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Nutritional Composition of Quail Meatballs and Quail Pickled Eggs

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Abstract

The aims of this study were to evaluate the acceptance of meatballs and pickled quail eggs, determine the nutritional composition of the quail pickled eggs and quail meatballs. Data indicate that quail meatballs and pickled quail eggs are an acceptable market product. The quail meatballs have 70.56% moisture content and 29.44% dry matter which include 7.78%, 12.98%, 7.10% and 2.48% in wet basis for total lipids, proteins, ash and carbohydrate, respectively. Total cholesterol content in quail meatballs was 0.087 g/100 g. Regarding pickled quail eggs, the values of moisture, dry matter, total lipids, proteins, ash and carbohydrate are 53.32%, 46.68%, 20.09%, 20.38%, 4.70% and 1.51% in wet basis, respectively. Average of cholesterol content in pickled quail eggs is 2.06 g/100 g yolk. Total essential amino acids were 6.17 g/100 g protein in quail meatballs, while total non-essential amino acids were 5.87 g/100 g protein in quail meatballs. In pickled quail eggs the values of total essential amino acids and non-total essential amino acids were 6.84 g/100 g and 8.81 g/100 g protein, respectively. Total Saturated Fatty Acids (SFAs) in quail meatballs and quail pickled eggs are 26.37% and 37.52%, respectively. Total mono-unsaturated fatty acids and poly-unsaturated fatty acids contents in quail meatballs are 36.61% and 36.21, respectively, while these values for pickled quail eggs are 54.12% and 8.36%, respectively.

Keywords: Quail; Meatballs; Pickled egg; Chemical composition

Introduction

The consumption of poultry meat and poultry meat products is growing all over the world [1]. In recent years, quail meat has gained much popularity among consumers. Quails, most commonly bred for human consumption, belong to the species *Coturnix coturnix japonica.* Their distribution in the wild spreads over large areas of Asia, Europe and Africa, but they were first domesticated in Japan as a source of both egg and meat [2]. Quail meat is recommended for the low-fat diet because it contains low amount of fat and cholesterol especially thanks to its thin skin and low fat accumulation between its tissues [3]. Japanese quail meat may be taken into consideration in diet for prevention of heart diseases because of high C18:1 content. The ratio between PUFAs and SFAs was 0.43 in female quail meat and 0.40 in male quail meat. Both ratios are in accordance with the WHO recommendations. Quail eggs have a very interesting chemical composition, being rich in fat soluble vitamins and B-complex; in proteins, amino acids, macro and microelements, but are low in cholesterol [4], triglycerides and saturated fatty acids [5]. Chinese use quail eggs to help treat tuberculosis, asthma, and even diabetes. Quail eggs can help prevent sufferer of kidney, liver, or gallbladder stones and remove these types of stones. The nutritional value of quail eggs is much higher than those offered by other eggs with they are rich sources of antioxidants, minerals, and vitamins, and give us a lot of nutrition than do other foods [6]. Because of its valuable chemical compositions, quail egg is considered to be a true universal panacea, placed 3rd in the Chinese natural medicine after snake venom and Ginseng [7,8]. The eggs of quail are used in the same manner as those of chickens. Because of their small size and attractive appearance quail eggs are often used for special purposes. Pickled quail eggs are a specialty. Pickles occupy an important place among processed foods. With the increasing popularity of quail (*Coturnix coturnix japonica),* there is a good scope for the utilization of small and tinted quail eggs in the form of pickle. Technological details pertaining to the manufacture of pickled quail eggs have been worked out with a view to offer such nutritious, ready-to-eat product to the consumers.

Quail meat is considered a delicacy. It can be fried or roasted, and many recipes have been developed. Meatballs are a popular meat product in Egypt. This includes products such as chicken meatballs, fish meatballs, beef meatballs, other meat sources such as quail is also potential raw materials for meatballs production [9] suggested that the quail meat can be used successfully for the manufacture of meatballs as an alternative to the use of other meats such as beef and chicken, using different types of flour.

Egyptian consumer preferably eats chicken eggs. But quail eggs sold in the form much more restricted, commonly used in the ornamentation of cold dishes or snacks. In recent years, it has become spread the quail eggs consumed by the belief that these do not contain cholesterol or its content is irrelevant and greater value nutritious, belief that has been fuelled to some extent by the producers themselves at the lack of information about their composition.

In developed countries continues to drive consumption chicken egg through the development of new egg products are used in various dishes, however quail egg by their different physical characteristics to chicken cannot be used for preparing the same egg products but can be exploited in other presentations. The objective of this work was to evaluate the acceptance of meatballs and pickled quail eggs. Determine the nutritional composition of the quail pickled eggs and quail meatballs.

Materials and Methods

Quail (*Coturnix coturnix japonica)* carcasses and eggs were collected from the National Center for Agricultural Research in Dokki, Egypt. Other materials were collected from local markets in Damanhour city, Egypt.

Preparation of Samples

Preparation of pickled quail eggs

According to Indian standard [10] fresh quail eggs stored at ambient temperature for at least 24 salts, for about 10 min at simmering temperature. After boiling, the eggs shall be cooled immediately in running tap water and peeled off manually. There shall be no pieces of egg shell or shell membrane adhering over the peeled eggs. Peeled eggs showing tom or rugged-looking albumen surface shall not be used for pickling. Pickling solution shall consist of vinegar and water (50: 50 vlv), 8% (w/v) common salt, and 2% (wlv) each spice mixture, onion (fresh and chopped), garlic and ginger. The solution shall be boiled for 10 min and then filtered using clean muslin cloth. Pickling solution shall be heated to 70 ± 2°C and poured onto the peeled eggs. Cover the peeled eggs with pickling solution. The pickled eggs shall be aged for 48 hours at ambient temperature in pre-sterilized glass container.

Preparation of meatballs

The quail carcasses were deboned mechanically. The mean carcass weights were 203.04 ± 16.67 g. meatballs blend was prepared using the formula given by Youssef [11] as follows: Meat 90% was mixed into house mincer, flour 3%, fresh onion 3% were peeled and minced before the addition, 2% salt and 2% spices. These ingredients were mixed together, divided to balls to formulate quail meatballs. Samples were freeze stored at -18 ± 2°C meatballs cooked before analysis at 95°C for 5 min.

Sensory properties

The sensory properties of consumers were applied for the pickled quail eggs and meatballs. Sixty panelists evaluated the sensory attributes of the quail products. Panelists were given no time limit for the evaluation. Pickled quail eggs and meatballs were cut into small pieces and placed on a plastic plate. The attributes evaluated were color, flavor, texture and overall acceptability. For each sample, panelists scored their liking of these characteristics using a five-point hedonic scale (1=Dislike very much, 2=Dislike slightly, 3=Neither like nor dislike, 4=Like slightly, 5=Like very much) [12].

Analytical Methods

Chemical analysis

Moisture, protein, fat and ash contents were determined in accordance with standard methods of Association of Official Analytical Chemists (AOAC) [13]. Protein determination involved a Kjeldahl assay (N × 6.25). Fat were determined extracting samples in a Folch apparatus using chloroform: Ethanol (2:1 v/v) as a solvent. Moisture was quantified by oven-drying 10 g samples at 100°C overnight. Ash was determined after incineration in a furnace at 500°C and carbohydrate content was calculated by computing the difference. Minerals (Ca; Na; P & Fe) contents were performed by the classical method of chemical analysis [13].

Total cholesterol content

It was determined by the method of Lieberman-Buchart [14].

Amino acid profile

The technique recommended by Mabbott [15]. The minced liver samples were hydrolyzed with 6 N HCl for 24 h and amino acids were quantified using the Beckman Amino Acid Analyzer (model 6300; Beckman Coulter Inc., Fullerton, Calif., U.S.A.) employing sodium citrate buffers as step gradients with the cation exchange post-column ninhydrin derivatization method. The data was reported as gram of amino acid per 100 g of sample.

Fatty acid methyl esters analyses

For fat content determination lipids were extracted from 10 g breast by the method described by Folch et al.; Association of Official Analytical Chemists [16,17]. Five mL chloroform/methanol (2:1 v/v) solution was added to sample and shook thoroughly by vortex for 3 min. One mL of 0.9% NaCl was added to mix and shake again. The chloroform phase containing lipids were collected. Lipid extracts were converted to fatty acid methyl esters as described by Association of Official Analytical Chemists [17]. It was prepared after alkaline hydrolysis following procedures. Briefly, lipid extract was mixed with 0.5 N 2 mL methanolic NaOH and held at 100°C for 10 min. This solution was cooled to room temperature and mixed with 2 mL of (14% Boron tri fluoride, 86% Methanol). Then after, solution obtained by adding BF3 was incubated at 100°C for 2 min and cooled dawn to again room temperature. 1 mL n-heptane was added to final solution and thoroughly mixed by vortex for 3 min and reheated to 100°C for 1 min. Final solution was cooled down to room temperature and centrifuged at 300 rpm for 5 min. Upper layer (heptane phase) was transferred to glass tube for the GC analysis. The final concentration of the Fatty acid methyl esters analyses was approximately 7 mg/mL in heptane.

Statistical analysis

Statistical analysis of experimental data was performed by analysis of variance (ANOVA) producers using SPSS version 9.0 programs to examine statistical significance differences of sensory analysis means of experimental data. Results were considered statistically significant when $p \leq 0.05$. Mean ± standard deviation values were also presented.

Results

Sensory properties

Sensory properties was conducted to measure the organoleptic properties of organic, which include color, taste, smell, texture and general acceptance of both meatballs quail and pickled quail eggs. General precautions to taste tests have been taken. Evaluation of sensory properties of quail meatballs and pickled eggs are shown in Table 1. The panelists generally gave a score denoting moderate likeability, perhaps due to the fact that the panelists were not very familiar with meatballs made from quail meat. The data indicate that pickled quail eggs are an acceptable market product.

Data of chemical composition for quail meatballs and pickled quail eggs are presented in Table 2. Results demonstrated that quail meatballs have 70.56% moisture content and 29.44% dry matter which

include 7.78%, 12.98%, 7.10% and 2.48% in wet basis for total lipids, proteins, ash and carbohydrate, respectively. These results are agreed with results produced by Ikhlas et al. [9]. They found that quail meatballs have value of 65.94% moisture, 13.53 (% wet basis) protein, 10.59 (% wet basis) fat, 2.30 (% wet basis) ash and 7.63 (% wet basis) carbohydrates. The quail meatballs have proximate analysis values that are not so different from those of meatballs made from other meats such as chicken which prepared by Huda et al. [18]. they found that commercial chicken meatballs have moisture, protein, fat, ash and carbohydrate contents of about 64.33-71.81%, 9.94-15.96(% wet basis), 4.26-14.00 (% wet basis), 1.92-2.82 (% wet basis) and 5.54-20.85(% wet basis), respectively.

Properties	Meatball Quail	Pickled quail egg
Colour	4.7 ± 0.23	4.2 ± 0.51
Taste	4.5 ± 0.35	4.5 ± 0.35
Odour	5.0 ± 0.37	4.0 ± 0.65
Flavour	4.3 ± 0.27	4.3 ± 0.45
Texture	4.3 ± 0.17	4.1 ± 0. 65
Overall acceptability	4.5 ± 0.24	4.2 ± 0.45
The value ± standard deviation (SD)		

Table 1: Sensory properties of quail meatballs and pickled quail egg.

Chemical composition

Chemical composition (g/100 g DW)	Quail meatballs	Pickled quail eggs
Moisture	70.56 ± 2.04	53.32 ± 1.74
Dry matter	29.44 ± 1.63	46.68 ± 0.86
Total lipids	7.78 ± 0.68	20.09 ± 0.85
Cholesterol	0.087 ± 0.005	2.06 ± 0.56 g/100 g yolk
Proteins	12.98 ± 1.03	20.38 ± 2.03
Carbohydrate	6.10 ± 0.74	1.51 ± 0.04
Ash	2.48 ± 0.22	4.70 ± 0.33
Na (mg/kg)	1425.23 ± 21.67	1058.96 ± 7.97
P (mg/kg)	3838.79 ± 18.31	955.19 ± 6.55
Ca (mg/kg)	1448.60 ± 8.08	613.21 ± 1.27
Fe (mg/kg)	36.028 ± 0.17	22.476 ± 0.68
All values are means of triplicate determinations ± standard deviation (SD). DW: Dry Weight; TC: Total Carbohydrates		

Table 2: Chemical composition of quail meatballs and pickled quail egg (g/100 g in wet basis).

Quail meatballs have higher protein content and lower carbohydrate content than various kinds of commercial chicken meatballs in Malaysian markets, as reported by Huda et al. [19], who reported protein and carbohydrate contents ranging from 12.83-13.71% and 5.23-8.25%, respectively. Total cholesterol content in quail meatballs was 0.087 g/100 g. This value is agreed with that reported by Genchev et al. [20], who found that cholesterol content in quail carcass was 0.097 and 0.094 g/100 g for male and female, respectively. It is clear that quail meatballs have high minerals content this may be due to the mixing of soft bone with flesh of quail when manufacturing.

With regard to pickled quail eggs, Table 2 indicated that the values of moisture, dry matter, total lipids, proteins, ash and carbohydrate are 53.32%, 46.68%, 20.09%, 20.38%, 4.70% and 1.51% in wet basis, respectively. Average of cholesterol content in pickled quail eggs is 2.06 g/100 g yolk [21] found that the proximal composition of quail eggs with a protein content of 13.6 ± 2.1%, total lipids of 12.59 ± 2.2 and 1.13 ± 0.33% cholesterol in wet basis [22] reported that the quail eggs have 1.06, 4.01, 9.89, 12.7, and 72.25 g /100 g for ash, carbohydrate, fat, protein and moisture, respectively [23] indicate that the quail egg yolk has a 1.21 ± 0.07 g of cholesterol per 100 g of yolk. According to Bragagnalo and Rodriguez-Amaya [24] the highest cholesterol content was observed in ostrich and duck eggs, whereas the lowest in compared the cholesterol content of Brazilian chicken and quail eggs [23]. They showed that there was no significant difference in cholesterol level between chicken and quail eggs in terms of yolk (12.0 mg/g vs. 12.1 mg/g). Opposite results were presented by Kaźmierska et al. [25], who reported higher cholesterol content in quail egg yolk (13.6 mg/g) compared to Tunsaringkarn et al. [23].

Amino acids content

One of the most important factors determining the quality of food protein is amino acid composition. In general, high protein food is also high in contents of amino acids including eight which are essential in human nutrition: lysine, valine, leucine, isoleucine, threonine, tryptophan, methionine and phenylalanine [26]. Analysis of amino acids in quail meatballs and pickled quail eggs are recorded in Table 3.

Essential amino acids were 6.17 g/100 g protein this value equals 47.5% from protein in quail meatballs. Among the essential amino acids lysine has the greatest value (1.63%) of amino acids. lysine is required for growth and bone development in children, assists in calcium absorption and assists in maintaining the correct nitrogen balance in the body, as well as maintaining lean body mass. Lysine is also needed to produce antibodies, hormones, enzymes, collagen formation as well as repair of tissue [27]. While total non-essential amino acids was 5.87 g/100 g protein in quail meatballs. In pickled quail eggs the values of total essential amino acids and non-total essential amino acids were 6.84 g/100 g and 8.81 g/100 g protein, respectively. It means that sum of essential amino acids equals 33.56% from protein content in pickled egg. The greatest value of amino acids refers to leucine as essential amino acid. Leucine is a branched chain amino acid along with valine and isoleucine. It is beneficial and functional to protein structure for 60-70% in human body, and blood sugar level regulation which maintains a balance of insulin and glucose [28]. It proposed as a promising pharmaconutrient in the prevention and treatment of sarcopenia and/or type 2 diabetes [29]. According to FAO/WHO specialists in 1973, the “ideal” protein should contain the following concentrations of essential amino acids: lysine−5.5%, methionine+cysteine−3.5%, threonine−4%, leucine−7%, isoleucine −4%, valine−5%, phenylalanine+tyrosine−6% [30].

Fatty acids composition

Quail is the good source of both saturated and unsaturated fatty acids. In our studies, we found that quail meatballs and pickled quail

eggs used in study contain saturated and unsaturated fatty acids. As shown in Table 4, Palmitic acid (C14:0) is present in higher number in saturated fatty acids with values of up to 20.48% and 28.11% for quail meatballs and pickled quail eggs, respectively. It is similar with results reported by Ribarova et al. [31]. They found that Palmitic acid (C16:0) was the major fatty acid, followed by stearic acid (C18:0) in female and male quail meats.

Amino acids	Quail meatballs	Pickled quail eggs
Essential amino acids		
	1.63 ± 0.41	1.36 ± 0.16
Lysine	1.63 ± 0.41	1.36 ± 0.16
Methionine	0.48 ± 0.08	0.78 ± 0.03
Leucine	0.89 ± 0.17	1.47 ± 0.09
Isoleucine	0.97 ± 0.03	0.77 ± 0.02
Phenylalanine	0.94 ± 0.08	0.81 ± 0.08
Threonine	0.47 ± 0.24	0.71 ± 0.03
Valine	0.79 ± 0.16	0.94 ± 0.12
∑ essential amino acids	6.17	6.84
Non-essential amino acids		
Tyrosine	0.43 ± 0.06	0.51 ± 0.04
Histidine	0.62 ± 0.11	0.47 ± 0.02
Arginine	0.51 ± 0.09	0.47 ± 0.04
Glycine	0.64 ± 0.15	0.51 ± 0.07
Glutamic acids	1.02 ± 0.28	2.02 ± 0.04
Serine	0.38 ± 0.06	1.41 ± 0.07
Alanine	0.59 ± 0.13	0.73 ± 0.05
Proline	0.51 ± 0.03	0.60 ± 0.07
Asparatic acids	1.05 ± 0.06	1.26 ± 0.03
∑ Non-essential amino acids	5.87	8.81
All values are means of triplicate determinations ± standard deviation (SD)		

Table 3: Amino acids content in quail meatballs and pickled quail eggs %.

Myristic acid was in very low concentration in comparison to Palmitic and stearic acid. Sum of saturated fatty acids (∑ SFA) in quail meatballs and quail pickled eggs are 26.37% and 37.52%, respectively. Saturated fatty acids play important role in different biological functions like source of metabolic energy and in cell membrane structure formation. Whereas Oleic (C18:1) is present in highest value in all fatty acids. Sum of mono unsaturated fatty acids (∑ MUFA) and Sum of poly unsaturated fatty acids (∑ PUFA) in quail meatballs are 36.61% and 36.21, respectively. While ∑ MUFA and ∑ PUFA values for pickled quail eggs are 54.12% and 8.36%, respectively. These data are similar with that reported by Gecgel et al. [32]. He found that ∑ MUFA and ∑ PUFA values for egg in Pharaoh Japanese quail are 51.3% and 9.9%, respectively. The published fatty acid profiles of meat from different animal species show that avian meat is relatively rich in the essential

Ω-3 α-linolenic fatty acid (C18:3). Our data for α-linolenic acid content in quail meatballs and pickled quail eggs are 23.6% and 5.36%, respectively and higher than to those of about its content in chicken meat–1.74% [33]. The α-linolenic acid content in the meat of the different duck populations varies in a wider range–0.8-1.62% [34].

Sample fatty acid	Quail meatballs	Pickled quail eggs
Myristic (C14:0)	0.95 ± 0.06	0.79 ± 0.07
Myristoleic (C14:1)	1.15 ± 0.06	6.29 ± 0.51
Palmitic (C16:0)	20.42 ± 0.34	28.11 ± 0.62
Palmitoleic (C16:1)	0.46 ± 0.03	2.60 ± 0.04
Stearic (C18:0)	5.00 ± 0.08	8.62 ± 0.11
Oleic (C18:1)	35.80 ± 0.74	45.23 ± 0.65
Linoleic (C18:2)	23.62 ± 0.05	5.36 ± 0.04
γ-Linolenic (C18:3)	3.16 ± 0.02	2.27 ± 0.13
Eicosapentaenoic acid (C20:5)	9.43 ± 0.28	0.73 ± 0.07
∑ SFA	26.37	37.52
∑ MUFA	36.61	54.12
∑ PUFA	36.21	8.36
All values are means of triplicate determinations ± standard deviation (SD)		

Table 4: Fatty acid content (%) of quail meatballs and pickled quail eggs (%) from total lipids.

Wolaszyn et al. [35] reported that quail eggs have higher concentration of monounsaturated fatty acid in yolk (45%) compared to chicken eggs (39.1%) and lower content of polyunsaturated fatty acid (25.1% vs. 31.3%, respectively). The total concentration of saturated fatty acid in yolk was similar in both species.

Conclusion

Quail meatballs and pickled quail eggs are an acceptable market product, have a very interesting chemical composition. Quail meatballs have higher protein content and lower carbohydrate content (High minerals content).

Sum of essential amino acids in quail meatballs was 6.17 g/100 g protein this value equals 47.5% from protein, while in pickled quail eggs total essential amino acids and was 6.84 g/100 g protein which represents 33.56% from protein content in pickled egg. Sum of saturated fatty acids (∑ SFA) in quail meatballs and quail pickled eggs are 26.37% and 37.52%, respectively. So we should transfer knowledge to people for good nutrient benefits of quail eggs as good nutritional foods and may be the alternative resolving problem of people in some or all nutritional nutrients necessary for human health in developing countries [36].

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