. Singh and Panda (1984) reported that total plate count of pickled quail meat (org.sq.cm) values ranged from $18.5x10^2$ to 48.10^3 at zero to 150 days of storage.

Puttrajappa *et al.* (1996) reported that the values of total plate count of pickled broiler meat ranged from $5.8x10^4$ to $4.8x10^4$ for zero to six months of storage at ambient temperature. Prabhakara Reddy and Eswara Rao reported that aerobic mesophilic count of pickled spent chicken cut-up-parts values ranged from 2.74 to 3.5 for solution I, 2.74 to 3.55 for solution II and 2.74 to 3.47 for solution III for zero to 80 days of storage.

However, a trend of significant ($P<0.01$) increase in total plate count was observed both in untenderized and tenderized meat groups with the advancement of period of storage except second and third period of storage. But there was no significant difference existed in counts between control and treatment at all periods storage. Fairly low counts were observed in control and treatment groups even at 64 days of storage. This might be due to inhibitory actions of the pickle additives and these findings agree with those of Singh and Panda (1984).

Organoleptic evaluation of spent chicken meat pickle

The taste panel scores of the chicken pickle prepared as per the two groups were evaluated in terms of tenderness, flavour, juiciness, and overall acceptability (Table 7).

The flavour, juiciness, tenderness and overall acceptability of chicken pickle prepared as per two group of meat were not affected by the different duration of storage under ambient temperature for varying periods.

However in case of tenderness the treatment group had numerically higher score throughout the periods of storage. It was due to the effect of tenderization by papain enzyme at the concentration of 0.002 per cent solution.

These findings are also in agreement with Singh and Panda (1984) for quail pickle, Puttarajappa *et al.* (1996) for broiler chicken meat pickle and Prabhakara Reddy and Eswara Rao (1997) for spent chicken pickled cut-up parts. Singh and Panda (1984) reported that the mean overall sensory score of quail pickle stored at room temperature ranged from 6.71±0.18 to 5.00±0.31 for 30 to 110 days of storage. Puttarajappa *et al.* (1996) reported that flavour and overall quality of broiler chicken meat ranged from 8.8 to 7.21 and 8.81 to 6.93 for zero and six months of storage at ambient temperature.

The overall acceptability of chicken meat pickle prepared by both the group of meat was not found to be different statistically at ambient temperature for varying periods. The chicken meat pickle prepared using untenderized and tenderized meat were equally acceptable with regard to flavour, juiciness, tenderness and overall acceptability.

Cost structure

The present study revealed that acceptable and nutritious chicken meat pickle could be prepared by using tenderized meat as that of untenderized meat of spent hen and this could be stored upto 64 days at ambient temperature without any quality deterioration. The product was microbiologically safe, acceptable from the sensory quality point of view and economic considering the cost structure.

Summary

SUMMARY

An experiment was designed and carried out to evaluate the feasibility of preparing chicken meat pickles from untenderized and tenderized spent chicken with papain using a recipe to suit Indian palate and to study the nutritional characteristics, keeping quality, conditions of storage without deterioration of quality and overall acceptability.

Broiler breeder spent hens in the age group of 72 weeks were used in the study. Data on processing yields and losses were recorded from all the birds. The boned meat obtained from these spent hens was made into pieces of 2.5 to 3.5 cm and used for the preparation of chicken meat pickle. Boned meat pieces were divided into two portions. One half was soaked in the papain enzyme solution having a strength of 0.002 per cent for 60 minutes and the other half served as control. A recipe was developed to suit Indian palate and as per the recipe product was prepared for the control and treatment groups and stored at ambient temperature in glass bottles.

The chicken meat pickle of the control and treatment groups were withdrawn from the bottles at zero, eight, 16, 24, 32, 40, 48, 56 and 64 days of storage period. The shelf-life of the product in terms of quality parameters viz., proximate

composition, oxidative rancidity, total bacterial count and organoleptic evaluation were carried out at each stage of storage period. Cost structure for producing one kilogram of untenderized and tenderized spent chicken meat pickle was also worked out.

The following observations were made in this investigation.

1. It was observed that the ready-to-cook yield and the total loss of spent broiler breeder hens averaged 70.50±0.335 and 19.1±0.345 per cent respectively.

2. Moisture content of the pickle decreased and protein, fat and total ash content increased significantly ($P<0.01$) during the period of storage for both the pickle prepared using untenderized (control) and tenderized (treatment) chicken meat.

3. Chemical composition of the product was found to agree with the reported values for the poultry meat and meat products.

4. Storage of product at ambient temperature significantly ($P<0.01$) increased the TBA values with each incremental storage period in control and treatment groups. But between control and treatment groups no significant

difference was observed during the different storage period.

5. The total bacterial count per gram of pickle also increased significantly ($P<0.01$) for each period of storage under ambient temperature in control and treatment groups. But there was no significant difference between control and treatment groups during the periods of storage.

6. The organoleptic evaluation of untenderized and tenderized spent chicken meat pickles stored at ambient temperature revealed that product was quite acceptable and it could be stored for 64 days at ambient temperature without any loss in quality.

7. The cost structure revealed that cost of production of one kilogram untenderized and tenderized spent chicken meat pickle were Rs.60.27 and Rs.60.45 respectively.

On the basis of the above findings it was concluded that a highly acceptable spent hen meat product in the form of spent chicken meat pickle could be prepared from boned spent chicken meat. The meat treated with papain solution had numerically higher tenderness score than the untreated group. The product could be stored upto 64 days without any deterioration in quality.

Plate 1. Ready to eat chicken pickle in bottle

Plate 2. Ready to eat chicken pickle in plate

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ASSESSMENT OF THE QUALITY OF TENDERIZED CHICKEN MEAT PICKLE

By

MURUGAN. M.

ABSTRACT OF A THESIS

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Kerala Agricultural University

Department of Poultry Science

COLLEGE OF VETERINARY AND ANIMAL SCIENCES

MANNUTHY, THRISSUR - 680851

KERALA

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ABSTRACT

A study was carried out to examine the feasibility of preparing chicken pickle using untenderized and tenderized (papain treated) boned spent hen meat, and to evaluate its shelf-life.

The ready-to-cook yield and total loss averaged 70.5±0.34 per cent and 29.5±0.07 per cent respectively for broiler breeder spent hens (72 weeks of age) used for the study. The cooking yields of control (untenderized) and treatment (tenderized) groups were 76.70 and 71.70 per cent respectively.

The chicken meat pickle prepared were kept at ambient temperature upto 60 days. Analysis for qualitative assessment on the representative samples was conducted qualitatively and evaluated organoleptically by a taste panel at zero, eight, 16, 24, 32, 40, 48, 56 and 64 days of storage. It was observed that during different periods of storage, the proximate components viz., moisture, protein, fat and total ash of the product significantly altered. As the storage period increased the 2-thiobarbituric acid number (TBA) was also increased significantly ($P<0.01$). The total bacterial count increased significantly ($P<0.01$) with the increase in the duration of storage. In case of organoleptic evaluation

scores no significant difference was found between control and treatment groups. However, tenderized meat group had numerically higher tenderness values than untenderized meat group during all the periods of storage.

Based on the cost structure it was observed that the cost of production of one kilogram of chicken meat pickle using untenderized and tenderized spent hen meat were Rs.60.27 and 60.45 respectively.

From the above findings it was concluded that, a highly acceptable, nutritious, ready-to-cook chicken meat pickle could be prepared using untenderized and tenderized spent hen meat. The product could be stored upto 64 days at ambient temperature without any quality deterioration.