THE EFFECT OF COOKING METHODS ON YIELD AND ACCEPTABILITY OF BATTERED SPENT FOWLS

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ABSTRACT

Sixteen culled layer fowls were slaughtered, dressed and dismembered into parts after a four week period of frozen storage. The breast, thigh and drumsticks were subjected to either of the following prefrying treatments: Microwave, steaming and pressurizing. The treated and the control chicken parts were battered and dusted with baking flour before they were deep fat fried for 14 minutes. The breast portions steamed and pressurized gave the highest cooked yield and least cooking loss while microwave precooked parts had the least final product yield as well as the highest cooking loss. The shear force values were least for pressurized and steamed samples and highest for the control and microwave samples. The sensory scores for juiciness and tenderness were best for steamed samples followed by pressurized parts.

Keywords: Cooking, yield, acceptability, spent-fowls.

INTRODUCTION

Marketing of spent layers in most developed countries is usually a problem because of the toughened nature of its meat. This has led to restructuring of its meat into various products. In Nigeria, the production of spent layers is on the increase due to the problem of marketing broiler chickens and its due role of producing meat is the tenderness of the product. This is the reason while broiler meat is mostly preferred in fast food industries. However, various cooking methods have been found to alter the characteristics of poultry meat, such as flavour, loss in weight, contraction in volume and structural changes of connective

tissues, muscle fibres and fatty tissues (Love and Goodwin, 1974).

The production of precooked, battered, breaded and browned chicken is a multimillion dollar business in the United States of America (Baker *et al.*, 1986). The demand for quick easy to prepare foods is on the increase in most urban cities of Nigeria. Precooking is the cooking of meat or food prior to the final cooking that is to be adopted. Precooking has been said to have an appreciable effect on the consumers sensory evaluation, acceptability and yield of chickens (Bakers *et al.*, 1986). Webb (1969) found that steam cooking resulted in higher cooking losses than microwave cooking. Mickelberry and Stadelman (1962) evaluating five cooking methods including deep fat frying on broiler halves found little difference in yield between these two methods. Hale and Goodwin (1968) cooked breaded chicken parts (breast, thigh, drumsticks and wings) using three cooking methods; Conventional deep fat frying, microwave oven followed by deep fat frying and autoclaving followed by deep frying. They found no difference in final yield although the non precooked parts had higher ($P < 0.05$) breaded yield than the precooked parts. This study was undertaken to investigate how the palatability of spent fowls could be enhanced in the fast food industry through precooking methods.

MATERIALS AND METHODS

The spend fowls utilized in this study were obtained from a reputable commercial farm. Sixteen birds were bought, their live weights ranged from 1.7 – 2.1kg. These birds were slaughtered and dressed conventionally and

then kept in the freezer for four weeks prior to the experiment. At the commencement of the experiment the birds were thawed, cut into various parts. The breast, thighs and drumsticks used in this trial, were such that each treatment had eight thighs and drumsticks and four breast (whole). These chicken parts were individually weighed and tagged with a metal plate for identification. The samples were subjected to any of the following treatments:

Steam cooking: The chicken parts were arranged on a tripod stand placed in a pot containing water such that the chicken was above water. The temperature of the water was raised to boiling point using an electric cooker. Steaming was done for 15 minutes after the water had started boiling.

Pressure Cooking:

The pressure cooker used was mirromatic (Tower Pressure Cooker, Pifco Ltd). The chicken parts were placed in a 200ml of water and heated for 8 minutes at 15 lb pressure. The temperature was 108°C. After cooking, the chicken parts were drained in a wire-mesh basket.

Microwave Cooking:

The microwave oven used was sharp carousel. The chicken parts were cooked in 3 runs for 3 minutes each.

Control (non precooked): These chicken parts were not precooked.

All the precooked chicken parts were allowed to cool to room temperature before being reweighed. The cooking loss was obtained as the difference between the raw and cooked weights. The control and the precooked chicken parts were battered and then dusted with baking flour. Their weights were again taken. All the chicken parts were deep fat fried for 14 minutes in 1750ml of pure vegetable cooking oil (bleached and deodorized palm olein) to an internal temperature of 83°C determine by a digital thermometer. The fried

samples were drained in a wire mesh basket and cooled to room temperature before their weights were determined.

Batter Preparation:

The batter was prepared fresh for each treatment. In a bowl of 300ml of water, 120g of baking flour, 10.0g of common salt, 12.5ml egg white (beaten) and 20g of defatted powdered milk were added. All these were thoroughly mixed with a handwhip until smooth.

Yields:

The cooking loss was determined in two parts first the cooking loss due to precooking and that after deep fat frying (frying loss). The two losses were added together to obtain the total cooking loss. The final product yields were obtained by dividing the fried weight by the coated weight and multiplying by 100.

Edible Portion: All the fried chicken parts were hand deboned into meat (including skin plus coating) and bone using scarpel and tong. The edible portion was obtained thus: weight of meat plus coating divided by fried weight multiplied by 100.

Chemical Composition:

The moisture and fat contents of the samples were determined for each treatment. The moisture content was determined by oven drying 3gm of each sample part at a temperature of 100°C for 24 hours. The fat content in the dried samples were extracted with petroleum ether in a soxhlet lipid extraction apparatus.

Objective Tenderness:

The drumstick, thigh and breast portions were used in evaluating the shear force values, using the Warner-Bratzler shear device. Three cores about 1.3cm in diameter were obtained from each chicken part. Three shearing were done on each core.

COOKING METHODS AND VALUE OF SPENT FOWLS

Sensory Evaluation:

The drumstick, thigh and breast portions from each of the four treatments (3 precooking methods and control) groups were used for the taste panel evaluation. Visual assessment of colour was carried out by the panelist before cutting into bites sizes. Twelve staff of the department were trained on how to adjudge for colour, flavour, tenderness, juiciness and overall acceptability, using a 5-point scale (Table 3).

Statistical Analysis:

The data obtained were subjected to analysis of variance as described by Steel and Torrie (1980). The means were separated by Duncan's Multiple Range Test (Duncan, 1955).

RESULTS AND DISCUSSION

The effects of precooking spent layers on cooking loss and yield are shown in Table 1. Precooking methods had significant effects on the cooking loss and yield of spent layers.

Microwave method of precooking had the lowest cooking loss regardless of the chicken parts. This might be due to the high energy of the microwave coupled with the short time in cooking. The microwave cooking resulted in the formation of a hard dry layer on the surface of the meat which prevented further losses of moisture. Precooking with steam resulted in the highest cooking loss with the drumstick and the thigh portions, while with breast portion pressure cooking caused the highest loss. The high moisture retention observed with the chicken parts precooking with microwave energy could not be sustained when the parts were deep fat fried as evidenced in the final product yield. When the chicken parts were deep fat fried, the parts with the highest water contents had the highest frying loss. This is not surprising as the parts precooked by the steam and pressure cooking had already lost much of their weights.

TABLE 1: EFFECT OF PRE-COOKING ON COOKING LOSS AND YIELD OF BATTERED SPENT FOWLS¹

CHICKEN PART	COOKING METHOD ²	RAW WEIGHT (g)	PRE-COOKING LOSS (%)	FRYING LOSS (%)	TOTAL COOKING LOSS (%)	FINAL PRODUCT (%)	FRYING YIELD (%)	EDIBLE PORTION (%)
DRUM STICK	NP-DFF	68.8 ^{NS}	-	40.1 ^d	40.1 ^d	67.8 ^b	60.1 ^a	77.8 ^{NS}
	SC-DFF	61.3	17.8 ^e	28.7 ^b	46.5 ^d	67.8 ^b	69.7 ^c	77.9
	PC-DFF	66.6	14.5 ^b	20.3 ^a	34.8 ^a	76.1 ^c	79.8 ^d	81.2
	MW-DFF	70.0	9.3 ^a	35.7 ^c	45.0 ^c	64.6 ^a	66.4 ^b	79.2
	SEM ±	3.1	0.28	0.51	0.23	0.98	1.8	0.61
THIGH	NP-DFF	73.4 ^{NS}	-	42.6 ^d	42.6 ^a	68.2 ^b	57.4 ^a	82.8 ^b
	SC-DFF	63.7	21.9 ^c	23.2 ^b	45.1 ^b	71.7 ^b	76.8 ^b	79.2 ^a
	PC-DFF	69.2	18.8 ^b	21.5 ^a	40.3 ^a	73.8 ^c	78.5 ^b	85.4 ^c
	MW-DFF	73.2	8.0 ^a	41.4 ^c	49.4 ^c	57.6 ^a	58.7 ^a	82.6 ^b
	SEM ±	3.1	1.7	0.72	0.42	1.05	8.20	0.68
BREAST	NP-DFF	135.3 ^{NS}	-	36.6 ^d	36.6 ^b	70.2 ^b	63.1 ^b	88.8 ^{NS}
	SC-DFF	132.7	14.4 ^b	17.8 ^b	32.2 ^a	83.1 ^c	82.2 ^d	89.9
	PC-DFF	159.8	15.1 ^c	15.1 ^a	30.7 ^a	83.1 ^c	64.9 ^c	91.0
	MW-DFF	145.8	4.6 ^a	36.1 ^c	40.7 ^c	66.6 ^a	55.2 ^a	87.9
	SEM ±	4.0	0.64	0.43	0.26	0.58	6.1	0.70

¹Values are means of eight determinations

abc Within each Subgroup, means not followed by the same superscripts differed significantly from one. (P<0.05)

²NP-DFF = Non precooked with deep fat frying; SC-DFF = Steam Cooking with deep fat frying; PC-DFF = Pressure cooking with deep fat frying; MW-DFF = Microwave cooking with deep fat frying; SEM = Standard error of means; NS = Not significant.

TABLE 2: EFFECT OF COOKING ON MOISTURE, LIPID AND OBJECTIVE TENDERNESS OF BATTERED SPENT FOWLS¹

CHICKEN PART	COOKING METHOD ²	MOISTURE CONTENT (%)	LIPID CONTENT (%)	W-B SHEAR FORCE (KO)
DRUMSTICK	NP-DFE	66.8 ^c	20.5 ^{NS}	6.2 ^b
	SC-DFE	61.4 ^{bc}	24.0	5.0 ^a
	PC-DFE	51.6 ^a	21.0	5.8 ^a
	MW-DFE	55.5 ^{ab}	27.5	7.3 ^c
	SEM ±	2.8	1.8	0.21
THIGH	NP-DFE	72.9 ^c	26.0 ^{NS}	6.3 ^b
	SC-DFE	63.7 ^b	22.5	4.8 ^a
	PC-DFE	54.4 ^a	23.0	5.5 ^a
	MW-DFE	61.1 ^b	27.0	7.8 ^c
	SEM ±	1.7	2.3	0.20
BREAST	NP-DFE	78.0 ^c	24.5 ^{NS}	3.8 ^a
	SC-DFE	51.9 ^a	22.3	3.6 ^a
	PC-DFE	63.2 ^b	29.8	3.8 ^a
	MW-DFE	60.6 ^b	26.3	5.1 ^b
	SEM ±	2.5	1.6	0.21

1, 2 as in Table 1

a, b, c, = Within each subgroup, means not followed by the same superscripts differed significantly from one another ($P < 0.05$)

W-B = Warner – Bratzler Shear force.

SEM = Standard error of means

NS = Not significant.

The edible portion of drumstick and the breast parts were not significantly affected by the precooking method. But the thigh parts that were precooked by the pressure cooker had the highest yield of edible portion ($P < 0.05$) while those cooked by microwave and the control were similar. The least edible portion was observed with the thighs precooked by the steaming method. The results of the precooking effect on the moisture, lipid and shear values are shown on Table 2. The non-precooked chicken parts had the highest moisture contents. Precooking treatment did not affect the lipid contents of the chicken parts, this might be due to the fat absorption due to fat frying. The precooking treatment was observed to have significant effect on the tenderness of spent fowls as analyzed by shear force. The shear press values were highest ($P < 0.05$) for all the parts precooked electronically (microwave). Electronic cooking

is a dry method of cooking which may cause the formation of hard, dry layer on the meat surface. Precooking by the steaming method produced the most tender chicken meat irrespective of the part. Among the parts the breast portion was the most tender followed by the thigh and then the drumstick. This is not surprising since the breast muscles are merely supportive.

The precooking treatment did not significantly ($P > 0.05$) affect the flavour, overall acceptability and juiciness of spent layer parts except the breast portion as evaluated by taste panel (Table 3). The juiciness rating of the breast portion was least for the non precooked chicken part although it was not significantly different from the pressure and microwave precooked. The chicken parts precooked by pressure cooker were adjudged to be the most tender by the panelist except with the thigh

COOKING METHODS AND VALUE OF SPENT FOWLS

portion where those precooked by steaming were most tender. The high content of the connective tissue of the drumstick might have been broken down by moist cooking to gelating. In general the taste panel rated chicken parts that were precooked in moisture to be darker in colour than those dry cooked or the control, this might be due to the loss of haemoglobin. However, they failed to detect any significant ($P>0.05$) effect of precooking on overall acceptability.

It is therefore evident from the result of this study that precooking spent fowls with moist cooking method produced chicken parts that had higher yield and were more tender than those precooked by dry cooking method. Pressurized cooking was found to be best of all the cooking methods considered in terms of yield. However, no clear cut distinction was made by the taste panel as regards overall acceptability.

TABLE 3: EFFECT OF COOKING ON SENSORY ATTRIBUTES OF BATTERED SPENT FOWLS¹

CHICKEN PART	COOKING METHOD ²	FLAVOUR	JUICINESS	TENDERNESS	COLOUR	OVERALL ACCEPTABILITY
DRUMSTICK	NP-DFF	2.7 ^{NS}	2.0 ^{NS}	2.2 ^a	4.3 ^c	3.6 ^{NS}
	SC-DFF	2.6	2.4	2.4 ^a	2.8 ^a	3.2
	PC-DFF	3.1	2.7	3.0 ^b	2.4 ^a	3.6
	MW-DFF	2.6	2.9	2.4 ^a	3.5 ^b	3.2
	SEM ±	0.11	0.16	0.21	0.31	0.15
THIGH	NP-DFF	3.1 ^{NS}	2.3 ^{NS}	2.4 ^{ab}	3.9 ^a	3.1 ^{NS}
	SC-DFF	2.7	2.8	3.4 ^c	2.9 ^{ab}	3.9
	PC-DFF	2.3	2.8	2.7 ^b	2.5 ^a	3.4
	MW-DFF	2.9	2.7	2.2 ^a	4.5 ^d	3.5
	SEM ±	0.10	0.21	0.15	0.15	0.13
BREAST	NP-DFF	3.0 ^{NS}	2.4 ^a	2.7 ^b	4.3 ^b	3.5 ^{NS}
	PC-DFF	2.8	2.8 ^{ab}	2.9 ^b	2.1 ^a	3.7
	MW-DFF	2.8	2.8 ^{ab}	2.1 ^a	4.1 ^b	3.8
	SEM ±	0.13	0.28	0.31	0.10	0.13

¹Values are mean of 12 determinations

²As in Table 1

a, b, c, = Means not followed by the same letter differed significantly from one another ($P<0.05$)

SEM = Standard error of means

NS = Not significant

Hedonic rating

Flavour: 1 - undesirable; 3 - medium; 5 - excellent

Juiciness: 1 - Dry; 3 - Averagely juicy; 5 - very juicy

Tenderness: 1 - tough; 3 - Averagely tender; 5 - very tender

Colour: 1 - too light; 3 - Just light; 5 - too dark.

Overall acceptability: 1 - Very much disliked; 3 - indifferent, 5 - very much liked.

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