

**EFFECT OF MARINATION AND POLYPHOSPHATE  
ON QUALITY IMPROVEMENT OF SPENT  
LAYER MEAT**

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**DISSERTATION**

**Submitted in partial fulfilment of the  
requirement for the diploma**

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1997**

## DECLARATION

I hereby declare that this dissertation entitled "**EFFECT OF MARINATION AND POLYPHOSPHATE ON QUALITY IMPROVEMENT OF SPENT LAYER MEAT**" is a bonafide record of research work done by me during the course of research and that the dissertation 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.



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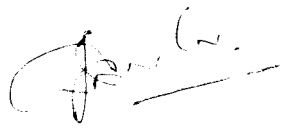
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Certified that this dissertation entitled "**EFFECT OF MARINATION AND POLYPHOSPHATE ON QUALITY IMPROVEMENT OF SPENT LAYER MEAT**" is a record of research work done independently by Sri. M. ANILKUMAR, under my guidance and supervision and that it has not previously formed the basis for the award of any degree, fellowship or associateship to him.

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M. ANILKUMAR

*Dedicated to*  
*my*  
*Beloved Parents*

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# Introduction

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# INTRODUCTION

Poultry meat and its products form a major component of the foods of animal origin for human consumption. The demand for poultry meat and its products is increasing rapidly in both developing and developed countries.

Among the reasons for its increased demand are competitive price, consumer concern for low fat, high quality meat and wide variety of consumer accepted products. In many countries the demand for white meat over red meat is on the increase.

The quality of broiler chicken has increased considerably due to constant research in areas of breeding, feeding and management. But spent chicken being a by-product of the egg industry, has not been given proper consideration. Meat from spent chicken is generally tough. Consequently consumer acceptance for spent chicken is low and the returns to the farmer by sale of spent chicken is also low. Annually the poultry industry produces 200 million spent chicken and the availability of spent chicken has increased in recent years due to rapid development of Indian poultry industry. Very little attention has been bestowed on quality component of spent chicken meat. A study aimed at utilising the spent birds more effectively will help the farmers by way of better returns.

Some attempts have been made in the past by scientists to improve the quality of spent chicken meat. The ultimate pH, water holding capacity, cooking yield and palatability evaluation of meat are important meat quality parameters that require consideration. Tenderness of cooked meat is the most important palatability trait for acceptance of cooked meat.

Meat tenderness is influenced by age, breed, sex, fatness, pre-slaughter treatment, dressing, cooking, storage and cooling procedures.

Marination is a method for improving tenderness of meat. Marinade in olden days was the brine solution used to pickle fish. But now the term implies any liquid used to soften and flavour meats. A marinade may contain ingredients such as oil, sugar, seasonings, wine or fruit juices. Several studies have indicated that the operational component in the marinade that affect pH and tenderness of meat is the acid present. It has been suggested that marinades act by altering the ultimate muscle pH, which in turn alters physical and or chemical properties of meat. Polyphosphates have been used in meat and poultry products in the past to improve cooking yield, texture and moisture retention. Phosphates tenderise meat by their ability to increase pH and subsequent hydration of proteins and increase in water holding capacity of meat.

Although many research workers have studied the tenderising effect of marinades containing weak acids such as citric acid and acetic acid in their pure form, the use of commonly available weak acids, such as lactic acid in curd, citric acid in Lemon juice and Oxalic acid in tomato pulp have not been studied.

In the present study spent chicken meat was subjected to three different marinations and cooked by conventional and microwave methods. The quality parameters such as pH, water holding capacity, cooking yield and organoleptic scores were measured.

# **Review of literature**

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## REVIEW OF LITERATURE

Lawrie (1985) determined the initial pH of meat of different species and stated that pig and ox had a pH value of 6.74 while lamb had a value of 6.95. Reddy and Reddy (1994) reported the pH of cockerel meat to be  $6.23 \pm 0.14$ . Sing *et al.* (1994) reported that the pH of quail meat was  $6.28 \pm 0.04$ . Kauffman *et al.* (1986) stated that the water holding capacity (WHC) of muscle vary considerably among muscles originating from animals of same species, breed, sex, weight, age and antemortem and post mortem treatment and that it affects both the quality and composition of meat. They also stated that muscles releasing excess fluids are drier tasting and loose more weight during processing, storage, transit and display. Gault (1985) described that at pH levels above ( $>6$ ) or below ( $<4$ ) the isoelectric point the number of available charge is increased and thus the WHC is increased.

Marination of meat in acid solution was found to increase tenderness (Lind *et al.*, 1971; Wenham and Locker 1976; Howat *et al.*, 1983).

Cunningham and Levonne (1981) studied the effect of tenderising marinades on chicken muscles by injecting the marinades on to the muscle and found that the marinade improved tenderness and flavour of spent chicken considered to be tough for consumers accustomed to tender broiler.

Oreskovich *et al.* (1992) studied the effect of different pH (pH 3.25 to 10.15) on beef and showed that low and high muscle pH after marination had a positive effect on texture which resulted in increased water holding capacity and reduced cooking

loss. They also suggested that by altering the pH of muscle above 2 units in either direction from the isoelectric point, substantial changes in meat tenderness and WHC could be achieved. Phosphates have been used successfully in tenderising meat because of their ability to increase pH and subsequent hydration of protein (Monk *et al.* 1964; Farr and May 1970; Baker *et al.* 1970; Shultz and Weirbiki 1973; Wood and Richard 1974).

May *et al.* (1962) found that chilling the carcasses in a 3 per cent solution of polyphosphates significantly improved tenderness of poultry meat. Spencer and Smith (1962) chilled fryers in a 7.5 per cent. Polyphosphate solution for 6 hours resulting in increased tenderness. Peterson (1977) found that toughening effect of cutting chicken broiler breast muscle within 1 hour after slaughter could be prevented by injecting sodium polyphosphate into the muscle at 20 mts. post mortem.

It was suggested by Hamm and Deatherage (1960) that the positive effects of inorganic salts on tenderness and WHC of meat were due to the increased charge of the protein introduced by the salts.

Reddy and Reddy (1994) in a study of cockerel meat treated with different combination of trisodium poly phosphate (STPP) and salt showed that the 3 per cent STPP treatment gave highest moisture uptake and less cooking loss.

Sing *et al.* (1994) in a study on effect of salt and poly phosphate on quail meat found that salt had appreciable effect on pH of meat and that STPP treatment significantly elevated muscle pH and reduced cooking loss and a combination of the two had a synergistic effect.

Salama (1993) compared the effect of microwave and conventional cooking on preparation of chicken pretreated with sodium chloride or STPP. Chicken cooked in the microwave had a lower moisture and higher cooking loss than that cooked conventionally. Microwave cooked meat was less tender and had higher colour than those cooked conventionally. But the aroma and flavour scored high on sensory evaluation.



# **Materials and methods**

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## MATERIALS AND METHODS

### 3.1 Collection and slaughter of spent chicken

Six spent white leghorn layers aged between 1.5 to 2 years (average 1.5 years) reared on identical conditions were purchased from local market. The live weight of birds ranged from 1.100 kg. to 1.700 kg. (Average 1.35 kg.). Each bird was slaughtered and dressed as per standard procedure at the meat technology unit, the carcasses were cut up into small pieces of 2 inch size.

### 3.2 Preparation of Marinade

A common mix of spices and condiments was prepared with the following ingredients.

Table 1 Ingredients used for preparation of common mix for marinade

Ingredient	Quantity as percentage of meat weight
Anise	0.5%
Cardamom	0.2%
Cinnamon	0.5%
Chilli	1.2%
Garlic	1.0%
Ginger	2.0%
Pepper	0.2%
Turmeric	0.05%
Onion	10.0%
Salt	1.2%

The ingredients were blended in a mixer grinder to a fine pasty consistency and the same was divided into 3 equal parts A, B and C. Three different marinades were prepared by adding 10 ml. of curd to part A, 10 ml. of lemon juice to part B and 10 ml. tomato pulp to part C. All the three marinades were thoroughly mixed and kept ready for application on to the spent chicken parts.

Fig. 1a Experimental design C - Control, T1 Treatment (Curd), T2 Treatment (Lemon juice), T3 Treatment (Tomato pulp)

Group I				
	Meat pieces of 75 gm each			
	C Control	T1	T2	T3
Dipping in 3% STPP solution for 30 mts.		✓	✓	✓
Draining		✓	✓	✓
Application of marinade		Marinade-A (Curd)	Marinade-B (Lemon juice)	Marinade-C (Tomato pulp)
Overnight chilling	✓	✓	✓	✓
Pressure cooking at 15 lbs. pressure for 10 mts. and fried in oil	✓	✓	✓	✓
Sensory evaluation	✓	✓	✓	✓

Fig. 1b Experimental design C - Control, T<sub>1</sub> Treatment (Curd), T<sub>2</sub> Treatment (Lemon juice), T<sub>3</sub> Treatment (Tomato pulp)

Group II				
	Meat pieces of 75 gm each			
	C Control	T1	T2	T3
Dipping in 3% STPP solution for 30 mts.		✓	✓	✓
Draining		✓	✓	✓
Application of marinade		Marinade-A (Curd)	Marinade-B (Lemon juice)	Marinade-C (Tomato pulp)
Overnight chilling	✓	✓	✓	✓
Microwave cooking at 200° C for 13 mts.	✓	✓	✓	✓
Sensory evaluation	✓	✓	✓	✓

As shown in the experimental design cut up parts 1 to 4 form Group I and parts 5 to 8 form Group II. Group I was intended for pressure cooking and Group II for microwave cooking.

### 3.3 Marination of Meat

Cut up chicken was divided into 8 equal parts (1 to 8) each weighing 75 gms. Parts 2,3,4,6,7 and 8 were dipped separately in 3 per cent. STPP solution for 30 mts. and the remaining 2 parts were kept as control. (Parts 1 and 5). The STPP treated parts 2,3,4,6,7 and 8 were drained and kept ready for marination part 2 and 6 were

mixed separately with marinade A (T1). Part 3 and 7 were treated with marinade B (T2) and part 4 and 8 were mixed with marinade C (T3).

The marinated meat pieces were stored overnight in separate polythene bags at 4°C in a refrigerator. Next day the bags were taken out and the meat pieces were cooked.

### **3.4 Cooking**

Parts 1 to 4 of Group I were pressure cooked in a Hawkins pressure cooker at 15 lbs. pressure for 5 mts. drained and fried in oil till brown. Parts 5 to 8 of Group II were cooked in a microwave oven (BPL BMC 900T) at 200 °C for 13 mts.

### **3.5 Recording of Weights**

Weights of samples were recorded on a balance as shown below:

- a) Weight of fresh meat (WT1)
- b) Weight of meat after marination (WT2)
- c) Weight of meat after overnight chilling (WT3)
- d) Weight of meat after cooking by pressure cooking and frying (WT4)
- e) Weight of meat after microwave cooking (WT5)

### **3.6 pH recording**

pH of meat was recorded as per method described by Moeller *et al.* (1977) using a combined electrode digital pH meter (Systronics) as shown below:

- a) pH of fresh meat (pH1)
- b) pH of marinade (pH2)
- c) pH of marinated meat after overnight chilling (pH3)

### **3.7 Water holding capacity**

The water holding capacity of fresh meat and that of marinated meat was recorded using filter paper press method as per procedures described by Weirbicki and Deatherage (1958) by precise sample weight (300 mg.) of meat and pressure to determine expressible fluid as a ratio of meat film area and total area, the m/t ratio.

### **3.8 Sensory evaluation**

An experienced four member panel judged the cooked samples for appearance, flavour, juiciness, tenderness and overall acceptability and scored the meat using a 9 point hedonic scale.

The treatment were repeated six times and the data were analysed as per method suggested by Snedecor and Cochran (1967).

# Results

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## RESULTS

A study was conducted for assessing the effect of marination on quality improvement of spent chicken meat. Three different marinades were used for the study containing curd (T1), Lemon juice (T2) and Tomato pulp (T3).

The pH of meat used, marinades and marinated meat after chilling were recorded and the observations are presented in Table 2.

It was observed that the meat had a initial pH of  $6.49 \pm 0.00$ . The pH of marinade (T1) containing lemon juice was the lowest  $4.73 \pm 0.07$  and that of marinade containing curd (T2) recorded a pH of  $5.77 \pm 0.05$  and the pH of marinade containing tomato pulp (T3) was  $5.70 \pm 0.13$ .

Marinades were not applied on the control samples.

The marinated meats and controls were chilled overnight and the pH was recorded the next day. The pH of samples treated with marinade containing curd (T1) and Lemon juice T2 was lowered to  $5.77 \pm 0.05$  and  $4.73 \pm 0.07$  respectively. The pH of tomato pulp containing marinade T3 and control group was not appreciably changed.

The pH of treatment groups T3 after overnight chilling was significantly different from that of control group (C).



Table 2 Mean and Standard Error of pH of meat, marinades and meat after marination

Treatment	pH of fresh meat	pH of marinade	pH of meat after marination and overnight chilling
Control	6.49 ± 0.00	6.36 ± 0.04 <sup>a</sup>	6.24 ± 0.02 <sup>a</sup>
Curd (T1)	6.49 ± 0.00	5.77 ± 0.05 <sup>b</sup>	5.84 ± 0.04 <sup>b</sup>
Lemon juice (T2)	6.49 ± 0.00	4.73 ± 0.07 <sup>c</sup>	5.77 ± 0.07 <sup>b</sup>
Tomato pulp (T3)	6.49 ± 0.00	5.70 ± 0.13 <sup>b</sup>	6.21 ± 0.03 <sup>a</sup>
Group mean		5.64 ± 0.04	5.69 ± 0.23

Columns bearing different superscript letters are significantly different

#### **4.1 Effect of marination on water holding capacity**

In the present study the WHC of both fresh meat and marinated meat after chilling overnight were recorded and the data is presented in Table 3.

It was observed that the WHC of fresh meat was not significantly different in any of the treatment groups. Significant differences in WHC were observed among the marinated meat groups. The mean highest WHC of  $0.53 \pm 0.03$  was recorded in the treatment T3 (Tomato pulp) whereas the lowest  $0.48 \pm 0.01$  was observed in curd group T1 and the lemon juice treated group T2 had a mean value of  $0.51 \pm 0.01$ .

The control group had a mean of  $0.41 \pm 0.01$  which was significantly lower for all the treatment groups.

#### **4.2 Effect of STPP**

Six samples of spent chicken meat were dipped in 3 per cent STPP solution for 30 mts., allowed to drip and weights were recorded in three groups T1, T2 and T3 viz. curd, lemon juice and tomato pulp. The data is given in Table 4. It was observed that after dipping in 3 per cent STPP solution the weight of samples increased to  $80.60 \pm 0.33$  in T3 group  $80.66 \pm 0.71$  in T1 group and  $81.83 \pm 0.60$  in T2 group. The control group was not dipped in STPP solution.

#### **4.3 Weight gain on marination**

The samples other than the controls were subjected to marination and the weights after marination was recorded, the weights are given in Table 4.

Table 3 Mean and Standard Error of water holding capacity of fresh meat and marinated meat (ratio)

Treatment	WHC fresh meat	WHC of marinated meat
Control	0.42 ± 0.00 <sup>a</sup>	0.41 ± 0.01 <sup>a</sup>
Curd (T1)	0.41 ± 0.00 <sup>a</sup>	0.51 ± 0.01 <sup>c</sup>
Lemon juice (T2)	0.42 ± 0.01 <sup>a</sup>	0.48 ± 0.01 <sup>b</sup>
Tomato pulp (T3)	0.43 ± 0.01 <sup>a</sup>	0.53 ± 0.03 <sup>d</sup>

Columns bearing different superscript letters are significantly different

Table 4 Mean and Standard Error of weights of chicken meat after treatment

Treatment	Initial weight of meat	Weight after dipping in 3% STPP for 30 mts.	Weight of meat with marinade	Weight of meat with marinade after overnight chilling	Chiller loss (%)	Weight after cooking		Cooking yield percentage	
						Pressure cooking	Micro wave	Pressure cooking	Micro wave
Control	75±0.00	75.00±0.00	75.00±0.00	71.66±0.42	4.50	50.83±0.40	33.00±0.66	66.00	44.00
Curd	75±0.00	80.66±0.71	92.33±0.76	90.16±0.65	2.35	64.00±0.63	67.16±0.87	85.00	89.00
Lemon juice	75±0.00	81.83±0.60	91.66±0.66	90.66±0.76	1.09	63.00±0.73	65.00±0.96	84.00	86.00
Tomato pulp	75±0.00	80.66±0.33	91.83±0.47	90.83±0.47	1.08	68.50±0.55	69.00±0.55	90.60	92.00

There was gain in weight in all treatment groups.

#### **4.4 Weight after overnight chilling**

The control and marinated samples were kept overnight in a refrigerator and after 24 hours the weight was recorded. The loss in weight on chilling was significant. The highest loss was observed in control samples (4.5%) and lowest loss was in tomato pulp treated group T3 (1.08%).

#### **4.5 Effect of marination on cooking yield**

Two different cooking methods viz. pressure cooking and microwave cooking were employed. The weights of samples in control and treatment groups T1, T2 and T3 were recorded under both methods and the results are given in Table 4.

The weights recorded for the control group after pressure cooking and frying was  $50.83 \pm 0.40$  and  $33 \pm 0.66$  after microwave cooking. The weight of marinated group (T1) was  $64 \pm 0.63$  and  $67.16 \pm 0.87$  respectively in pressure cooking and microwave cooking. The treatment group T2 (curd) gave  $63 \pm 0.73$  and  $65 \pm 0.96$  respectively by pressure cooking and microwave cooking. In the T3 group pressure cooking gave  $68.50 \pm 0.76$  whereas the microwave cooked samples in the same group gave  $69 \pm 0.15$ .

The percentage of cooking yield was calculated based on the initial weight and the data is given in Table 4. The percentage of cooking yield in pressure cooking and frying ranged from 66 per cent of 90.6 per cent. The cooking yield in microwave ranged from 44 per cent to 92 per cent. The cooking yield of the treatment groups

were significantly higher than that of the control group. The percentage of yield in the control group was 66 per cent and 44 per cent respectively for pressure cooking and microwave.

## **4.7 Sensory evaluation**

### **4.7.1 Pressure cooking**

The sensory evaluation of the cooked samples was conducted with the help of a nine point Hedonic scale and the data is presented in Table 5 and 6. It was observed that the scores for appearance, flavour, juiciness, tenderness and overall acceptability of treatment groups were significant in the case of pressure cooking and frying. The scores for appearance ranged from  $4.16 \pm 0.08$  to  $6.48 \pm 0.21$ . The highest scores  $7.15 \pm 0.02$  was recorded in the case of T3 (Tomato pulp) group in respect of flavour, followed by T1 (curd) T2 (Lemon juice) and control (C) samples. The scores for juiciness were significant, it varied from  $4.18 \pm 0.09$  to  $5.7 \pm 0.20$ . The scores for tenderness of control sample was only  $3.76 \pm 0.21$  and for tomato pulp sample (T3) it was  $5.95 \pm 0.5$  being the highest. Overall acceptability scores varied from  $4.00 \pm 0.10$  to  $6.85 \pm 0.09$ . In general tomato (T3) had a higher score followed by marinade containing lemon juice (T2) and curd marinade (T1) and control.

### **4.7.2 Microwave cooking**

In the case of microwave a similar trend to that of pressure cooking was noticed. There was significant difference between treatments when compared to the control. The appearance score for control was  $4.58 \pm 0.13$  and that of T1 was  $5.83 \pm 0.05$  T2 had a score of  $5.43 \pm 0.14$  and T3 tomato pulp treatment had a score of  $6.33 \pm 0.08$ .

Table 5 Mean and Standard Error of sensory scores of marinated spent chicken after pressure cooking and frying

Treatment	Appearance	Flavour	Juiciness	Tenderness	Overall acceptability
Control	4.16 ± 0.08	4.21 ± 0.16	4.18 ± 0.09	3.76 ± 0.21	4.00 ± 0.10
Curd	6.23 ± 0.01	6.26 ± 0.17	4.60 ± 0.20	5.58 ± 0.13	6.15 ± 0.24
Lemon juice	5.71 ± 0.22	5.98 ± 0.04	5.20 ± 0.26	5.55 ± 0.15	6.40 ± 0.58
Tomato pulp	6.48 ± 0.21	7.15 ± 0.02	5.70 ± 0.20	5.95 ± 0.05	6.85 ± 0.09

Table 6 Mean and Standard Error of sensory scores of marinated spent chicken after microwave cooking

Treatment	Appearance	Flavour	Juiciness	Tenderness	Overall acceptability
Control	4.58 ± 0.13	3.55 ± 0.16	3.88 ± 0.26	3.16 ± 0.08	4.28 ± 0.10
Curd	5.83 ± 0.05	5.85 ± 0.05	4.08 ± 0.09	5.13 ± 0.04	5.99 ± 0.89
Lemon juice	5.43 ± 0.14	5.68 ± 0.38	4.23 ± 0.09	4.93 ± 0.07	5.90 ± 0.05
Tomato pulp	6.33 ± 0.08	7.15 ± 0.08	5.66 ± 0.19	5.75 ± 0.19	6.55 ± 0.12



The flavour scores for microwave cooking ranged from  $3.55 \pm 0.16$  to  $7.15 \pm 0.08$ . Control group had a score of  $3.55 \pm 0.16$  and T1 had a score of  $5.85 \pm 0.05$ , T2 had a score of  $5.68 \pm 0.03$  and tomato pulp marinade (T3) had a score of  $7.15 \pm 0.08$ . The scores were significantly different between treatments and control. The scores for juiciness ranged for  $3.88 \pm 0.2$  to  $5.6 \pm 0.19$ . The highest being that of tomato pulp treatment group T3. The tenderness also showed a high value in T3 and low value in control groups.

The overall acceptability of samples were  $4.28 \pm 0.1$  for control,  $5.90 \pm 0.59$  for T2 (curd)  $5.99 \pm 0.59$  for T1 and highest value of  $6.55 \pm 0.12$  was attained by T3.

Analysis of variance showed that the effect of pressure cooking and microwave cooking on organoleptic qualities of spent chicken meat was significantly different having a better mean in pressure cooked samples. The overall acceptability scores for microwave cooking was  $4.74 \pm 0.09$  and that for pressure cooking was  $5.21 \pm 0.94$ .

# Discussion

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## DISCUSSION

### 5.1 pH

The effect of marination on the pH of meat was studied using marinade mix containing either curd, lemon juice or tomato pulp and compared with control meat samples. It was observed that the initial pH of meat was  $6.49 \pm 0.00$ . Reddy and Reddy (1994) reported a lower pH in cockerel meat. Baker *et al.* (1970) reported that the normal pH of heavy fowl meat as 6.1. Among the various treatment groups the initial pH of the meat was found to be the same.

Among the three marinades used in this study the lowest pH was observed in the marinade containing lemon juice which could be due to the presence of citric acid. However the pH of all the three marinades was acidic.

Oreskovich *et al.* (1992) stated that the operational component in the marinade that affects muscle pH is the concentration of acid present. He also stated that marinades act by altering the ultimate pH of muscle which in turn alters the physical and or chemical properties of meat.

The pH recording of the meat after application of marinades proves that the marinades containing weak acids have the ability to lower the pH of the meat. The finding is in agreement with that of Reddy and Reddy (1994). According to



Oreskovich *et al.* (1992) the organoleptic quality of meat is improved when muscle pH is changed either positively or negatively.

In the present study it was observed that the control sample did not show significant variation in the case of pH when compared to initial pH of fresh meat. In the case of marinade containing curd and lemon juice the reduction in pH of meat was significantly different compared to that of control and tomato pulp marinated samples.

## 5.2 Chiller loss

The chiller loss sustained by the samples under the study was assessed after the overnight storage of samples at 4°C. The highest loss of 4.5 per cent was recorded in the control samples while the treated samples had only 1.08 per cent in T3 followed by 1.09 per cent in T2 and 2.35 per cent in T1. The results indicate that marination is effective in reducing the chiller loss of meat during refrigerated storage.

## 5.3 WHC

The WHC of meat measured in terms of meat film area to the total wet area expressed as a ratio showed that the initial values of the fresh samples were not significantly different. The higher WHC observed in the treated samples could be due to the action of STPP on meat proteins. The finding agrees with the findings of Monk *et al.* (1964) Farr and May (1976) Baker *et al.* (1972) Shultz and Weirbicki (1973) Wood and Richards (1974).

The WHC of STPP dipped marinated meat had a significantly higher value compared to that of the fresh samples irrespective of the type of marination.

Oreskovich (1992) found that marination of meat changed the pH of muscle and improved the WHC. It was found in the present study that all the treatment groups had a better WHC than that of control groups. This finding is in agreement with that of Lind *et al.* (1971) Wenham and Locker (1976).

Among the three treatments under the study the marinade containing tomato pulp (T3) showed a higher WHC than that of T1 and T2. From this result it could be suggested that a marinade with pH 5.7 is better for improvement of WHC of spent chicken meat than the ones which has a lower pH. This is in agreement with the findings of Hamm and Deatherage (1960) who reported that pH increased WHC of meat at high pH values (5.5 to 11.0).

#### **5.4 Cooking yield**

Cooking yield is an important quality attribute of meat (Lawrie (1985). In the present study the cooking yield of controls and treated groups were recorded and the results obtained showed that there is a significant improvement in the cooking yield of all groups compared to the controls. The lowest cooking yield of 44 per cent was recorded in control samples cooked under microwave, whereas under pressure cooking this yield was 66 per cent. The cooking yields of the treated samples were significantly higher than that of the control irrespective of the treatments and irrespective of the cooking method. However, the cooking yield was better in the microwave cooking compared to pressure cooking under all the treatments. Among the three treatments under the study T3 group which had tomato pulp marinade yielded the highest of 92 per cent in microwave and 90.6 per cent in pressure cooking

followed by T1 and T2. The results clearly indicate that marination and application of STPP had positive effect in improving the cooking yield of spent chicken meat.

### 5.5 Organoleptic qualities

The effect of marination on sensory evaluation of cooked spent chicken was conducted in both pressure cooked and microwave cooked samples. The sensory qualities viz. Appearance, Flavour, Juiciness, Tenderness and Overall acceptability were assessed with the help of a nine point hedonic scale. The scores in the case of all the treated samples irrespective of the treatments and cooking methods were significantly higher compared to those of controls. In the present study higher sensory evaluation scores were obtained in the case of marinated spent chicken meat which is in agreement with the findings of Cunningham and Lavonne (1981) who studied the effect of marinades on organoleptic qualities of meat. Oreskovich *et al.* (1992) reported that change in pH, increased WHC and reduced cooking loss, in the case of marination of beef muscle. In the present study the pH, WHC, appearance, flavour, juiciness tenderers and overall acceptability were improved on marination. Among the treatments the samples treated with marinade containing tomato pulp (T3) yielded the highest sensory scores in respect of all the sensory attributes studied.

It was observed that the score for appearance was not significantly different in the case of pressure cooking and microwave cooking where as the scores for flavour, juiciness, tenderness and overall acceptability were significantly higher for samples cooked under moist pressure. Price and Schweighert (1987) reported better flavour in conventionally cooked meat. In the case of microwave cooking the heating is fairly uniform which does not lead to surface browning or crusting. The effect might be marked by the application of marinade.

Among the sensory attributes of meat quality tenderness is the most important one considered by the consumer. In the present study it was observed that marinated spent chicken samples had significantly higher sensory score for tenderness irrespective of the cooking methods compared to the controls. Similar results on improvement of sensory scores in marinated samples were reported by Hamm and Deatherage (1960), Spencer and Smith (1962) and May *et al.* (1962).

In this study, it was observed that marination had a significant effect on pH, water holding capacity, cooking yield and organoleptic qualities. The spent chicken meat treated with tomato pulp marinade had the highest score for pH, water holding capacity, cooking yield and organoleptic qualities.

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# Summary

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## **SUMMARY**

A study was conducted to assess the effect of Sodium Tripolyphosphate and three different marinades containing either curd, lemon juice or tomato pulp on quality improvement of spent chicken meat in comparison to a control group under two cooking methods. The study included various parameters viz., pH, water holding capacity, chiller loss, cooking yield and sensory evaluation.

The results of the study revealed that the marination irrespective of the ingredients used had effect on lowering the pH of meat. The water holding capacity of meat was improved significantly by the STPP and marinades and there was no significant difference between treatment groups. Chiller loss was significant between control and treatment groups. The cooking yield on pressure cooking and frying ranged from 66% to 90.6% and that on microwave cooking ranged from 44% to 92%. The percentage of yield in the control group was significantly lower irrespective of cooking methods.

Sensory scores for treatment groups and control showed that the scores for flavour, juiciness, tenderness and overall acceptability were significant in the case of treatments with tomato pulp treated group getting the highest score in both pressure cooking and microwave cooking.

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# Appendix

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## SCORE CARD FOR TASTE PANEL

Name of the product

Sample No.

Date

Type of cooking

Colour							
1		2		3		4	
A	B	A	B	A	B	A	B

Flavour							
1		2		3		4	
A	B	A	B	A	B	A	B

Juiciness							
1		2		3		4	
A	B	A	B	A	B	A	B

Tenderness							
1		2		3		4	
A	B	A	B	A	B	A	B

Overall acceptability							
1		2		3		4	
A	B	A	B	A	B	A	B

Appealing							

Delicious							

More juicy							

Very tender and resilient							

Extremely good							
Very good							
Good							

Pleasing							

Agreeable							

Juicy							

Less tender and resilient							

Extremely fair							
Very fair							
Fair							

Not so pleasing							

Not so agreeable							

Less juicy							

Tough and no resilient							

Poor							
Very poor							
Extremely poor							

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Name

Signature



# **EFFECT OF MARINATION AND POLYPHOSPHATE ON QUALITY IMPROVEMENT OF SPENT LAYER MEAT**

**By**  
**M. ANILKUMAR**

## **ABSTRACT**

Submitted in partial fulfilment of the  
requirement for the diploma

## **Post Graduate Diploma**

Faculty of Veterinary and Animal Sciences  
Kerala Agricultural University

**Department of Livestock Products Technology**  
**(MEAT TECHNOLOGY UNIT)**  
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KERALA  
**1997**

## **ABSTRACT**

Six spent chicken were slaughtered and cut into suitable size, cut up parts were divided into 8 equal parts, two parts were kept as control and the remaining 6 parts were divided into 2 groups and were dipped in 3 per cent STPP solution for 30 minutes and drained, three marinades were prepared containing either curd, lemon juice or tomato pulp. Samples of each group were marinated and kept at 4°C overnight.

Parameters such as pH, water holding capacity, weight after marination, weight after overnight chilling, cooking yield and sensory scores were studied after pressure cooking followed by frying and microwave cooking.

In this study, it was observed that marination had a significant effect on pH, water holding capacity, cooking yield and organoleptic qualities. The spent chicken meat treated with tomato pulp marinade had the highest score for pH, water holding capacity, cooking yield and organoleptic qualities.