



Determination on Coated Chicken Meat Products (Nugget, Schnitzel, Cordon Bleu) Physical, Chemical and Microbiological Quality Characteristics

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Abstract Changing lifestyles and living standards has changed the traditional nutritional habits of people as a result of rapid urbanization and work intensity, the number of working women increasing as a result of it. As a result of this change, the option of finding a healthy, desired amount and variety of products that will not require much time and effort has increased the market share of prepared and processed foods. Manufacturers are also increasing their product range and quality by taking these into consideration. All-sale chicken products are now being transformed into various varieties of added value and profitability by breaking up, becoming boneless, marinating, saucing, curing or covering. Coated products also make up the majority of the market. Some of the products produced for this purpose are nugget, schnitzel, cordon bleu, burger, croquet, kievska and so on. In this study Cordon bleu (20 pcs), nugget (20 pcs) and schnitzel (20 pcs) products were taken from the market and maintained under cold chain conditions to determine the physical, chemical and microbiological properties of coated poultry products. Examples include pH, chemical composition determination assays and microbiologically total mesophilic aerobic bacteria count, coliform group bacteria count, *E. coli*, *S. aureus*, *Salmonella* spp. and *L. monocytogenes*. According to the results of analysis, schnitzel samples had higher values than the other samples in terms of fat %, peroxide and free fatty acid in moisture %, protein % and ash %, cordon bleu samples were higher than nugget and schnitzel sample averages. Carbohydrate In terms of amount, nugget samples were found to contain higher carbohydrate. According to the results of microbiological analysis, *E.coli*, *S. aureus*, *Salmonella* spp. and *L. monocytogenes* which do not pose any danger which adversely affect consumer health. Cordon bleu, nugget and schnitzel samples we have examined have been found to be both chemically and microbiologically safe in terms of consumer health according to the results of our analysis.

Keywords Cordon bleu, nugget, schnitzel, quality characteristics, poultry meat

1. Introduction

Chicken meat is one of the most important sources of animal protein that must be consumed for healthy and balanced nutrition, physical and mental development. Chicken proteins contain enough and balanced amounts of all the amino acids needed for human nutrition. Chicken meat is not only an animal protein source; it is also an advantageous food material for healthy nutrition due to some minerals it contains. Chicken meat is an excellent source of nutrients for low-sodium diets that are important for hypertension patients. Digestion is very easy due to the shortness of the fibers. This is why it is very useful for people with digestive problems to take their protein needs from chicken meat [1, 2, 3, 4].

It is possible that people can benefit more from this valuable food source by making new applications to increase consumption. This can be achieved by expanding the range of products produced, creating new products in line with consumers' demands, and trying to reach a wider consumer base [5].



Chicken products are now being broken down into pieces, boneless, marinated, sauced, cured, or coated to produce higher value added and more profitable varieties [6].

Changes in life styles and living standards, rapid urbanization and work intensity, increasing number of working women every day, and so on. As a result of the causes, people's traditional eating habits have changed. As a result of this change, the healthy, desired quantity and variety of product finding option which does not require much time and effort has increased the market share of prepared and processed foods [7]. Manufacturers are taking these into consideration and increasing their product range and quality every day. The coated products are now widely available in the delicatessen sections of the market stores and provide ease of purchase. Some of the products produced for this purpose are nugget, schnitzel, cordon bleu, burger, croquet, kievsk and so on. This study was conducted to determine the physical, chemical and microbiological properties of coated poultry products such as cordon bleu, schnitzel and nugget.

2. Material and Methods

Moisture, protein, fat, carbohydrate (CHO), peroxide value (meq oxygen/kg fat), free fatty acids (FFA, oleic acids), ash and salt contents and pH measurements were done according to the methods described by AOAC [8]. All determinations were performed in duplicate.

Mesophilic aerobic bacteria, *Staphylococcus aureus*, *Escherichia coli*, and presence of *Salmonella* spp., of samples were determined according to the Bacteriological Analytical Manual [9]. Total mesophilic aerobic counts were determined on Plate Count Agar (PCA) and incubated at 35°C for 48 h. The presence of *Escherichia coli* was examined by transferring 1 ml of each sample dilution to sterile petri dishes followed by pouring 10 ml of Violet Red Bile Agar (with 4-methyl umbelliferyl-B-D-glucuronide (VRB-MUG) and incubated at 48°C. The plates were swirled and allowed to solidify and overlaid with 3 to 5 of VRB-MUG and then incubated at 37°C for 24 to 48 h. The plates were examined for typical coliform colonies which were counted to obtain a presumptive coliform count. Isolates that were Gram-negative and produced acid and gas in lactose broth were recorded as confirmed coliforms. These plates were also examined under long wave ultraviolet (UV) light for the presence of fluorescent colonies, indicating possible presence of *E. coli*. Those with positive fermentation and gas production in lactose broth were further characterized as *E. coli* using indole, methyl red, Voges-Proskauer and citrate (IMVIC) identification tests.

The presence of *S. aureus* was tested by surface plating on pre-poured Baird-parker agar with egg-yolk tellurite enrichment. The plates were incubated at 35°C for 48 h then they were examined for typical *S. aureus* colonies. Suspicious colonies were transferred to the slants for *S. aureus* confirmation by Gram stain, catalase reaction and coagulase test.

For *Salmonella*, 25 g samples were enriched in Selenite Cystine Broth for 24 h at 35 °C and then the cultures were streaked onto Bismuth Sulfite Agar and incubated at 35 °C for 24 h. The typical *Salmonella* colonies were subjected to subsequent biochemical tests by using Triple Sugar Iron and Lysine Iron Agar slants. However, due to the some inconveniences, the presumptive *Salmonella* cultures from the agar slants could not be subjected to serological tests for the final confirmation.

From each sample, 25 g was added to 225 mL of one-broth *Listeria* and incubated aerobically at 30 °C for 22-26 hours. Then, 0.1 mL of enrichment broth cultures was inoculated on Brilliance *Listeria* Agar plates using spread plate method and incubated at 37 °C for 22-26 h. Green-blue colonies surrounded by zones on the agar plate were evaluated as suspicious *Listeria* spp., and *Listeria monocytogenes*. Gram staining, rhamnose and xylose sugar, and CAMP (Christie Atkins Munch-Petersen) tests were performed on the suspicious colonies [10]. All culture media was purchased by OXOID. The data obtained from three replications were analyzed by ANOVA using the SPSS statistical package program, and differences among the means were compared using the Duncan's Multiple Range test [11].

3. Results and Discussion

Chicken meat is richer in some nutrients than cattle and sheep. The amount of protein they contain is higher than that of red meat. Chicken meat contains all the essential amino acids needed for human nutrition, so protein quality is high. The energy it generates is lower than other meat. Chicken meat has an important place when we



are nutrition with nutritional value as well as being economical and easily digestible. It may be possible to increase consumption by making new applications so that people can benefit more from this valuable food source. This can be achieved by expanding the range of products produced, creating new products in line with consumers' demands and trying to reach a wider consumer base. The demand for chicken nuggets has increased significantly in the last decades in Turkey.

The results of this study, in which the physical and chemical properties of, nugget (Table 1), schnitzel (Table 2) and cordon bleu (Table 3) products from the coated chicken meat products are determined, are given below.

Results achieved in Table (1-3) declared that the mean values of moisture content (%) in the examined samples of coated chicken meat products in were 55.29 % for nuggets, 57.73 % for schnitzel and 59.48 % for Cordon Bleu. The obtained results were nearly similar to those obtained by Güner and Yılmaz [3], Innawong et al. [12] and El-Tahan et al. [13].

Protein content of chicken meat products is of high biological value, they can supply the human being by all essential and non-essential amino acids [14]. Results achieved in Table (1-3) declared that the mean values of protein content (%) in the examined samples of coated chicken meat products in were 14.55 % for nuggets, 14.90 % for schnitzel and 15.36 % for Cordon Bleu. The current results agree with those recorded for protein by Güner and Yılmaz [3], Lukman et al. [15], and Al-Dughaym and Altabari [16].

The mean values of fat content (%) in the examined samples of coated chicken meat products in were 15.24 % for nuggets, 16.26 % for schnitzel and 15.61 % for Cordon Bleu. The current results agree with those recorded for fat by Edris et al [4] and Güner and Yılmaz [3].

The mean values of CHO content (%) in the examined samples of coated chicken meat products in were 12.74 % for nuggets, 8.96 % for schnitzel and 7.19 % for Cordon Bleu. The mean values of ash content (%) in the examined samples of coated chicken meat products in were 2.16 % for nuggets, 2.12 % for schnitzel and 2.36 % for Cordon Bleu. The mean values of salt content (%) in the examined samples of coated chicken meat products in were 1.71 % for nuggets, 1.70 % for schnitzel and 1.76 % for Cordon Bleu. The current results agree with those recorded for CHO, ash and salt contents by Edris et al [4] and Lukman et al. [15].

Results achieved in Table (1-3) declared that the mean values of FFA content (%) in the examined samples of coated chicken meat products in were 0.35 % for nuggets, 0.45 % for schnitzel and 0.38 % for Cordon Bleu. The current results agree with those recorded for FFA by Sawaya et al [17] and Sahoo and Anjaneyulu [18]. The mean values of pH value in the examined samples of coated chicken meat products in were 6.08 for nuggets, 6.03 for schnitzel and 6.05 for Cordon Bleu. The current results agree with those recorded for pH by Yavaş et al. [1], Güner and Yılmaz [3] and Patsias et al [19].

Results achieved in Table (1-3) declared that the mean values of peroxide value in the examined samples of coated chicken meat products in were 2.12 % for nuggets, 2.87 % for schnitzel and 1.91 % for Cordon Bleu.

When samples were examined in terms of % moisture content, it was determined that cordon bleu samples contained more water than nugget and schnitzel samples. It was also found that cordon bleu samples had higher content of protein than other samples in terms of % protein content ($p < 0,05$). In view of the fact that it is preferred to nutrition on the basis of the amount of protein in particular for the nutrition of children and the elderly, it is thought that it can be used as a protein source since it is easy to prepare and ready for consumption. When samples were analyzed in terms of fat content, it was determined that schnitzel samples had a higher amount of fat than the other sample averages. In terms of % ash content, the cordon bleu sample average was found to have a higher average than schnitzel and nugget samples. Nugget samples have higher carbohydrate content than other samples, which is thought to be due to the coating material being detected at a high rate. In any case the amount of salt did not exceed 2%. These results are especially important for consumers who are sensitive to salt consumption. In terms of the average values of pH values, nugget samples were found to have higher values of schnitzel samples than the other samples in terms of averages of free fatty acid and peroxide values ($P < 0,05$).

According to the microbiological analysis results of cordon bleu, nugget and schnitzel samples we have examined, it has been determined that sufficient temperature values have been applied to the cooking process to provide microorganism inhibition in the samples (Table 4). It was also determined that the subsequent



packaging and cold chain conditions applied to the samples did not adversely affect the quality values. It has been determined that the coated chicken meat products we consume are safe for consumption.

According to the results of microbiological analysis, *E. coli*, *S. aureus*, *Salmonella* spp., and *L. monocytogenes* which do not pose any danger which adversely affect consumer health.

Table 1: Chemical analysis results of nugget samples

Samples	Moisture %	Protein%	Fat %	CHO%	Ash %	Salt %	FFA% (oleic acid)	Peroxide (meq oxygen/kg fat)	pH
1	48.16i	14.33def	21.55b	13.89bcd	2.07ef	1.68ef	0.41bcd	2.18cdef	5.90i
2	46.19j	14.92bc	33.89a	2.94h	2.06ef	1.63fg	0.43bc	2.26bcde	5.42i
3	57.51cd	14.05efgh	12.32k	13.92bcd	2.20bc	1.86a	0.38cde	1.96gh	6.18abc
4	56.87cdef	14.55cde	12.72j	13.70cd	2.16cd	1.76bcd	0.36def	2.08efg	6.19abc
5	56.10defg	13.73h	12.78j	15.18abc	2.21bc	1.74cde	0.28gh	1.85h	6.13cde
6	57.69c	14.99bc	12.32k	12.82de	2.18c	1.69ef	0.25i	0.97j	6.14cde
7	59.50b	13.82gh	14.05fg	10.55ef	2.08e	1.71de	0.41bcd	2.90a	6.08def
8	60.96a	14.89bc	13.98fg	8.10g	2.07ef	1.85a	0.32efg	1.36i	6.06efg
9	57.42cde	15.21b	13.37ii	11.82def	2.18c	1.73cde	0.33efg	2.16defg	6.22ab
10	52.32i	14.19defgh	15.07d	16.21ab	2.21bc	1.69ef	0.27hi	2.43b	6.23a
11	55.03gh	15.98a	16.01c	10.77ef	2.21bc	1.78bc	0.29gh	2.85a	6.03gh
12	53.96h	14.36def	15.41d	13.96bcd	2.31a	1.69ef	0.36def	2.37bc	6.12cdef
13	58.01c	14.56cde	15.37d	9.98fg	2.08e	1.81ab	0.35def	2.15defg	6.09defg
14	56.88cdef	15.01bc	13.52hii	12.58de	2.01f	1.72de	0.42bc	1.98fgh	5.98h
15	55.36fgh	14.68cd	13.68gh	14.03bcd	2.25a	1.62g	0.45b	2.07efg	6.05efg
16	51.69i	14.26defg	14.55e	17.33a	2.17bc	1.69ef	0.26i	2.39b	6.11cdef
17	55.91efg	15.03bc	14.33ef	12.63de	2.10de	1.71de	0.36def	1.56i	6.23a
18	56.25cdef	13.99fgh	13.79gh	13.82cd	2.15cd	1.69ef	0.33efg	2.34bcd	6.24a
19	54.36h	14.57cd	13.16i	15.60abc	2.31a	1.63fg	0.29dh	2.09efg	6.07def
20	55.67efg	14.51cde	13.41hii	15.07de	2.16c	1.63fg	0.52a	2.77a	6.13cde

Means with different superscripts within a column for a particular parameter differ significantly ($p < 0.05$).

Table 2: Chemical analysis results of Schnitzel samples

Samples	Moisture %	Protein%	Fat %	CHO%	Ash %	Salt %	FFA%	peroxide	pH
1	46.38l	15.37e	21.01a	15.09a	2.15d	1.81d	0.42fg	2.84g	5.32j
2	57.85h	14.62l	16.01f	9.41g	2.11de	1.49i	0.44ef	2.71h	6.01g
3	56.78i	15.02h	13.16k	13.01c	2.03gh	1.71fg	0.51d	3.07e	6.14dc
4	54.01k	15.04gh	15.23i	13.61b	2.11de	1.75e	0.26j	2.96f	6.20bc
5	56.82i	15.54d	15.36h	10.18	2.10e	1.73ef	0.25j	1.98l	6.10ef
6	56.86i	13.89l	16.29e	10.93f	2.03gh	1.56i	0.27ij	6.39a	6.00gh
7	58.03h	14.99h	15.77g	9.06d	2.15d	1.92b	0.32i	2.43i	6.25a
8	53.83k	13.57m	16.99d	13.59i	2.02h	1.54i	0.33i	1.86m	6.19bc
9	58.56g	14.71i	17.01d	7.62b	2.10e	1.71fg	0.26j	3.41de	6.16cd
10	60.50e	13.55m	15.36h	8.53j	2.06fg	1.76e	0.97a	2.62i	6.10ef
11	59.81f	14.01k	18.01c	6.06n	2.11gh	1.75e	0.66bc	2.01l	5.96h
12	61.23c	15.09g	12.89l	8.76i	2.03de	1.68gh	0.64c	2.33j	5.89i
13	65.01a	15.66c	14.78i	2.43p	2.12de	1.85c	0.52d	2.08k	5.91i
14	60.88d	15.28f	16.38e	5.20ö	2.26bc	1.96a	0.37h	1.99ln	6.01g
15	57.86h	15.78b	16.98d	7.14m	2.24c	1.66h	0.46e	1.60m	6.12def
16	55.67j	14.67ii	17.06d	10.31e	2.29b	1.56i	0.29i	1.89m	6.22ab
17	55.81j	14.39j	18.05c	9.33h	2.42a	1.84dc	0.38h	4.51b	6.09f
18	57.73i	15.33ef	19.05b	5.80o	2.09ef	1.81d	0.41g	3.96c	5.88i



19	59.63f	15.68c	15.34h	7.36l	1.99h	1.55i	0.51d	3.45d	5.81i
20	61.52b	15.98a	14.63j	5.86o	2.01h	1.49i	0.67b	3.37e	6.26a

Means with different superscripts within a column for a particular parameter differ significantly ($p < 0.05$).

Table 3: Chemical analysis results of Cordon Bleu samples

Samples	Moisture%	Protein%	Fat %	CHO%	Ash %	Salt %	FFA%	peroxide	pH
1	44.96i	14.97fg	29.29a	8.36d	2.42bcdef	1.62ii	0.42f	2.43bcd	5.54k
2	47.14i	14.78gh	22.70b	13.13a	2.25gh	1.81cde	0.50bcd	2.71ab	5.56k
3	61.43d	17.28a	10.65m	8.33d	2.31defgh	1.83bcd	0.61a	1.48gh	6.19bcd
4	62.52b	15.92cde	10.25n	9.01c	2.30defgh	1.76cdefg	0.53b	0.97i	6.13ef
5	59.32f	14.19i	12.26l	11.92b	2.31defgh	1.64ii	0.48bcde	1.81efgh	6.28a
6	61.22d	14.68h	17.02c	4.75hi	2.33defgh	1.71efgh	0.47cdef	1.61fgh	6.01ij
7	60.11f	16.17c	14.08j	7.15e	2.49abc	1.75cefg	0.25ii	2.92a	6.16cde
8	61.83c	15.12f	13.34k	7.37e	2.34cdefgh	1.92ab	0.35g	2.20cde	6.03hii
9	61.63d	15.67e	15.81e	4.49ii	2.40bcdefg	1.63ii	0.14k	0.99i	6.02hii
10	63.54a	14.24i	14.93hi	5.06h	2.23h	1.81cde	0.28hi	0.25i	5.99j
11	60.16e	15.66e	14.51i	7.16e	2.51ab	1.66hii	0.22ij	2.96a	5.98j
12	62.38b	14.98fg	13.89j	6.72f	2.03i	1.59i	0.19j	3.01a	6.01ij
13	62.89b	15.01fg	15.55f	4.29i	2.26fgh	1.68fghi	0.36g	1.52gh	6.11efg
14	58.76g	15.63e	16.01e	7.32e	2.28efgh	1.96a	0.31gh	1.39hi	6.21bc
15	59.21fg	14.65h	15.23g	8.29d	2.62a	1.67hii	0.28hi	1.96defg	6.15cde
16	55.68h	16.54b	15.89e	9.35c	2.54ab	1.77cdef	0.45def	2.07cdef	6.08fgh
17	60.14e	16.01cd	16.27d	5.15h	2.43bcde	1.75cefg	0.26hii	2.54abc	6.07fgh
18	61.11d	15.77de	14.88i	5.69g	2.55ab	1.86abc	0.49bcde	2.06cdef	6.05hii
19	62.59b	15.03fg	14.35i	6.02g	2.01i	1.92ab	0.44ef	1.99defg	6.22b
20	63.01b	14.89h	15.31gh	4.18ii	2.61bcd	1.78cdef	0.47bc	1.36efgh	6.28a

Means with different superscripts within a column for a particular parameter differ significantly ($p < 0.05$).

Table 4: Total Mesophilic Aerobic Bacteria Results of Coated Product Samples (\log_{10})

Samples	Nugget	Schnitzel	Cordon bleu
1	3.11	2.10	2.84
2	3.50	3.08	3.09
3	2.74	2.78	3.13
4	2.91	3.23	2.76
5	3.00	3.45	2.98
6	2.89	2.16	3.13
7	2.33	2.30	3.24
8	2.54	2.90	2.46
9	2.35	3.57	2.41
10	3.18	3.14	3.48
11	1.90	2.89	2.70
12	2.88	3.14	2.93
13	2.70	3.52	2.63
14	2.23	3.18	2.67
15	2.99	2.71	2.71
16	1.90	2.89	2.73
17	2.88	3.13	2.77
18	3.70	3.53	2.80
19	2.23	3.19	2.88
20	2.99	2.72	3.11



4. Conclusion

Nowadays, very fast working conditions and more existence of women in business life impels the consumers to consume ready to eat products. Recently, especially chicken meat and chicken meat products have been occurring in markets more than before. Some products are made from formed chicken, which consists of chopped chicken pieces that are pressed and formed into specific shapes and used for products such as nuggets, schnitzel and cordon bleu. These processes offer many opportunities to the food industry. Physico-chemical, nutritional, functional and microbiological properties of the coated chicken meat products were acceptable for consumers.

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