



Research Article

Assessment Of Different Preservative Methods For Microbial Quality And Shelf Life Of Chicken Meat

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ABSTRACT

Poultry meat is nutritionally dense and frequently use in Pakistan. However, chances of poultry meat contamination by food borne pathogenic microorganisms are always high during slaughtering, processing and marketing. The present study was aimed at the use of gamma irradiations and autoclaving on both packed fried and boiled chicken meat for total bacterial count, total coliform count and total fungal count. Two kilograms of chicken meat was fried and two kilograms of chicken meat was just boiled followed by packing of each fried and boiled (25g) samples into silver tetra packs and sealed in vacuum sealer. Half of the sealed samples (fried & boiled) were autoclaved and the other half were irradiated with 5.0 KGy and 7.5 KGy and then stored at room temperature. Gamma radiations of 5.0 KGy and 7.5 KGy intensity as well as autoclaving showed significant ($p < 0.05$) effect on growth of total aerobic count as compared to control group. However, coliform bacteria showed non-significant difference between control samples and gamma irradiated as well as autoclaved samples during storage for 60 days. Fungal count was significantly affected ($p < 0.05$) in treated group as compared to control group. Quality attributes of sensory analyses showed non-significant difference ($P > 0.05$) for all treatments. The level of significance were found to be $P=0.984$, $P=0.73$, $P=0.954$, $P=0.300$ and $P=0.432$ for color, flavor, taste, texture and overall acceptability respectively. It is concluded that irradiations increases shelf life and microbial quality of the meat products and it should be promoted for meat quality maintenance

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INTRODUCTION

Food-borne diseases continually happen and becoming an important health issue (Lynch et al. 2006) causing about 5000 deaths in USA annually (Mead et al. 1999). The main cause of foodborne illness is considered to be pathogenic microbes. Poultry meat, which is nutritionally dense (Cherian et al. 2005) and one of the easily available cheap sources of meat, is usually contaminated during slaughtering, processing and marketing (Mead et al. 1999). On quality perspective, doses of ionizing radiations should be carefully selected in order to achieve safety, nutrients and acceptable sensory target. Irradiation at low doses does not change flavor, texture or other important attributes (Farkas, 2006). Similarly, packed food should be irradiated because pre-packed food irradiation followed by packing may certainly give rise to contamination. Modern food industry is therefore, irradiate packed food item in accordance to the principle laid down by Hazard Analysis and Critical Control Point (HACCP). This technology is considered superior than freezing, high temperature and chemical treatment of sterilization food commodities (Grollichova et al. 2004). However, radiation-resistant spore forming bacteria (*Clostridium botulinum*) may reduce or

eliminate at a higher dose (30kGy) (Dezfulian and Bartlett 1987). Market based campaign and awareness among customer is necessary to achieve marketing goals (Hunter 2000). The present study was conducted to check the effect of gamma irradiations and autoclaving on both packed fried and boiled chicken meat for aerobic plate count, coliform count and total fungal count for food safety concern

MATERIALS AND METHODS

All the samples were collected from different poultry shops of Peshawar city, Pakistan and were brought to Food Microbiology Laboratory, Department of Food Sciences Division Nuclear Institute for Food and Agriculture Peshawar to check the effects of different cooking and preservation methods on storage quality of poultry meat samples as described by Andersen (2005).

Sample Preparation

Chickens samples were washed with portable water in order to remove dust and blood and other extraneous matters. The chicken samples were cut into small pieces and then washed with tap water again. Poultry meat was cooked in presence of cooking oil 500 mL, chicken 3 pieces, onion ½ kg, green peppers ¼ kg, tomato ½ kg. Spices and salt were added

according to need of meal. After cooking the samples were taken into silver tetra packs with net weight of 25-30 g and sealed up each tetra pack under vacuum sealer (Henkelman vacuum system, Netherland). After sealing half of the samples were autoclaved and remaining half samples were irradiated with 5KGys and 7.5 KGys doses of irradiations. All processed meat was stored at room temperature.

Total Aerobic, Fungal Plate, Viable, Total Coliform and Total Fungal Count

Samples were serially diluted in normal saline. Total aerobic plate Count (APC), Coliform Count (CC) and Fungal Count (FC) were determined according to the procedure explained by Saha et al. (2009).

Sensory Evaluation

Sensory evaluation of all samples for color, flavor, taste, texture and overall acceptability was performed on a 9 point hedonic scale using 15 untrained panelists as described (Yun et al. 2012).

Statistical Analysis

The data thus collected was analyzed statistically in SPSS (16.0 version) software under linear regression design (Osaili et al., 2007) and the results were considered significantly effective at $P < 0.05$.

RESULTS AND DISCUSSION

Aerobic plat count was analyzed through regression technique and the result was found significantly different (0.018) throughout the study period. The effects of radiation and autoclaving was also evaluated on aerobic plat count in poultry meat stored up to 60 days and treatment groups were as follow: T1= control tetra packs (Boiled) T2= control tetra packs (fried) T3= Autoclaved (boiled) tetra packs T4= Irradiated (boiled) with 5.0KGy tetra packs T5= Irradiated (boiled) with 7.5KGy tetra packs T6= Autoclaved (FRIED) tetra packs T7= Irradiated (fried) with 5.0KGy tetra packs T8= irradiated (fried) with 7.5KGy tetra packs. In eight treatment groups (T1-T8) at 0 day, 15 day, 30 day, 45 day and 60 days of storage showed that at 0 day, 15 days, 30 days and 45 days were resulted in few aerobic microbes in treatment group T1-T8 respectively. However, after 60 days of storage interval, in treatment group T1 and T2 there were numerous bacterial count found whereas, the remaining treatment groups (T3-T8) showed few aerobic plat count. As for as effect of radiation and autoclaving on coliform count in poultry meat is concerned, it was found that at all storage intervals all groups (T1-T8) treatment showed few colony count. The statistical analysis revealed significant difference in microbial count on pack chicken meat samples provided samples are packed after irradiated therapy (5kGys and 7.5 KGys) as well as

autoclaving treatment compared with control group. It was also observed that not only sterility treatment has significant effect on bacterial load on packed chicken but also duration of incubation has significant effect on bacterial load of packed chicken. The finding of the present study is in collaboration with findings reported (Farkas 1998) that radiation (2-7 kGy) can effectively removes pathogenic non-spore-forming bacteria like *Salmonella*, *Staphylococcus aureus*, *Campylobacter*, *Listeria monocytogenes* and *Escherichia coli* O157:H7 (Farkas 1998). Other study (Park et al. 2012) on total aerobic bacteria of Bibimbap was found to be 6.3 log CFU/g (non-irradiated) but however after irradiation (25kGy) the bacterial population down to below detection limit and according to another study conducted on ground beef (Ouattara et al. 2002) revealed that irradiation (1, 2 and 3 KGys) lowers 2, 3 and 4 log in aerobic plate count. Similarly, *Pseudomonas aeruginosa* is removed from broiler carcasses when 1.0-2.5 kGy irradiation dose is applied while, *Serratia marcescens* does not remove until 2.5-5.0 kGy dose irradiation is used (Hanis et al. 1989).

We were unable to determine outcomes of irradiation in terms of some chemical substances due to lack of equipment's and funding opportunity. Some studies had shown that hydrogen peroxide is produced in response to irradiation which then kills pathogens. It is also worth to mention that further research is needed to find out level of hydrogen peroxide verses irradiation doses and time intervals. In addition, sensory attributes (freeze-dried miyeokguk) lowers at doses higher than 10 kGy. At this dose level sensory properties remain unchanged of high specific food like space food (Song et al. 2012).

Due to constant data of coliform count in both control and treated group, statistical analysis is not possible. Total coliform bacteria were not detected in both autoclaved and irradiated chicken meat as well as in control group at all storage intervals. The present study is in harmony with the findings (Inamura et al. 2012) reported that irradiated samples showed decrease in microbiological counts of total coliforms and might be safe up to 8 months of storage after gamma irradiation.

Fungal counts in treated samples (T1-T8) were evaluated. The result showed significant (0.017) association of fungi with storage time. In sample T1, T2 & T6 numerous fungal counts were found while in all other there were few colonies of fungi observed. The overall results of fungal count after radiation and autoclaving showed significant difference with in incubation period while non-significance was found with treatment. In irradiated samples fungal counts were not detected (T4 & T5). The study (Inamura et al. 2012) showed expected decrease in microbiological counts for yeast, molds

Table (1): sensory evaluation of processed chicken meat

Treatment	Color	Flavor	Taste	Texture	Overall acceptability
Boiled	5.56±0.41	6.66±0.25	5.66±0.25	5.40±0.26	5.63±0.20
Fried	5.50±0.3	5.86±0.55	5.73±0.4	5.53±0.2	5.70±0.1
Bolied + Autoclaved	5.60±0.26	6.46±0.30	5.80±0.55	5.66±0.32	5.63±0.2
Fried+ Autoclaved	5.63±0.20	6.63±0.2	5.96±0.61	5.76±0.05	5.73±0.15
Boiled + Irradiated at 5.0 KGys	5.63±0.15	6.56±0.23	5.66±0.25	5.40±0.2	5.40±0.1
Boiled + Irradiated at 7.5 KGys	5.66±0.2	6.36±0.05	5.60±0.26	5.46±0.2	5.53±0.11
Fried + Irradiated at 5.0 KGys	5.56±0.28	6.40±0.36	5.80±0.1	5.43±0.23	5.60±0.26
Fried + Irradiated at 7.5 KGys	6.46±0.28	6.66±0.15	5.73±0.2	5.36±0.11	5.60±0.17
Significance	$P=0.984$	$P=0.73$	$P=0.954$	$P=0.300$	$P=0.432$

$P > 0.05$ is non-significant

and total coliforms at 5 and 10 kGy doses while, another study (Park et al. 2012) reported 5 kGy and 25 kGy gamma irradiation after which yeasts/molds eliminated.

Results of sensory evaluation are presented in Table 1, which shows non-significant difference ($P > 0.05$) in mean value for all treatments. The level of significance mean values were found to be $P = 0.984$, $P = 0.73$, $P = 0.954$, $P = 0.300$ and $P = 0.432$ for colour, flavor, taste, texture and overall acceptability respectively. The colour score was found to be 5.56 ± 0.41 for boiled and 5.63 ± 0.15 for boiled irradiated at a dose 5.0 kGys. The present value is in collaboration with the study in which ready-to-eat chicken breast was evaluated for colour attributes score (6.4) at a dose 5.0 KGys (Yun et al. 2012). Our findings for boiled irradiated sample taste (5.66 ± 0.25) are also in harmony with the value 4.9 for taste attributes after the mentioned irradiation dose (Yun et al. 2012). The same researcher also evaluated for texture attributes and reported 4.8 score at 5.0 KGys which match with our values 5.40 ± 0.2 . Finally, overall acceptability in the current study was found to be 5.40 ± 0.1 which is similar with the finding (Yun et al. 2012) reported for overall acceptability (5.0)

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