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Article

Effect of adding different cinnamon oil concentrations on the chemical, physical, and microbial properties of local goose liver meat during different storage periods

Adnan Shakor Ahmed Al-Perkhdri[1*], Sami Ibrahim Abdullah[2], Ahmed Sami Shaker [3]
[1]Public health, College of Veterinary, University of Kirkuk, Kirkuk, Iraq.
[2]Anatomy and histology, College of Veterinary, University of Kirkuk, Iraq.
[3]Animal production department, directorate of agricultural research, Al-Sulaymaniyah, KGR, Iraq.
* Correspondence: dradnan@uokirkuk.edu.iq
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Abstract: Cinnamon oil is a plant extract used to exert antimicrobial actions against essential pathogens. 96 samples of goose liver were used and divided for four treatments (control, T1=0.025, T2=0.050, T3=0.075) for three different storage times (1, 15, 20 days). After the storage periods, finished samples were analyzed, including chemical traits (carbohydrate, protein, ash, and moisture) and physical traits (pH, water holding capacity, loss during cooking, and loss during throwing). Also, a microbial trait was measured (cold bacteria and total bacteria). Significant differences were found just in (pH, loss during throwing, cold bacteria, and total bacteria (0.000, 0.046, 0.000, and 0.000), respectively, in the three different storage periods. There were statistically significant differences between the different levels of cinnamon oil and the storage periods, which affected the microbial number. Further studies are needed to test other goose meat parts with different cinnamon levels.

Keywords: Liver, meat, storage, chemical, physical, microbiological

Introduction

Several techniques have been developed to keep and obtain healthy meat products [1], which contain various nutrient compositions [2]. Thus, plant extracts were used as one of the healthy and safe methods, which effect the physical changes concerning the modifications in the structure of the tissues such as (volume, appetence, and texture), chemical changes [3] like (molecular interaction and lipid oxidation), and microbial [4, 5] properties. Cinnamon oil, an herbal extract, was used to exert antimicrobial action against important pathogens by researchers [6, 7, 8]; also, it was used in meat and fast food products for culinary purposes and is a powerful antioxidant agent in seasoned meat and fish products [9].

Also, cinnamon in the diet of broiler chicken at various levels has a positive impact on performance in terms of body weight gain, feed intake and FCE [10]. Moreover, cinnamon can be used as a potential alternative to antibiotics for more safety in poultry industries' health, environmental and economic aspects [11]. The study aims to evaluate the addition of different cinnamon oil concentrations to local goose liver meat's chemical, physical, and microbial properties during different storage periods.

Materials and methods

The current study was done through 10 – 11/ 2021 in the Department of Animal Production, College of Agriculture, Kirkuk University. Then, each treatment was divided into three Meals and wrapped in polyethylene bags. Goose liver meat was taken from a local slaughtered goose, placed in insulated polystyrene iceboxes and transferred to the laboratory within 1 h. After that, the livers were placed in the refrigerator for 72 hours to be treated with cinnamon oil. The liver samples were assigned to the following treatments: control (without any additive), 0.025, 0.050, and 0.075 cinnamon oil applied to the 100 g goose liver. After that, the samples were collected at 1, 15, and 30 days of storage at a temperature of – -18 C.

The percentage of moisture in the liver, as a weight loss of samples before and after drying, was estimated based on the drying method using a known weight of about 5 g of liver samples, which were placed in a pallet of a known weight in advance and dried in an electric oven at 105 ° C for some time. 24 hours later, the eyelids were taken out and weighed, and the moisture percentage was calculated by subtracting the dry matter percentage from [12].

The percentage of dry matter was estimated according to what was stated in the American [12], where 5 g of the sample was placed in a ceramic jar of a pre-known weight. The jar was placed with the model in an electric oven at 105 ° C for 24 hours, after which the lids were taken out and weighed, and the ratio was calculated as a percentage of dry matter. After knowing the weight of the dry matter in the above, the ceramic pots containing the dry model were placed at a temperature of 550° C for six hours, and after being cooled, they were weighed, and the percentage of ash was calculated [at 12]. The protein content of minced veal samples was estimated by the Semi-micro kjeldal method [12]. The extraction was carried out according to what was stated in [12] and using a fat extracting device (Soxhlet); the pH was measured in liver samples for experimental treatments based on the method mentioned by [13] by homogenizing 10 g of minced meat sample with 100 ml of distilled water using a homogenizer. After that, the pH was measured after calibrating an instrument at (pH 7.4). The loss during the thawing of meat was estimated according to method [14], where 50 gm of frozen meat samples were taken from each treatment after accurate weight recording and placed in a transparent nylon bag. The bags were placed inside the refrigerator at 4 C for 24 hours. Weigh the samples after drying them and removing liquids from the surface of the meat samples using filter papers.

The loss during cooking was estimated by taking 50 g of meat after accurately recording the weight and placing it in a cooking bag (transparent nylon), closing it tightly, and then placing the bag in the electric oven at 180 ° C 0 for 30 minutes Then the bags were left with the meat inside to cool, then the samples were weighed after removing the liquid on the surface of the model with filter paper. The water carrying capacity of WHC was estimated according to the method of [15] by taking 50 g of meat for each treatment, mixing and mashing it with 50 ml of distilled water for one minute using an electric mixer, then discarding the homogenized mixture in a centrifuge at speed (5000 x g for 10 minutes).

The tests were carried out on three replicates, and the model was placed in sterile nylon bags containing 100 ml of sterile peptone dilution liquid. After good shaking, decadal dilutions were performed in sterile conditions, as the culture media used in bacteriological tests were sterilized at 121 ° C for 15 minutes and under a pressure of 15 pounds/ing square. The glassware was sterilized in an electric oven at 180° C for three hours.

Total bacteria were counted using the Pour-plate method mentioned before [16] by transferring (1 ml) of each decimal dilution using a sterile pipette into two

sterilized, empty Petri dishes (Duplicate) and directly added to each dish. (15 ml) of sterile Nutrient Agar kept in a water bath at (46° C), then mix the culture medium with a dilution of the bacterial suspension well by rotating the plates to the right and the left, stirring each time. After the solidification of the culture medium, the plates were kept and inverted in the incubator at a temperature of (37° C) for 24 hours, after which the developing colonies were counted in the dishes containing (30-300) colonies.

Cryophilic bacteria were counted using Nutrient agar, and the steps mentioned in the paragraph estimating the total number of bacteria were followed, except for incubating dishes at a temperature of 5 ° C for 10 days. Then, the number of colonies in each dish was calculated per milliliter.

The number of units/gm = the average number of colonies in the replicates X the reciprocal of the dilution forming colonies (µM), noting that the number of bacteria was counted from the dishes in which the number of colonies ranged from 30-300 colonies.

A general linear model (GLM) was used to express the significance of differences ($p<0.05$) between means. Statistical analysis of data was performed using the IBM Statistical Package for Social Sciences (SPSS) Statistics 18 software (SPSS Inc., Chicago, IL, USA). Duncan multiple range test was applied to determine the significant difference ($p<0.05$).

Result

The descriptive analysis concerning mean and standard error for the physical traits of the goose liver, which is stored in different periods, is in Table 1. The carbohydrate, Ash, Fat, protein, and Humidity for the five treatments in three periods were not significant (0.878, 0.974, 0.861, 0.999, 0.905), respectively, in levels of ($P<0.05$).

Treatment	Period	Carbohydrate	Ash	Fat	Protein	Humidity
T1	1 day	1.33 ± 0.97 a	1.40 ± 1.00 a	6.14 ± 0.88 a	23.24 ± 1.00 a	67.87 ± 1.05 a
	20 days	1.40 ± 0.40 a	1.47 ± 0.45 a	5.91 ± 0.53 a	23.22 ± 016 a	67.58 ± 0.02 a
	40 days	1.47 ± 0.10 a	1.58 ± 0.11 a	6.30 ± 0.50 a	23.38 ± 1.01 a	67.27 ± 0.11 a
T2	1 day	1.28 ± 0.16 a	1.43 ± 0.06 a	6.26 ± 0.16 a	23.26 ± 0.15 a	67.74 ± 0.49 a
	20 days	1.35 ± 0.12 a	1.47 ± 0.22 a	6.27 ± 0.06 a	23.28 ± 0.27 a	67.65 ± 0.21 a
	40 days	1.31 ± 0.14 a	1.73 ± 0.28 a	6.33 ± 0.07 a	23.17 ± 0.23 a	67.35 ± 0.14 a
T3	1 day	1.68 ± 0.57 a	1.59 ± 1.23 a	6.25 ± 1.15 a	23.40 ± 1.28 a	67.73 ± 1.07 a
	20 days	1.38 ± 0.10 a	1.58 ± 0.75 a	6.31 ± 0.10 a	23.26 ± 0.15 a	67.66 ± 0.09 a
	40 days	1.47 ± 0.08 a	1.52 ± 0.02 a	6.23 ± 0.14 a	23.34 ± 0.07 a	67.33 ± 0.21 a
T4	1 day	1.32 ± 0.06 a	1.44 ± 0.10 a	6.21 ± 0.11 a	23.27 ± 0.27 a	67.87 ± 0.65 a
	20 days	1.35 ± 0.11 a	1.50 ± 0.03 a	6.29 ± 0.03 a	23.30 ± 0.15 a	67.63 ± 0.03 a
	40 days	1.39 ± 0.03 a	1.48 ± 0.02 a	6.25 ± 0.78 a	23.28 ± 0.05 a	67.69 ± 0.17 a
P value		0.226	0.073	0.250	0.010	0.186
Sig.		0.878	0.974	0.861	0.999	0.905
Means with different superscripts in each column differ significantly ($P < 0.05$).						

Table 1. The mean and standard error for the chemical traits of the goose liver, which is treated with three levels of cinnamon oil and storage in different periods.

The mean and standard error for the chemical trait of the goose liver treated with cinnamon oil in three storage periods are shown in Table 2. A significant difference ($P<0.05$) was found in pH, with Treatment 1, 2, and 3 for all the

storage periods and treatment 4 in storage period 1 was the highest. Treatment 4 in storage periods 2 and three had the lower pH (6.04, 6.32), respectively.

Treatment	Period	pH	Water holding capacity	Loss during coking	Loss during throwing
T1	1 day	7.08 ± 0.10 a	55.59 ± 0.54 a	20.44 ± 1.27 a	5.37 ± 0.65 ab
	20 days	7.23 ± 0.23 a	55.11 ± 1.01 a	21.37 ± 1.12 a	5.87 ± 1.01 ab
	40 days	7.29 ± 0.03 a	54.68 ± 0.40 b	21.48 ± 0.20 a	6.13 ± 0.13 a
T2	1 day	7.09 ± 0.18 a	55.97 ± 0.05 a	20.47 ± 0.76 a	5.00 ± 0.03 b
	20 days	7.03 ± 0.02 a	55.64 ± 0.25 a	20.79 ± 0.96 a	5.28 ± 1.10 ab
	40 days	7.10 ± 0.01 a	55.91 ± 0.70 a	21.44 ± 0.74 a	5.93 ± 0.67 ab
T3	1 day	7.01 ± 0.02 a	56.20 ± 0.52 a	20.27 ± 1.12 a	4.99 ± 0.04 b
	20 days	7.02 ± 0.03 a	55.74 ± 0.90 a	20.57 ± 0.62 a	5.19 ± 0.01 ab
	40 days	7.04 ± 0.02 a	55.63 ± 0.04 a	20.88 ± 0.21 a	5.32 ± 0.01 ab
T4	1 day	7.01 ± 0.04 a	55.88 ± 1.00 a	20.30 ± 0.01 a	5.01 ± 0.03 b
	20 days	6.04 ± 0.04 b	55.65 ± 0.11 a	20.62 ± 0.08 a	5.25 ± 0.11 ab
	40 days	6.32 ± 0.60 b	55.56 ± 0.21 a	20.80 ± 0.95 a	5.28 ± 0.10 ab
P value		12.718	1.890	0.902	2.975
Sig.		0.000	0.151	0.451	0.046
Means with different superscripts in each column differ significantly ($P < 0.05$).					

Table 2. The mean and standard error for the physical trait of the goose liver treated with three levels of cinnamon oil and storage in different periods.

The loss during throwing was significant between the four treatments (P<0.046). It was high in the control treatment, stored for 40 days (6.13). The lowest was in Treatment two for one-day storage, treatment one-day storage, and the fourth treatment for one-day storage (5.00, 4.99, 5.01), respectively. Moreover, intermediate in 20 and 40 days for treatments 2, 3, and 4, except the control (T1), had a 1 and 20-day storage period.

The mean and standard error for the microbial trait of the goose liver treated with cinnamon oil in three storage periods are shown in Table 3. It was significant differences between the treatments (p<0.05); the highest cold bacteria number was in treatment 1 in the 40-day storage period (18900). Moreover, the less cold bacteria were in treatment 4 for 40 days storage period (960).

Treatment	Period	Cool bacteria	Total bacteria
T1	1 day	5500.00 ± 100.00 c	77000.00 ± 1000.00 bc
	20 days	13800.00 ± 100.00 b	110333.33 ± 82567.14 b
	40 days	18900.00 ± 100.00 a	186000.00 ± 1000.00 a
T2	1 day	6090.00 ± 4521.76 c	36700.00 ± 47891.23 cd
	20 days	1446.67 ± 15.28 d	14400.00 ± 100.00 d
	40 days	1525.00 ± 7.07 d	16050.00 ± 70.71 d
T3	1 day	3270.00 ± 4269.51 cd	10200.00 ± 100.00 d
	20 days	1300.00 ± 100.00 d	14700.00 ± 100.00 d
	40 days	1370.00 ± 14.14 d	14500.00 ± 707.11 d
T4	1 day	960.00 ± 10.00 d	6960.00 ± 5179.07 d
	20 days	1370.00 ± 10.00 d	12600.00 ± 100.00 d

	40 days	1440.00 ± 10.00 d	12900.00 ± 100.00 d
P value		20.671	21.785
Sig.		0.000	0.000
Means with different superscripts in each column differ significantly (*P* < 0.05).			

Table 3. The mean and standard error for the microbial trait of the goose liver treated with three levels of cinnamon oil and storage in different periods.

Discussion

[17] reported that the different levels of cinnamon oil did not affect the pH level. Also, [18] did not have significant differences in his experiment when using three different Cinnamon oil levels.

The water holding capacity and loss during cooking traits were not significant in all four treatments and their storage periods (0.151, 0.451), respectively, at a significant level (P<0.05). The result differed from what [17] found, in which he reported significant differences using different cinnamon levels. However, [18] recorded non-significant differences in his study. Loss during cooking also was non-significant (0.451), near the result of [19].

Conclusion

There were statistically significant differences between the different levels of cinnamon oil and the storage periods, which affected the microbial number. Further studies are needed to test other goose meat parts with different cinnamon levels.

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