# Choux pastry made from fresh eggs: a comparative

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FULL PAPER

# Choux pastry made from fresh eggs: a comparative study between chicken and duck eggs

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**Abstract**

Chicken and duck eggs are the two most consumed types of poultry eggs. There are many egg products, one of which is choux pastry. Choux pastry is usually made from chicken eggs and is popular because of its tasty aroma and flavour. Duck eggs are used to replace chicken eggs in choux pastry dough. The protein and lipid content of duck eggs is 20% and 70% higher on average than chicken eggs, respectively. Also, the quality of duck eggs, which included the Haugh unit (HU) score, albumen index, and yolk index, was 11%, 25%, and 20% higher, on average, than chicken eggs. Organoleptic tests conducted on 600 people resulted in choux pastry made from duck eggs having better colour and texture, respectively, with the criteria for enough dark brown colour and a firm texture. However, duck eggs have a lower aroma and taste, respectively, with the attribute of less butter aroma and non-savoury taste. The preference test showed that choux pastry made from chicken eggs is better than choux pastry made from duck eggs.

## 1. Introduction

Eggs from poultry are a source of nutrients needed by humans (Harlina *et al*., 2018; Wang *et al*. 2020). Among several poultry eggs, chicken and duck eggs are the most consumed (Yu *et al*., 2020). Several studies have shown that the protein content of duck egg whites, lyophilized, was higher than chicken (Hu *et al*., 2016). Therefore, several aspects of salted eggs, such as taste, orange colour, gritty texture, and oil exudation of duck eggs, are closer to customer expectations than chicken eggs (Yuan *et al*., 2018; Sun *et al*., 2020). The quality of salted egg products decreases along with the lipid oxidation of yolk (Harlina *et al*., 2015). The addition of antioxidants is a solution to overcome this (Harlina *et al*., 2019).

Egg whites, about 60% of the whole egg, contain 88% water, 11% protein, 1% carbohydrates, and minerals (Sun *et al*., 2019). In the form of salted eggs, egg whites containing OVA protein account for 54% of the total protein (Jiang *et al*., 2019). In the process of uptake of calcium which is necessary for the body, two substances that play a significant role are prebiotics and peptides (Hou, Kolba, Glahn *et al*., 2017), which come from desalted duck egg whites (DDEW) (Hou, Liu, Kolba *et al*., 2017). In addition, DDEW also acts as an antioxidant (Yang *et al*., 2017; Thammasena and Liu, 2020), anti-inflammatory (Ding *et al*., 2019), a salt substitute (Tan *et al*., 2016), an additive to bind iron (Li *et al*., 2018), antimicrobials (Arshad *et al*., 2020; Thammasena and Liu, 2020), protease inhibitory activity (Quan and Benjakul, 2018; Quan and Benjakul, 2019a), texture enhancers (Quan and Benjakul, 2019b). Unfortunately, although DDEW has many benefits, it is still considered a by-product of salted eggs (Quan and Benjakul, 2019c; Xiao *et al*., 2019).

The albumen quality decreases with the increasing shelf life of the eggs. This decrease is characterized by a foul odour and dilutes albumen. It is due to environmental conditions such as pH and temperature (Tang *et al*., 2020). The pH condition highly affects the protein composition of eggs, particularly during salting (Panpipat and Chaijan, 2020). The effect of temperature, especially in cooking eggs, can cause changes in the yolk fatty acid composition (Özcan *et al*., 2019). In addition, the fishy odour caused by eggs is due to increased levels of trimethylamine (TMA) content and can cause fish odour syndrome in humans (Li *et al*., 2019). In addition to that, the level of TMA content in duck eggs is higher than in chicken eggs (Li *et al*., 2017). It causes the consumption of duck eggs to be lower than chicken eggs, apart from the outbreak of Salmonella, that attacked duck eggs between 1974 and 1976 in Germany (Owen *et al*., 2016).

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Chicken eggs are usually used as an ingredient in choux pastry dough. The savoury taste and aroma, which is a combination of chicken eggs and salted butter, attract people to eat this dish. The key to this dough is in the yolk. Therefore, duck eggs that have a higher ratio of yolk to chicken eggs will be used. The egg yolk ratio itself is influenced by many factors, one of which is the age of the birds (Du *et al*., 2019). Some studies say that the higher the age of the birds, the higher the ratio of the egg yolk (Ipek and Sozcu, 2017; Zhu *et al*., 2019). Several studies have also attempted to prolong the laying period of ducks for this reason (Zhu *et al*., 2017; Feng *et al*., 2018). Diet is one way to improve the quality of egg yolk (Zhang, Wang, Huang *et al*., 2020; Zhang, Wang, Li *et al*., 2020). In addition, the factors of avian genes are also determined (Langley *et al*., 2017).

This study compared choux pastries made from chicken eggs with those made from duck eggs. As previously explained, duck eggs have many advantages over chicken eggs. The nutritional content of raw duck eggs is the same as salted duck eggs (Guo *et al*., 2020). It has led to the nutritional content and organoleptic tests on choux pastry made from duck eggs. Tests on chicken egg-based choux pastry have been carried out before with the influence of egg freshness and age of the chicken. This time, choux pastry is only affected by the freshness of the eggs because all the choux dough had the same recipe. Duck breeders rarely raise them for up to two years and sell their ducks when they are over a year old to use their meat.

## 2. Material and methods

### *2.1 Preparation of eggs and dough*

Duck and chicken eggs are obtained directly from breeders on the first day of hatching. The type of duck chosen is the type commonly kept by breeders, the domestic duck. The age of ducks at five months was chosen as the initial age of laying eggs, to be compared with chicken eggs from the initial period of laying eggs as well. The chicken chosen is the ISA brown layer hen. Both ducks and chickens have the same laying period ranging from 5 months to 2 years.

Every choux dough consists of 225 g of high protein flour, 23 g of sugar, 150 g of salted butter, 375 mL of milk, and six eggs. Before the eggs are mixed into the dough, they are measured for freshness first. Freshness measurements and dough making were carried out on the first to forty days, once every ten days, to determine the effect of egg quality on the choux pastry dough. The flowchart of the process of measuring egg freshness and making choux pastry dough is presented in Figure 1. After the baking process, each choux pastry weighs an average of 50 g.

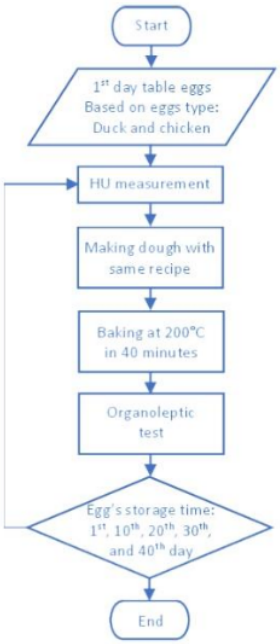


Figure 1. Flowchart diagram of measuring egg freshness and making choux dough

### *2.2 Egg quality measurement*

Egg quality is determined by the Haugh unit (HU), as presented in Equation (1), also by albumen and yolk index. These indexes are the ratio between the height and the diameter, as shown in Equation (2) and Equation (3), respectively.

$$HU = 100\log(H + 7.51 - 1.7W^{0.37}) \quad (1)$$

$$AI = AH/AD \quad (2)$$

$$YI = YH/YD \quad (3)$$

Where $H$ and $W$ are albumen height (mm) and egg weight (g), respectively. $AI$ is albumen index (dimensionless), $AH$ is albumen height (mm), $AD$ is albumen diameter (mm), and the same goes for the yolk.

### *2.3 Nutritional test*

Carbohydrates, proteins, and lipids were tested using the Luff Schoorl, Kjehdahl, and Soxhlet methods. These three nutrients indicate colour, aroma, and taste in organoleptic tests. Also, the water content affects the texture of the choux pastry. The energy test results are obtained from the calorimeter.

### *2.4 Organoleptic test*

Organoleptic tests and nutritional content are carried out for each choux pastry with a value range of at least five and a maximum of one. The tests carried out include colour, aroma, texture, and taste. In addition, a preference test was also carried out. Six hundred people

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represented enough to get an accurate result. ANOVA is used to test the relationship between two variables. Each test was carried out until it obtained a significant difference ($p \leq 0.05$).

## 3. Results and discussion

Figure 2, Figure 3, and Figure 4 show the results of measuring egg quality. From the results of these measurements, it was evident that duck eggs have HU values, albumen index, and yolk index above chicken eggs. Furthermore, because the eggs were purchased on the first day of hatching, they had a high level of freshness. It was proven from the HU value above 70 for all eggs.

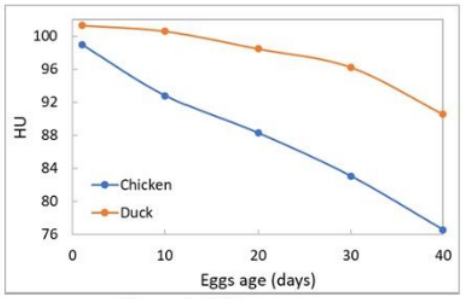


Figure 2. HU vs eggs age

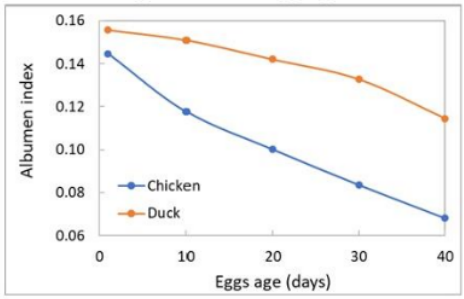


Figure 3. Albumen index vs eggs age

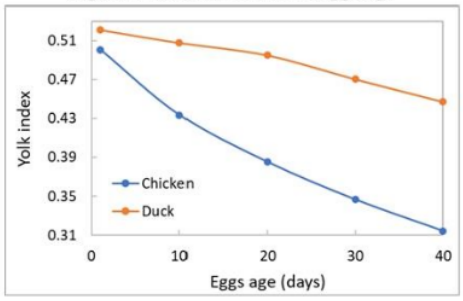


Figure 4. Yolk index vs eggs age

The nutritional content test results for each choux pastry are shown in Table 1. Since choux dough was made with the same recipe and baking process, the differences in this test were dominated by the nutritional content of the eggs. Fresh eggs were expected to have high protein and fat but low water content. In Table 1, it can be seen that the dough made from the first day's eggs had a lower protein content than the tenth day's eggs. The fat content of the first day's choux is lower than the twentieth day.

The egg is an embryo that will develop into a bird (Zhu *et al*., 2019). This development was reflected in the results of the protein and lipid tests in Table 1. Protein, lipids, and water are the main ingredients for forming eggs. Because of this, they influence each other in the composition of the egg. Other food ingredients, such as wheat flour and salted butter, played a role in the derivative of glucose, which dominated the rise of energy. It can also be seen in Table 1 that choux pastry made from duck eggs has a higher protein and lipid content than choux pastry made from chicken eggs.

The organoleptic test results of choux pastry were shown in Table 2. Choux pastry made from duck eggs had better colour and texture than choux pastry made from chicken eggs. The beta carotene content of duck eggs is higher than chicken eggs (Du *et al*., 2019), so the resulting choux pastry was darker in colour. Also, the water content of duck eggs was lower than chicken eggs and made the choux pastry texture firmer.

A different thing was shown by the aroma and taste test results in Table 2. Choux pastry from duck eggs tended to have a lower aroma and taste than choux pastry from chicken eggs. The TMA content of duck eggs, which is higher than chicken eggs (Li *et al*., 2017), caused excessive fishy odour in the choux pastry. Some people do not like this, which reduced the aroma of the choux pastry made from duck eggs. Duck eggs also have a higher mineral content than chicken eggs (Tang *et al*., 2020). It causes the taste of duck eggs to be saltier than chicken eggs. As salted butter was one of the ingredients of the choux dough, the choux pastry from duck eggs tended to be more bitter than choux pastry from chicken eggs.

The results of the preference test in Table 2 showed that choux pastry made from chicken eggs was better than choux pastry made from duck eggs. It was common because people paid more attention to smell and taste than colour and texture to choose preferences. It can also be used as a guide for choux pastry producers to pay more attention to the level of a favourite than the nutritional content contained in choux pastry. Meanwhile, the nutrition test results can be used as a reference in regulating the shelf life of eggs purchased from stores.

## 4. Conclusion

Duck eggs had better quality than chicken eggs. It was proven by the value of HU, albumen index, and yolk

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Table 1. Nutritional content test results in 100 g of choux pastry

| | Chicken | | | | | Duck | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Egg's age (days) | 1 | 10 | 20 | 30 | 40 | 1 | 10 | 20 | 30 | 40 |
| Glucose (g) | 26.4 | 27.3 | 25.8[a] | 26.8 | 27.3 | 23.4 | 24.2 | 23.8 | 23.2 | 22.8 |
| Protein (g) | 6.5 | 7.6[b] | 6.6 | 5.5 | 4.5 | 7.8 | 9.0[c] | 8.2 | 7.4 | 6.6 |
| Lipid (g) | 14.4 | 15.8 | 17.2[d] | 15.6 | 14.4 | 25.6 | 29 | 31.4[e] | 28.7 | 26.2 |
| Ash (g) | 1.5 | 1.7 | 1.6 | 1.5 | 1.4 | 1.3 | 1.5 | 1.4 | 1.3 | 1.2 |
| Water (g) | 51.2 | 47.6 | 48.8 | 50.6 | 52.4[f] | 41.9 | 36.3 | 35.2 | 39.4 | 43.2[g] |
| Energy (kcal) | 285.8 | 295.6 | 279.3 | 290.2 | 295.6 | 427.8 | 442.4[h] | 435.1 | 424.1 | 416.8 |

Mean values with superscript are significantly different ($p \leq 0.05$)

Table 2. Organoleptic test results of choux pastry

| | Chicken | | | | | Duck | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Egg's age (days) | 1 | 10 | 20 | 30 | 40 | 1 | 10 | 20 | 30 | 40 |
| Colour | 3 | 4 | 4 | 4 | 5[a] | 2 | 2 | 3 | 3 | 4[b] |
| Aroma | 3 | 2 | 1[c] | 2 | 3 | 2 | 3 | 4[d] | 3 | 2 |
| Texture | 2 | 2 | 3 | 3 | 4[e] | 2 | 1 | 1 | 2 | 2 |
| Taste | 2 | 1[f] | 2 | 3 | 4 | 2 | 3 | 4[g] | 3 | 2 |
| Preferences | 2 | 1[h] | 2 | 3 | 4 | 2 | 3 | 4[i] | 3 | 2 |

Mean values with superscript are significantly different ($p \leq 0.05$)

index of duck eggs above chicken eggs. The nutrition test for choux pastry also showed that duck eggs had higher protein and lipid content than chicken eggs. Organoleptic tests showed that choux pastry made from duck eggs was superior in colour and texture. Meanwhile, in terms of aroma and taste, choux pastry made from chicken eggs was eminent. The higher beta carotene content and lower water benefited the choux pastry from duck eggs in colour and texture. Meanwhile, the higher TMA and mineral content in duck eggs was detrimental because it caused a sharper fishy odour and a more bitter taste. The liking test showed choux pastry from chicken eggs was better. It was because people paid more attention to smell and taste than to colour and texture.

## Conflict of interest

The authors declare no conflict of interest.

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## References

Arshad, R., Meng, Y., Qiu, N., Sun, H., Keast, R. and Rehman, A. (2020). Phosphoroteomic analysis of duck egg white and insight into the biological functions of identified phosphoproteins. *Journal of Food Biochemical*, 44(10), e13367. https://doi.org/10.1111/jfbc.13367

Ding, N., Mao, C., Cai, Z. and Ma, M. (2019). Anti-inflammatory effect of preserved egg with simulated gastrointestinal digestion on LPS-stimulated RAW264.7 cells. *Poultry Science*, 98(10), 4401-4407. https://doi.org/10.3382/ps/pez243

Du, X., Ren, J.D., Xu, X.Q., Chen, G.H., Huang, Y., Du, J.P., Tao, Z.R., Cai, Z.X., Lu, L.Z. and Yang, H. (2019). Comparative transcriptome analysis reveal genes to the yolk ratio of duck eggs. *Animal Genetics*, 50(5), 484-492. https://doi.org/10.1111/age.12820

Feng, P., Zhao, W., Xie, Q., Zeng, T., Lu, L. and Yang, L. (2018). Polymorphisms of melatonin receptor genes and their associations with egg production traits in Shaoxing duck. *Asian-Australasian Journal of Animal Science*, 31(10), 1535-1541. https://doi.org/10.5713/ajas.17.0828

Guo, D., He, H., Zhao, M., Zhang, G. and Hou, T. (2020). Desalted duck egg white peptides via wnt/$\beta$-catenin signal pathway. *Journal of Food Science*, 85 (3), 834-842. https://doi.org/10.1111/1750-3841.15067

Harlina, P.W., Shahzad, R., Ma, M., Wang, N. and Qiu, N. (2019). Effects of galangal extract on lipid oxidation, antioxidant activity and fatty acid profiles of salted duck eggs. *Journal of Food Measurement and Characterization*, 13(3), 1820-1830. https://doi.org/10.1007/s11694-019-00100-z

Harlina, P. W., Ma, M., Shahzad, R., Gouda, M.M. and Qiu, N. (2018). Effect of clove extract on lipid oxidation, antioxidant activity, volatile compounds and fatty acid composition of salted duck eggs. *Journal of Food Science and Technology*, 55(12),

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4719-4734. https://doi.org/10.1007/s13197-018-3367-8

Harlina, P.W., Shahzad, R., Ma, M., Geng, F., Wang, Q., He, L., Ding, S. and Qiu, N. (2015). Effect of garlic oil on lipid oxidation, fatty acid profiles and microstructure of salted duck eggs. *Journal of Food Processing and Preservation*, 39(6), 2897-2911. https://doi.org/10.1111/jfpp.12541

Hou, T., Kolba, N., Glahn, R.P. and Tako, E. (2017). Intra-amniotic administration (*Gallus gallus*) of *Cicer arietinum* and *Lens culinaris* prebiotics extracts and duck egg white peptides affects calcium status and intestinal functionality. *Nutrients*, 9(7), 785. https://doi.org/10.3390/nu9070785

Hou, T., Liu, Y., Kolba, N., Guo, D. and He, H. (2017). Desalted duck egg white peptides promote calcium uptake and modulate bone formation in the retinoic acid-induced bone loss rat and Caco-2 cell model. *Nutrients*, 9(5), 490. https://doi.org/10.3390/nu9050490

Hu, S., Qiu, N., Liu, Y., Zhao, H., Gao, D., Song, R. and Ma, M. (2016). Identification and comparative proteomic study of quail and duck egg white protein using 2-dimensional gel electrophoresis and matrix-assisted laser desorption/ionization time-of-flight tandem mass spectrometry analysis. *Poultry Science*, 95(5), 1137-1144. https://doi.org/10.3382/ps/pew033

Ipek, A. and Sozcu, A. (2017). Comparison of hatching egg characteristics, embryo development, yolk absorption, hatch window, and hatchability of Pekin Duck eggs of different weights. *Poultry Science*, 96 (10), 3593-3599. https://doi.org/10.3382/ps/pex181

Jiang, B., Na, J., Wang, L., Li, D., Liu, C. and Feng, Z. (2019). Reutilization of food waste: One-step extraction, purification and characterization of ovalbumin from salted egg white by aqueous two-phase flotation. *Foods*, 8(8), 286. https://doi.org/10.3390/foods8080286

Langley, D.B., Crossett, B., Schofield, P., Jackson, J., Zeraati, M., Maltby, D., Christie, M., Burnett, D., Brink, R., Goodnow, C. and Christ, D. (2017). Structural basis of antigen recognition: crystal structure of duck egg lysozyme. *Acta Crystallographica Section D: Structural Biology*, D73, 910-920. https://doi.org/10.1107/S2059798317013730

Li, X., Huang, M., Song, J., Shi, X., Chen, X., Yang, F., Pi, J., Zhang, H., Xu, G. and Zheng, J. (2019). Analysis of fishy taint in duck eggs reveals the causative of the fishy odor and factors affecting the perception ability of this odor. *Poultry Science*, 98 (10), 5198-5207. https://doi.org/10.3382/ps/pez260

Li, B., He, H., Shi, W. and Hou, T. (2018). Effect of duck egg white peptide-ferrous chelate on iron bioavailability in vivo and structure characterization. *Journal of Science Food and Agriculture*, 99(4), 1834-1841. https://doi.org/10.1002/jsfa.9377

Li, X., Yuan, G., Chen, X., Guo, Y., Yang, N., Pi, J., Zhang, H. and Zheng, J. (2017). Fishy odor and TMA content levels in duck egg yolks. *Journal of Food Science*, 83(1), 39-45. https://doi.org/10.1111/1750-3841.13977

Owen, M., Jorgensen, F., Willis, C., McLauchlin, J., Elviss, N., Aird, H., Fox, A., Kaye, M., Lane, C. and de Pinna, E. (2016). The occurrence of *Salmonella* spp. in duck eggs on sale at retail or from catering in England. *Letters in Applied Microbiology*, 63(5), 335-339. https://doi.org/10.1111/lam.12660

Özcan, M.M., Al Juhaimi, F., Uslu, N., Ghafoor, K., Babiker, E.E., Ahmed, I.A.M. and Alsawhami, O.N. (2019). Effect of boiling on fatty acid composition and tocopherol content of hen, duck, and quail egg oils. *Journal of Food Processing and Preservation*, 43(7), e13986. https://doi.org/10.1111/jfpp.13986

Panpipat, W. and Chaijan, M. (2020). Physicochemical and techno-functional properties of acid-aided pH-shifted protein isolate from over-salted duck egg (*Anas platyrhucus*) albumen. *International Journal of Food Science and Technology*, 55(6), 2619-2629. https://doi.org/10.1111/ijfs.14515

Quan, T.H. and Benjakul, S. (2019a). Production and characterisation of duck albumen hydrolysate using enzymatic process. *International Journal of Food Science and Technology*, 54(11), 3015-3023. https://doi.org/10.1111/ijfs.14214

Quan, T.H. and Benjakul, S. (2019b). Trypsin inhibitor from duck albumen: Purification and characterization. *Journal of Food Biochemistry*, 43 (5), e12841. https://doi.org/10.1111/jfbc.12841

Quan, T.H. and Benjakul, S. (2019c). Impact of salted duck egg albumen powder on proteolysis and gelling properties of sardine surimi. *Journal of Texture Studies*, 50(5), 434-442. https://doi.org/10.1111/jtxs.12445

Quan, T.H. and Benjakul, S. (2018). Gelling properties of duck albumen powder as affected by desugarization and drying conditions. *Journal of Texture Studies*, 49(5), 520-527. https://doi.org/10.1111/jtxs.12339

Sun, C., Liu, J., Yang, N. and Xu, G. (2019). Egg quality and egg albumen property of domestic chicken, duck, goose, turkey, quail, and pigeon. *Poultry Science*, 98(10), 4516-4521. https://doi.org/10.3382/ps/pez259

 © 2022 The Authors. Published by Rynnye Lyan Resources

Sun, N., Liu, H., Wen, Y., Yan, W., Wu, Y., Gao, J. and Li, C. (2020). Comparative study on Tianjin and Baiyangdian preserved eggs pickled by vacuum technology. *Journal of Food Processing and Preservation*, 40(4), e14405. https://doi.org/10.1111/jfpp.14405

Tan, T.-C., Phatthanawiboon, T. and Easa, A.M. (2016). Quality, textural, and sensory properties of yellow alkaline noodles formulated with salted duck egg white. *Journal of Food Quality*, 39(4), 342-250. https://doi.org/10.1111/jfq.12203

Tang, H., Tan, L., Chen, Y., Zhang, J., Li, H. and Chen, L. (2020). Effect of κ-carrageenan addition on protein structure and gel properties of salted duck egg white. *Journal of Science Food and Agriculture*, 101(4), 1389-1395. https://doi.org/10.1002/jsfa.10751

Thammasena, R. and Liu, D.C. (2020). Antioxidant and antimicrobial activities of different enzymatic hydrolysates from desalted duck egg white. *Asian-Australasian Journal of Animal Science*, 33(9), 1487-1496. https://doi.org/10.5713/ajas.19.0361

Wang, Q., Liu, W., Tian, B., Li, D., Liu, C., Jiang, B. and Feng, Z. (2020). Preparation and characterization of coating based on protein nanofibers and polyphenol and application for salted duck egg yolks. *Foods*, 9(4), 449. https://doi.org/10.3390/foods9040449

Xiao, G., Chen, Y., Fang, R., Xiao, C., Yuan, H., Chu, B., Liu, X. and Gong, J. (2019). Salt-tolerant *Staphylococcus* bacteria induce structural and nutritional alterations of salted duck egg white. *Food Science and Nutrition*, 7(12), 3941-3949. https://doi.org/10.1002/fsn3.1255

Yang, J., Cui, C., Feng, W., Zhao, H., Wang, W. and Dong, K. (2017). Protein hydrolysates of salted duck egg white improve the quality of Jinga Shrimp (*Metapenaeus Affinis*). *International Journal of Food Science and Technology*, 52(7), 1623-1631. https://doi.org/10.1111/ijfs.13435

Yu, H., Qiu, N., Meng, Y. and Keast, R. (2020). A comparative study of the modulation of the gut microbiota in rats by dietary intervention with different sources of egg-white proteins. *Journal of Science Food and Agriculture*, 100(9), 3622-3629. https://doi.org/10.1002/jsfa.10387

Yuan, L., Zhang, J., Wu, J., Gao, Z., Xie, X., Wang, Z. and Wang, X. (2018). The effect on quality of pickled salted duck eggs using the novel method of pulsed pressure osmotic dehydration. *Journal of Food Processing and Preservation*, 42(4), e13581. https://doi.org/10.1111/jfpp.13581

Zhang, Y.N., Wang, S., Huang, X. B., Li, K.C., Chen, W., Ruan, D., Xia, W. G., Wang, S.L., Abouelezz, K.F.M. and Zheng, C.T. (2020). Estimation of dietary manganese requirement for laying duck breeders: effects on productive and reproductive performance, eggs quality, tibial characteristics, and serum biochemical and antioxidant indices. *Poultry Science*, 99(11), 5752-5762. https://doi.org/10.1016/j.psj.2020.06.076

Zhang, Y.N., Wang, S., Li, K. C., Ruan, D., Chen, W., Xia, W.G., Wang, S.L., Abouelezz, K.F.M. and Zheng, C.T. (2020). Estimation of dietary zinc requirement for laying duck breeders: effects on productive and reproductive performance, egg quality, tibial characteristics, plasma biochemical and antioxidant indices, and zinc deposition. *Poultry Science*, 99(1), 454-462. https://doi.org/10.3382/ps/pez530

Zhu, F., Zhang, F., Hincke, M., Yin, Z.-T., Chen, S.-R., Yang, N. and Hou, Z.-C. (2019). iTRAQ-based quatitative proteomic analysis of duck eggshell during biomineralization. *Proteomics*, 19(11), 1900011. https://doi.org/10.1002/pmic.201900011

Zhu, Z.M., Miao, Z.W., Chen, H.P., Xin, Q.W., Li, L., Lin, R.L., Huang, Q.L. and Zheng, N.Z. (2017). Ovarian transcriptomic analysis of Shan Ma ducks at peak and late stages of egg production. *Asian-Australasian Journal of Animal Science*, 30(9), 1215-1224. https://doi.org/10.5713/ajas.16.0470

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# Choux pastry made from fresh eggs: a comparative

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