Research Article

Effect of Iraqi Propolis on Shelf Life of Poultry Meat

Yaman Saad Fadhil

Department of Veterinary Public Health, College of Veterinary Medicine, University of Mosul, Mosul, Iraq.

Abstract | Background and objectives; The goal of the current study is to investigate what impact adding Iraq propolis aqueous extract in several concentrations (0%, 5%, 10%, 15%) on the chicken meat stored for 12 days at 4°C temperature. The microbiological properties (total plate count, *Coliform* count, *Staphylococcus aureus*), and the sensory properties (colour, odour, Brittleness, and general appearance) were investigated. In general, increasing the propolis extract concentration in samples leads to a reduction in the growth rate of the bacterial population, and it continued till the last day of storage at 4°C. The sensory study revealed that odour alterations in samples that contain propolis extract were much better in treated samples compared with the control treatment. This study concludes that propolis water extract has potential application as a food ingredient in poultry meat.

Received | September 25, 2022; **Accepted** | April 09, 2023; **Published** | June 09, 2023
***Correspondence** | Yaman Saad Fadhil, Department of Veterinary Public Health, College of Veterinary Medicine, University of Mosul, Mosul, Iraq; **Email:** ymansaadds@uomosul.edu.iq
Citation | Fadhil, Y.S., 2023. Effect of Iraqi propolis on shelf life of poultry meat. *Pakistan Journal of Agricultural Research,* 36(2): 130-134.
DOI | https://dx.doi.org/10.17582/journal.pjar/2023/36.2.130.134
Keywords | Propolis, Food preservative, Sensory quality, Chicken meat, Bacterial infection

Introduction

Chicken meat is one of the most nutrient-dense diets for harmful microbes. Improper cooking and a lack of hygiene requirements during the slaughtering process, piecing, packing, distribution, and conservation can result in food diseases or poisoning (Mead, 2005). Salmonella, *L. monocytogenes, S. aureus,* and *E. coli* are among the most typical harmful microbes transmitted through poultry meat. To preserve customers health, contaminations from such microorganisms must be eradicated or minimized (Jay *et al*., 2008; Nollet *et al*., 2012). Preserving meat refers to any process that prevents the growth of microorganisms while also slowing fat oxidation. Meat conservation techniques include drying, smoking, seasoning, supervised fermentation, chilling, packing, pasteurization, irradiation, as well as the use of synthetic and organic preservatives (Goswami *et al*., 2019).

Propolis is a one of a kind combination of wax and resin obtained by honeybees from trees, most notably flowers and leaves buds, and combined with saliva and other bee liquids and also waxes. The principal bioactive components in propolis are flavonoids, aromatic acids, and phenolic components like galanin and pinocembrin (Koohsar *et al*., 2018). Worker bees take full advantage of propolis's antibacterial and antifungal properties to preserve the hive from microbes.

Propolis extract possesses antimicrobial, antifungal, antiviral, antioxidant properties (Huang *et al*., 2014). In normal doses, propolis is not hazardous to humans, and it is applicable as a conservative in beverages, livestock meat, agricultural and milk products, along with pharmacological and beauty goods. Its antibacterial and antioxidant characteristics make it an excellent option for artificial preservatives (Khezri *et al*., 2006; Kubiliene *et al*., 2015).

Koohsar *et al*. (2018) have shown that using different concentrations from 3% to 7% v/w water and alcohol extracts of propolis in seafood fillets enhanced lifespan for nine days of chilled storage without compromising sensory characteristics qualities when compared to the control sample. Rijadiputri (2014) applied propolis extract at various concentrations up to 20% in poultry meat and reported that propolis extract at17.5% can inhabit pathogens development, keep the pH in the standard range, preserve the sensory properties of chicken meat consistent, and lengthen the lifespan. This study aims to investigate the possibility of the Iraqi propolis aqueous extract to be used as a natural antimicrobial to preserve food, by testing for the microbial and sensory properties of the socked chicken meat which was stored for 12 days at 4°C temperature. In this study, the possibility of natural antimicrobial compounds, Jordanian propolis.

Materials and Methods

Materials

Chicken meat specimens (20 samples of chicken breast) were collected from the local market of Mosul city (Iraq), transported to the lab under proper hygiene settings, and stored in the refrigerator. The propolis was purchased from Baghdad province, transported to the lab, and stored at -20 °C till the experiment.

Preparations of water propolis extract

The method used in preparing the extract was the soaking technique and produced in accordance with the recommended method by (Krell, 1996). A 5% water extract of Propolis was obtained by combining 200 mL water and 10 g of Propolis, a 10% extract was made by combining 200 mL water and 20 g of Propolis, and a 15% extract was formed via combining 200 mL water and 30 g of Propolis. These extracts were maintained in a glass bottle with the lid sealed for a week and shaken twice a day before being purified and stored in clean containers at 4°C until usage.

Preparing marinated chicken breasts

The chicken meat samples were separated into four sections and placed in four containers. The water extract of Propolis was applied at a concentration of 0, 5, 10, and 15% v/w. After 0, 4, 8, and 12 days of storage, microbiological, and sensory analysis were performed on all of the samples.

Microbiological analysis

Microbiological sampling and testing were taken using AOAC (2019) for the total bacterial count. Payandan *et al*. (2017) for *Staphylococcus aureus* count and Shahbazi *et al*. (2016) for *Escherichia coli* count.

Sensory analysis

Sensory assessments were conducted with eight trained testers. The assessors all presumed the basic odour and colour vision tests. The presented samples weighed 40 g of chicken breast and were served to assessors at room temperature in dishes. The meat's colour, odour, and overall acceptability were all assessed. Before each assessment, each evaluator drank a glass of water and randomly tested the samples. Every factor was graded on a five scale, with 1 being the lowest and 5 being the highest (Qaziyani *et al*., 2019).

Statistical analysis

The data were analyzed using the analysis of variance (ANOVA), and the findings were presented as mean/standard deviation (SD). To detect significant differences among treatments at ($P<0.05$), Duncan multiple range tests was used.

Results and Discussion

The bacterial counts for different food pathogens are shown in Figures 1, 2, 3. For the total bacterial count throughout the storage period at 4°C, the control treatment had the highest count, which ranged from (6.28 to 7.83 log cfu/g). The total bacterial count in all the treatments increased throughout the storage period. In comparison to the control treatment, the rapid growth in the majority of the treated samples was slower. This was noticed with the treated samples with a higher concentration of propolis extract, and it was significant ($p<0.05$). Similar findings have been mentioned by (Jafari *et al*., 2018; Shavisi *et al*., 2017), when the water extract of propolis is applied to chicken fillet, ground beef and fish, leads to increase of the life span. The increasing growth of total count

in treatments that contain propolis extract was not shown at the beginning of the storage period. These results contradicted those of Jafari *et al.* (2018) and Shavisi *et al.* (2017), and the reason for these results might be back to the lower concentration of propolis extract used in this study. In the research (El-Deeb, 2017), a reduction in the count of total bacteria was observed in raw milk with increased dosages of propolis extract.

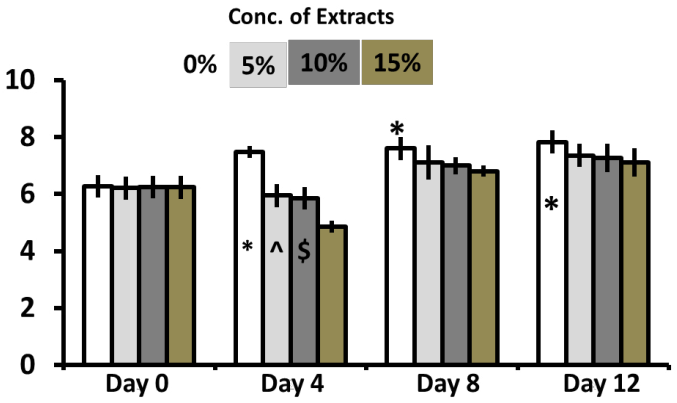

Figure 1: *Total bacterial count (Log CFU/gram) of Chicken samples as affected by water extract of propolis (WEP) addition during storage for 12 days. Data Expressed as mean±SD, *^$p<0.05 statistically significantly different. * as compared to 5%,10%, and 15%. ^ as compared to 10%, and 15%. $ as compared to 15%.*

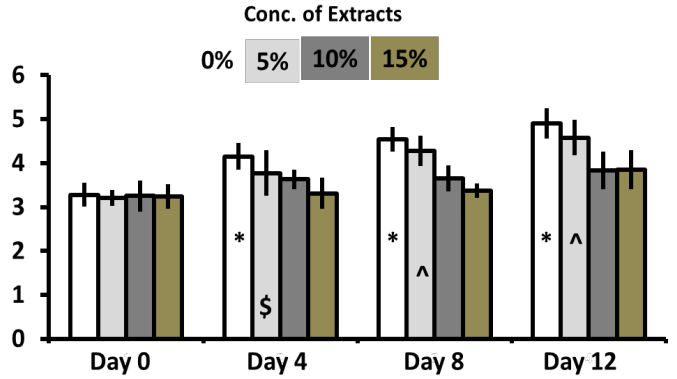

Figure 2: *E. coli count (Log CFU/gram) of Chicken samples as affected by water extract of propolis (WEP) addition during storage for 12 days. Data Expressed as mean±SD, *^$p<0.05 statistically significantly different. * as compared to 5%,10%, and 15%. ^as compared to 10%, and 15%. $ as compared to 15%.*

The increasing growth of *S. aureus* and *E. coli* was in all the treatments, and it was noticed that increasing the extract doses has led to significantly lower growth of the two microbes than the control treatment ($p<0.05$). These findings are similar to what (Payandan *et al.*, 2017) reported in their study on groundfish to stop the *S. aureus* growth. Propolis extract has also been proven to prevent the growth of *S. aureus* in a study (El-Bassiony *et al.*, 2012). Queiroga *et al.* (2018) have also reported a similar effective impact against *S. aureus* more than that in *E. coli*. Our results agree with the results of (Abotorab *et al.*, 2020; Przyblek and Karpinski, 2019).

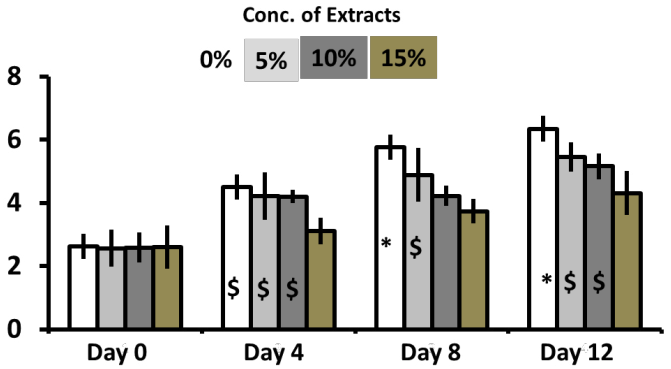

Figure 3: *S. aureus count (Log CFU/gram) of Chicken samples as affected by water extract of propolis (WEP) addition during storage for 12 days. Data Expressed as mean±SD, *$p<0.05 statistically significantly different. * as compared to 5%,10%, and 15%. $ as compared to 15%.*

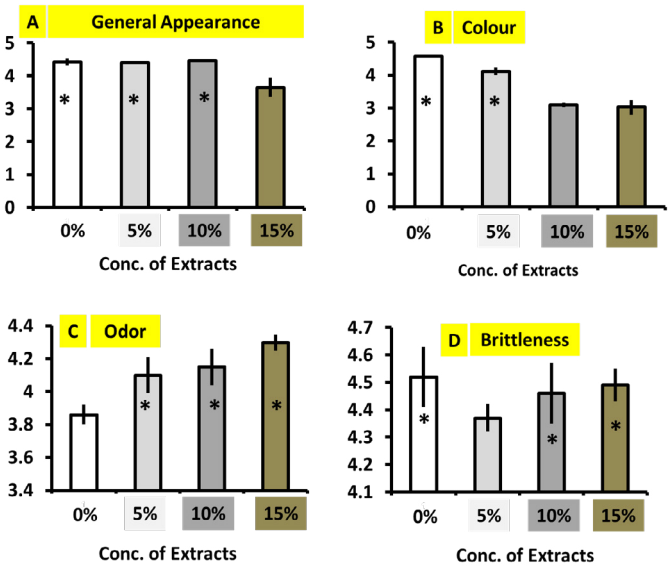

Figure 4: *Improved sensory parameters in presence of propolis extract with reciprocal relation to concentration (0%, 5%, 10%, and 15%). Data Expressed as mean±SD, *<0.05 statistically significantly different. (A) *as compared to 15%. (B) *as compared to 10%, 15%. (C) *as compared to 0%. (D) *as compared to 5%.*

The chemical examination of propolis has identified over 300 compounds (Salatino *et al.*, 2005). Its primary components are phenolics, which include flavonoids, phenolic acids, and esters (Bankova, 2005). These bioactive compounds improve cell membrane permeability, resulting in the breakdown of cells and, as a result, microbe growth inhibition or death. Propolis has been shown to have antimicrobial action *in vitro* against many Gram-positive and Gram-negative pathogens (Przybylek and Karpinski, 2019). This phenomenon can be explained due to the variety of propolis content and interactions between

them, that even can be shown at low concentrations (Bankova *et al.*, 2019).

Sensory evaluation

Natural food additives are commonly used in food items to improve nutritional content, shelf life, texture, flavour, and appearance (Balestra and Petracci, 2019).

The impacts of propolis on the sensory parameters were significant ($p<0.05$) in all scores except for the brittleness scores, as shown in (Figure 4). The effect of propolis extract caused a significant difference in the colour parameters, especially with the addition of 10 and 15% of propolis extract, which caused the lowest score in colour in compression with the control and the other treatment. The findings are similar to what Payandan *et al.* (2017) have reported.

A significant difference ($P>0.05$) was not found in the odour score of chicken meat among samples having different dosages of propolis. However, compared to the control treatment, a significant difference ($P<0.05$) was found, and the lowest score was found in the control treatment at (3.86). The presence of off-odour could be attributed to protein degradation during storage. The addition of propolis extract slowed this behaviour. The acquired findings are comparable to those of (Payandan *et al.*, 2017; Suarez *et al.*, 2014).

For the overall appearance, no significant differences ($P>0.05$) were noticed at the doses of 0, 5 and 10% of propolis extract. The fall in overall acceptance at the 15% concentration could be attributed to the decrease in the color score.

Conclusions and Recommendations

The current study concluded that (a) the addition of water extract of propolis can be consider as a natural antimicrobial against infectious pathogens from contaminating the chicken meat, which lead to extend the span life precisely when meat kept under fridge temperature, (b) in addition, the quality of the chicken meat preserved in terms of organoleptic properties, especially in the addition of 5 % and 10% of the Iraqi propolis extract where the general accepting were same as the control treatment. This study confirms that the addition of water extract of propolis can be consider as a natural antimicrobial against infectious microbes from contaminating the chicken meat, and leads to extend the span life of the chicken meat precisely when meat kept under fridge temperature. The use of propolis could be suggested as a preservative replacing the chemical preservative (methylparaben, propylparaben, Sodium benzoate, and benzoic acids) which are in current use.

Acknowledgement

The Department of Veterinary public health at the College of Veterinary Medicine/ University of Mosul is warmly acknowledged for providing necessary research facilities.

Novelty Statement

Iraqi propolis aqueous extract contains natural antimicrobial components which have positive effect on Food quality and its shelf life, to which the present study is a minor addition.

Conflict of interest

The authors have declared no conflict of interest.

References

AOAC, 2019. Official methods of analysis of AOAC International. Association of Official Analytical Chemists, Washington, DC.

Aboutorab, M., Goli, M., and Khosravi, E. 2020. Antimicrobial activity of aqueous, alcoholic and buffer extracts of honey-bee propolis on oral-intestinal bacteria. Journal of food microbiology, 7(1): 85-93.

Balestra, F., and Petracci, M., 2019. Techno functional ingredients for meat products: Current challenges. In sustainable meat production and processing. Academic press. pp. 45-68. https://doi.org/10.1016/B978-0-12-814874-7.00003-1

Bankova, V., 2005. Recent trends and important developments in propolis research. Evid. Based Complement. Altern. Med., 2(1): 29-32. https://doi.org/10.1093/ecam/neh059

Bankova, V., Bertelli, D., Borba, R., Conti, B. J., da Silva Cunha, I. B., Danert, C., and Zampini, C. 2019. Standard methods for Apis mellifera propolis research. J. Agic. Res., 58(2): 1-49.

El-Bassiony, T.A., Saad, N.M., and El-Zamkan, M.A., 2012. Study on the antimicrobial activity of ethanol extract of propolis against enterotoxigenic methicillin-resistant

staphylococcus aureus in lab prepared ice-cream. Vet. World, 5(3). https://doi.org/10.5455/vetworld.2012.155-159

El-Deeb, A.M., 2017. Utilization of propolis extract as a natural preservative in raw milk. J. Food Dairy Sci., 8(8): 315-321. https://doi.org/10.21608/jfds.2017.38890

Goswami, M., Pathak, V., Bharti, S.K., Chappalwar, A.M., Ojha, S., Singh, S., and Singh, S., 2019. Effect of low-temperature preservation on quality characteristics of meat. J. Anim. Feed Sci. Technol., 7(1): 41-46.

Huang, S., Zhang, C.P., Wang, K., Li, G.Q., and Hu, F.L., 2014. Recent advances in the chemical composition of propolis. Molecules, 19(12): 19610-19632. https://doi.org/10.3390/molecules191219610

Jafari, J.N., Kargozari, M., Ranjbar, R., Rostami, H., and Hamedi, H., 2018. The effect of chitosan coating incorporated with ethanolic extract of propolis on the quality of refrigerated chicken fillet. J. Food Proc. Preserv., 42(1): e13336. https://doi.org/10.1111/jfpp.13336

Jay, J.M., Loessner, M.J., and Golden, D.A., 2008. Modern food microbiology. Springer Science and Business Media.

Khezri, M., Rostami, S., Riseh, R., and Alizadeh, A., 2006. Effect of propolis and clotrimazole on controlling aflatoxin in pistachio (*Pistacia vera* L.). Int. J. Agric. Biol., 8: 605-608.

Koohsar, S.A.A., Sayyed-Alangi, S.Z., Shamloofar, M., and Sharifian, S., 2018. Effect of different extracts of Iranian propolis on shelf-life of silver carp (*Hypophthalmichthys molitrix*) fillet in the refrigerator. Iran. J. Food Sci. Technol., 15(3): 51-65.

Krell, R., 1996. Value-added products from beekeeping (No. 124). Food and Agriculture Org.

Kubiliene, L., Laugaliene, V., Pavilonis, A., Maruska, A., Majiene, D., Barcauskaite, K., and Savickas, A., 2015. Alternative preparation of propolis extracts: comparison of their composition and biological activities. BMC Complement. Altern. Med., 15(1): 1-7. https://doi.org/10.1186/s12906-015-0677-5

Mead, G.C., 2005. Food safety control in the poultry industry. CRC Press. https://doi.org/10.1533/9781845690236

Nollet, L.M., Boylston, T., Chen, F., Coggins, P., Hydlig, G., and McKee, L., 2012. Handbook of meat, poultry and seafood quality. John Wiley and Sons. https://doi.org/10.1002/9781118352434

Payandan, E., Sayyed-Alangi, S.Z., Shamloofar, M., and Koohsari, H., 2017. Study of chemical composition and efficacy of different extracts of Iranian propolis on the microbiological and sensory parameters of minced Cyprinus carpio meat at 4 C storage. J. Aquat. Food Prod. Technol., 26(5): 593-603. https://doi.org/10.1080/10498850.2016.1240281

Przybyłek, I., and Karpiński, T.M. 2019. Antibacterial properties of propolis. Molecules, 24(11), 2047.

Qaziyani, S.D., Pourfarzad, A., Gheibi, S., and Nasiraie, L.R., 2019. Effect of encapsulation and wall material on the probiotic survival and physicochemical properties of synbiotic chewing gum: Study with univariate and multivariate analyses. Heliyon, 5(7): e02144. https://doi.org/10.1016/j.heliyon.2019.e02144

Queiroga, C., Andrade, N., and Laranjo, M., 2018. Antimicrobial action of propolis extracts against staphylococci.

Rijadiputri, S.S., 2014. Study of propolis extract *Trigona* sp. as a chicken meat preservative at room temperature storage. Doctoral, University of Padjadjaran.

Salatino, A., Teixeira, É. W., and Negri, G., 2005. Origin and chemical variation of Brazilian propolis. Evid. Based Complement. Altern. Med., 2(1): 33-38. https://doi.org/10.1093/ecam/neh060

Shahbazi, Y., Shavisi, N., and Mohebi, E., 2016. Potential application of Ziziphora clinopodioides essential oil and nisin as natural preservatives against *Bacillus cereus* and *Escherichia coli* O157: H7 in commercial barley soup. J. Food Saf., 36(4): 435-441. https://doi.org/10.1111/jfs.12257

Shavisi, N., Khanjari, A., Basti, A.A., Misaghi, A., and Shahbazi, Y., 2017. Effect of PLA films containing propolis ethanolic extract, cellulose nanoparticle and *Ziziphora clinopodioides* essential oil on chemical, microbial and sensory properties of minced beef. *Meat Sci.*, 124: 95-104. https://doi.org/10.1016/j.meatsci.2016.10.015

Suarez, M.H., Jiménez, T.Á., and Díaz, M.C., 2014. Determination of microbiological and sensoryparameters of fish fillets with propolis preserved under refrigeration. Rev. MVZ Córdoba, 19(3): 4214-4225. https://doi.org/10.21897/rmvz.84