



Research Article

EVALUATION OF CHICKEN CUTLETS INCORPORATED WITH WHOLE EGG LIQUID

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Abstract- The present study was conducted to the effect of different levels viz. 0% (T1), 2.5% (T2), 5% (T3) and 7.5% (T4) of whole egg liquid incorporation on physico-chemical and sensory parameters of chicken cutlets with its control. Chicken cutlets prepared with different level of whole egg liquid which resulted in significant increase in product yield, pH, moisture, crude protein, crude fat and ash as compared to control. Mean sensory scores of chicken cutlets at different levels of whole egg liquid for did not differ significantly ($p>0.05$) as compared to control. Storage stability of aerobically packaged chicken cutlets with optimum level of whole egg liquid along with control was further assessed during refrigerated storage ($4\pm1^{\circ}\text{C}$) at intervals of 0, 3, 6 and 9 days with respect to physico-chemical, microbiological and sensory parameters. On the basis of sensory scores and physico-chemical characteristics, the incorporation level of 7.5% WEL was found to be optimum for preparation of acceptable chicken cutlet, which could be stored safely in low density polyethylene pouches at refrigeration condition ($4\pm1^{\circ}\text{C}$) for 6 days.

Keywords- Whole egg liquid, Chicken cutlets, Physico-chemical parameters, Sensory characteristics.

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Introduction

Processed products prepared from chicken meat included chicken sausages, chicken frankfurter, chicken meat balls, chicken nuggets, chicken patties, chicken sticks, chicken burgers, chicken cutlets etc. The ready to eat / ready to prepare (RTE/ RTP) food provides suitable option for consumers in today's busy life style [1]. Meat cutlets are ready to eat convenient meat products widely used in the breakfast throughout the world. Cutlets are flat croquette of minced meat, flour, pulse, nuts, shredded potato, condiments, spices and often coated with rusk crumbs.

Egg protein has high biological value and it contains all the essential amino acids required in human diet. Chicken egg proteins such as ovalbumin, ovotransferrin, phosvitin, egg lipids such as phospholipids, as well as certain micronutrients such as vitamin E, vitamin A, selenium, and carotenoids have antioxidant properties [2]. Whole egg liquid has binding and emulsifying properties. It increases the juiciness of products and cooking yield [3]. This study was carried out because of health benefits associated with chicken meat and whole egg liquid.

Materials and Methods

Source of Raw Materials

Broiler birds vencobb-400' were procured from Instructional Livestock Farm Complex of Vanbandhu Veterinary College, Navsari and slaughtered by using halal method. The dressed broiler carcasses were deboned by removing fat, tendons and connective tissue. The deboned meat was packaged in LDPE (low density polyethylene) bags and frozen at $-18 \pm 2^{\circ}\text{C}$. The frozen deboned meat were drawn as per requirement and thawed overnight in a refrigerator ($4\pm1^{\circ}\text{C}$) and were used for further study.

Whole egg, spices, table salt (Tata Chemicals Ltd, Mumbai), sugar, condiments

(onion, ginger and garlic), vegetable oil (Sunflower oil- Adani Wilmar Limited Company) and low density polyethylene (200 gauge) bags were purchased from local market of Navsari. All the chemicals used in the study were purchased from standard firms (Hi media). Condiments mix was prepared by peeling off onion, ginger and garlic, cutting in to small pieces and mixing it in domestic mixer in the ratio of 4:2:1.

Methodology for Preparation of Chicken Cutlets

Frozen deboned chicken meat was cut into small pieces and minced in meat mincer (Model no. P-22, Ramon) using 6 mm plate for two times and used for preparation of cutlet.

Chicken cutlets were prepared by slight modified method of [1]. Chicken cutlets formulation: Chicken meat 83.5%, 81% and 78.5%.

Whole egg liquid was incorporated at the levels of 2.5, 5 and 7.5% by replacing the lean meat in chicken cutlets formulation. Salt, sodium nitrite and sugar were added in minced chicken meat and fried for 3 minutes in 2.5% w/w refined sunflower oil. The condiments were fried separately till the appearance of light golden brown colour. The fried chicken meat, condiments and spices were mixed in mixer. After uniform mixing of all the ingredients, the batter was moulded into cutlets with the help of round shaped metallic moulds. The cutlets were deep fat fried in sunflower oil for 3 min till appearance of golden brown colour. The internal core temperature was measured with the help of a thermometer (80°C) and the excess fat was removed from the fried cutlets by using tissue paper.

pH

The pH of chicken cutlets was determining by method of [4].

Product yield

The product yield was calculated as:

$$\text{Product yield (\%)} = \frac{\text{Weight of cooked chicken cutlet}}{\text{Weight of whole cutlet dough}} \times 100$$

Proximate composition

Moisture, crude protein, crude fat, crude fiber and ash content of chicken cutlets were determined by standard procedure of Association of Office Chemist [5].

Free fatty acids

The method described by [6] was followed for the estimation of free fatty acid.

Thiobarbituric acid (TBA) value

The method of [7] with suitable modification was followed for thiobarbituric acid (TBA) value.

Microbiological analysis

Standard plate counts, Psychrophilic counts, Coliform counts and Yeast and mold counts were enumerated following the method described by American Public Health Association [8].

Sensory evaluation

Sensory evaluation panel consisting of seven members of the College of Veterinary Science and Animal Husbandry, Navsari participated in sensory evaluation. The chicken cutlets were evaluated for general appearance, flavour, juiciness, texture and overall acceptability [9], using an 8-point descriptive scale, where 8 is extremely desirable and 1 is extremely undesirable. The panelists were seated in a room free of noise and odours and suitably illuminated. Plain water was provided for oral rinsing between the samples.

Statistical analysis

Each experiment was repeated for five times. The data obtained from each experiment was analyzed statistically for analysis of variance (ANOVA) and Duncan's multiple range test as per the methods described by [10].

Results and Discussion

Mean values of the physico-chemical characteristics of chicken cutlets incorporated with different levels of whole egg liquid are presented in [Table-1]. The product yield of the chicken cutlets prepared with 5 and 7.5% whole egg liquid was significantly higher ($p < 0.05$) than that of control. However, products yield at 2.5% whole egg liquid was comparable to 5% and 7.5% whole egg liquid incorporation levels. This might be attributed to the increase in water retention in the meat matrix. [11] also reported significantly higher product yield of pork patties incorporated with whole egg liquid.

Table-1 Effect of different levels of whole egg liquid on physico-chemical characteristics of chicken cutlet

Parameters	T1	T2	T3	T4
Product yield (%)	72.60±0.4 ^a	73.70±0.55 ^{ab}	74.35±0.61 ^{bc}	75.35±0.43 ^c
pH	6.22±0.005 ^a	6.25±0.007 ^b	6.29±0.008 ^c	6.32±0.007 ^d
Moisture (%)	51.63±0.48 ^a	51.45±0.38 ^a	52.08±0.35 ^a	53.24±0.36 ^b
Protein (%)	20.69±0.13 ^d	19.59±0.20 ^c	18.66±0.20 ^b	17.64±0.14 ^a
Fat (%)	13.51±0.29 ^a	13.93±0.21 ^{ab}	14.53±0.21 ^{bc}	14.72±0.20 ^c
Ash (%)	3.72±0.04 ^a	3.86±0.04 ^b	4.04±0.02 ^{bc}	3.93±0.04 ^c

Mean±S.E. with difference superscripts in a row differ significantly ($p < 0.05$)

n₁ (Product yield) = 5, n₂ (Physico-chemical parameter) = 10 for each treatment

T1- Control, T2- Chicken cutlets with 2.5% whole egg liquid

T3- Chicken cutlets with 5% whole egg liquid, T4- Chicken cutlets with 7.5% whole egg liquid

The pH of chicken cutlets prepared with whole egg liquid was significantly higher ($p < 0.05$) at all level than control product. Similarly, [12] also reported higher value of pH in buffalo meat nuggets.

The replacement of lean meat with whole egg liquid at increasing level showed

increase in moisture percentage of chicken cutlets. it was significantly higher ($p < 0.05$) in chicken cutlets with 7.5% whole egg liquid as compared to the control. This increase in moisture content might be due to higher moisture retention and water binding property of egg albumin. [13] also reported increase in moisture content of chicken patties prepared by addition of whole egg powder.

Protein percentage of control product was significantly higher ($p < 0.05$) than chicken cutlets prepared with incorporation of whole egg liquid. The reduction in protein percentage could be due to lower protein content of whole egg liquid as compared to chicken meat. [14] also reported that incorporation of whole egg liquid decreased the protein content of mutton sausages. There was a gradual increase in fat percentage of chicken cutlets prepared with different levels of whole egg liquid. Fat percentage of chicken cutlets prepared with 5 and 7.5% levels of whole egg liquid was significantly higher ($p < 0.05$) than that of control. Increase in fat content may be attributed to higher fat content of whole egg liquid as compared to chicken meat. The findings are in accordance with those of [15] who also reported increase in the fat content by incorporation of whole egg liquid in beef burger respectively.

Ash percentage of chicken cutlets increased significantly ($p < 0.05$) at all three levels of whole egg liquid than control. At 5% level of whole egg liquid, it was comparable to 2.5 and 7.5% levels of whole egg liquid. Increase in ash percentage might be attributed to higher mineral content of whole egg liquid as compared to chicken meat. The findings are in accordance with those of [16] who also observed significant increase ($p < 0.05$) in the ash percentage of fat in chicken nuggets. On the contrary, [17] reported non-significant increase in ash % of chicken patties incorporated with whole egg liquid.

Mean sensory scores of chicken cutlets prepared with different levels of whole egg liquid are presented in [Table-2].

Table-2 Effect of different levels of whole egg liquid on sensory characteristics of chicken cutlets

Sensory Parameters	T1	T2	T3	T4
General appearance	7.28±0.078	7.27±0.079	7.17±0.1	7.12±0.07
Flavour	7.01±0.128	7.09±0.087	7.148±0.104	7.18±0.092
Texture	7.05±0.116	7.07±0.086	7.08±0.091	7.112±0.110
Juiciness	7.06±0.129	7.10±0.108	7.132±0.086	7.14±0.098
Overall acceptability	7.18±0.107	7.15±0.088	7.14±0.087	7.14±0.114

Mean±S.E. with difference superscripts in a row differ significantly ($p < 0.05$)

n = 35 for each treatment

T1- Control, T2- Chicken cutlets with 2.5% whole egg liquid

T3- Chicken cutlets with 5% whole egg liquid, T4- Chicken cutlets with 7.5% whole egg liquid

There were no significant differences ($p > 0.05$) in the general appearance, flavor, texture, binding, juiciness and overall acceptability scores amongst chicken cutlets of control product as well as those incorporated with different levels of whole egg liquid.. The findings are in accordance with those of [15] also reported that incorporation of whole egg in the beef burgers did not had any significant differences in texture, taste, juiciness, flavor, colour, cohesiveness and overall liking.

The physico-chemical and microbiological characteristics of aerobically packaged chicken cutlets during refrigerated storage ($4 \pm 1^\circ\text{C}$) are presented in [Table-3].

On 0 day, the pH of chicken cutlets prepared with 7.5% whole egg liquid (T2) was significantly higher than that of control product. The pH of chicken cutlets increased gradually during the entire period of storage and remained comparable up to 6th day of storage. There was a significant increase ($p < 0.05$) in pH of on the 9th day of storage. It might be attributed to the production of basic metabolites and amines due to protein breakdown by microorganism. Free fatty acid values increased gradually during the entire period of storage and significant ($P < 0.05$) increased. A range of 0.6-2 mg was considered to be the detectable minimum level for off flavour by in experienced panellists [18].

The microbiological characteristics of aerobically packaged chicken cutlets during refrigerated storage ($4 \pm 1^\circ\text{C}$) are presented in [Table-3]. On 3rd day of storage SPC of T1 was significantly higher ($p < 0.05$) than T2. Standard plate count followed a

linear increasing trend from 0 to 9th day of refrigerated storage in treatment products as well as control. This increase could be due to the availability of the nutrients and favourable conditions for microbial growth

Table-3 Effect of refrigerated storage on physico-chemical and microbiological characteristics of chicken cutlets prepared with optimized level of whole egg liquid

Treatments	Refrigerated storage period (days)			
	0	3	6	9
pH				
T1	6.20±0.02 ^{ab}	6.25±0.03 ^a	6.31±0.04 ^a	6.52±0.06 ^b
T2	6.31±0.03 ^{ba}	6.35±0.04 ^a	6.37±0.03 ^a	6.54±0.05 ^b
FFA Value				
T1	0.16±0.008 ^a	0.18±0.011 ^a	0.20±0.009 ^{ab}	0.22±0.017 ^b
T2	0.19±0.009 ^a	0.22±0.016 ^{ab}	0.25±0.020 ^b	0.27±0.011 ^b
TBARS Value				
T1	0.47±0.01 ^a	0.52±0.02 ^{ab}	0.58±0.02 ^b	0.68±0.02 ^c
T2	0.51±0.01 ^a	0.56±0.02 ^{ab}	0.63±0.05 ^b	0.68±0.01 ^b
Standard plate count (log₁₀ cfu/gm)				
T1	1.86±0.07 ^a	2.49±0.06 ^{bb}	3.64±0.17 ^c	4.86±0.15 ^d
T2	1.94±0.04 ^a	2.26±0.06 ^{ba}	3.08±0.20 ^b	4.91±0.16 ^c
Psychrophilic counts (log₁₀ cfu/gm)				
T1	ND	ND	1.57±0.05 ^a	2.09±0.06 ^b
T2	ND	ND	1.39±0.06 ^a	2.05±0.12 ^b
Yeast and mould count (log₁₀ cfu/gm)				
T1	ND	1.63±0.03 ^a	2.01±0.09 ^b	2.10±0.09 ^b
T2	ND	1.47±0.07 ^a	1.91±0.16 ^b	2.17±0.08 ^b
Coliform count(log₁₀ cfu/gm)				
T1	ND	ND	ND	ND
T2	ND	ND	ND	ND

Mean±S.E. with difference superscripts in a row (small alphabet) and column (capital alphabet) differ significantly (p<0.05)

n= 10 for each treatment, ND=Not detected

T1- Control, T2- Chicken cutlets with 7.5% whole egg liquid

They were detected on 6th day of storage and thereafter increased significantly (p<0.05) on 9th day. Absence of psychrophilic microbes on 0 and 3rd day might be because of longer incubation period required for growth of revived psychrophiles. Coliforms were not detected in the chicken cutlets prepared with 7.5% whole egg liquid as well as control during entire period of storage. This might be due to cooking of product to an internal temperature of 80°C. Similarly [19] observed no coliforms during refrigeration storage of cooked chicken rolls.

On 0 day of storage, there was no growth of yeast and moulds in T1 and T2. A significant (p<0.05) increase in yeast and mould counts of chicken cutlets was noted with the increase in the period of storage.

The sensory characteristics of aerobically packaged chicken cutlets during refrigerated storage (4±1°C) are presented in [Table-4].

Table-4 Effect of refrigerated storage on sensory characteristics of chicken cutlets prepared with optimized level of whole egg liquid

Treatment	Refrigerated storage period (Days)			
	0	3	6	9
General appearance				
T1	7.27±0.08 ^c	7.02±0.06 ^b	6.76±0.07 ^a	ND
T2	7.26±0.06 ^c	6.99±0.07 ^b	6.70±0.07 ^a	ND
Flavour				
T1	7.24±0.08 ^c	6.92±0.08 ^b	6.50±0.08 ^a	ND
T2	7.38±0.06 ^c	7.02±0.08 ^b	6.37±0.09 ^a	ND
Texture				
T1	7.15±0.09 ^c	6.81±0.08 ^b	6.42±0.10 ^a	ND
T2	7.27±0.06 ^c	6.86±0.07 ^b	6.38±0.08 ^a	ND
Juiciness				
T1	7.16±0.09 ^c	6.70±0.10 ^{bb}	6.27±0.10 ^a	ND
T2	7.35±0.06 ^c	6.94±0.06 ^{bb}	6.32±0.09 ^c	ND
Overall acceptability				
T1	7.20±0.09 ^c	6.88±0.08 ^b	6.42±0.07 ^a	ND
T2	7.29±0.06 ^c	6.86±0.09 ^b	6.28±0.10 ^a	ND

Mean±S.E. with difference superscripts in a row (small alphabet) and column (capital alphabet) differ significantly (p<0.05)

n= 35 for each treatment ND=Not detected

T1- Control, T2- Chicken cutlets with 7.5% whole egg liquid

Sensory evaluation showed a gradual decrease for all parameters with increase in storage period. There was a significant decrease (p<0.01) in flavor, texture, juiciness and overall acceptability scores of the products during storage period. The progressive decrease in flavour scores could be correlated to an increase in TBA value and free fatty acids in the chicken cutlets. The juiciness scores of chicken cutlets decreased significantly (p<0.05) with increase in the period of storage which might be due to the gradual loss of moisture from chicken cutlets. Similar findings were also reported [20] in buffalo meat cutlets. The most probable cause might be denaturation of proteins and degradation of muscle fiber protein by bacterial action [21] and lowering of water binding capacity. However, on 9th day of storage products became unacceptable due to production of off flavor and increase in microbial load.

However, there was a gradual decrease in the overall acceptability score of all treatments with increase in the period of storage and it might be due to the decrease in other sensory parameters viz. general appearance, flavour, texture and juiciness.

Conclusions

The present study showed that the optimum level of whole liquid egg was 7.5% for incorporation in chicken cutlets and chicken cutlets could be stored safely in aerobic packaging for 6 days at refrigeration condition (4±1°C).

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Abbreviations:

°C- Degree Celsius
ANOVA- Analysis of variance
AOAC- Association of Office Chemist
APHA- American Public Health Association
CC- Chicken Cutlet
Cfu- Colony forming unit
LDPE- Low density polyethylene
Log- Logarithm
PC- Psychrophilic count
SPC- Standard plate count
TBA- Thiobarbituric acid
WEL- Whole egg liquid

Ethical Approval: This article does not contain any studies with human participants or animals performed by any of the authors.

Conflict of Interest: None declared

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