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EFFECT OF TREATMENT WITH RHIZOME EXTRACTS OF *ALPINIA OFFICINARUM* ON SOME QUALITY CHARACTERISTICS AND ACCEPTABILITY OF FRESH CHICKEN MEAT DURING THE COLD STORAGE PERIOD

Ali Ameen Yaseen*, A. A. AL-Azzami and Munaf A. Qasim

Department of Food Sciences, College of Agriculture, University of Anbar, Iraq.
*e-mail : ag.ali.ameen@uoanbar.edu.iq

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ABSTRACT : We investigated the effect of two different solvent extractions (ethanol and petroleum ether) for rhizome of (*Alpinia officinarum*) on the quality and shelf life of broiler meat during the cold storage period (10 days at 4°C). The addition of rhizome extracts of (*Alpinia officinarum*) to the broiler meat caused a significant decrease (p<0.01) in the number of total bacteria, psychrophilic bacteria and coliform. The results indicated the superiority of treatment T_3 (100 mg of Alcoholic extract/kg broiler) over all other treatments in reducing the total number of bacteria, and psychrophilic bacteria and coliform. The average of total count reached (20×10^6 c.f.u\g) while the number of cold-loving bacteria reached (74×10^3 c.f.u.\g) and coliform (56×10^2 c.f.u.\g) after ten days of refrigerated storage. While, treatment T_6 (100 mg of Petroleum ether\kg broiler) was superior to the treatments containing petroleum ether extract of *Alpinia officinarum*, the numbers of total count reached (56×10^6 c.f.u.\g), while the numbers of psychrophilic bacteria reached (80×13^3c.f.u.\g) and coliform (75×10^2c.f.u.\g). In comparison with the control treatment, which had total count (121×10^7c.f.u.\g), psychrophilic bacteria (124×10^3c.f.u.\g) and coliform (42×10^3c.f.u.\g). However, the results did not record any significant effect (p>0.01) of the extracts on the molds and yeasts during the storage period. In addition, the *Alpinia officinarum* extracts Improved significantly (p.<0.01) the Sensory properties and general receptivity of broiler palatability (flavor, juiciness, tenderness and general receptivity) to which the extracts were added.

Key words : *Alpinia officinarum*, antimicrobial activity, chicken meat.

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INTRODUCTION

The (*Alpina galangal*) or Alpinia is belonging to family Zingiberaceae. Alpinia is considered a long-lived plant, and it comes out in the form of a shrub that reaches about two meters in length and has large leaves, white and red flowers, which produce a very beautiful aromatic scent (Nag *et al*, 2018). Alpinia has several types, such as the small galangal or what was known as white-eye Alpinia, and the large or red Alpinia. there are other types of Alpinia are used only for decoration because of the beauty of their flowers and the sustainability of their greenness, and some of these types are made of writing paper and some of the stems are eaten or cooked, in addition to many uses In the field of medicine (Lakhan *et al*, 2015). Alpinia was classified as native herbaceous ground of the rainforest, which grows naturally in wet and shaded lowlands or on the hillside slopes (Habash *et al*, 2000), it is very similar to ginger, and it has health benefits and high nutritional values, Galangal herb is available in three types: Medicinal galangal *Alpinia officinarum*, great galangal *Alpinia galanga* and galangal which is called *Alpinia zerumbet*, whose reddish-brown roots are used as a spice as it is characterized by its aromatic smell and pungent taste (Ravindran and Divakaran, 2012). Alpinia can be eaten fresh or cooked like other plants such as ginger or turmeric and it is commonly added to many Chinese, Indonesian, Malaysian, and Thai dishes (Subramanian and Nishan, 2015) as well as Africa, Jamaica, Mexico and Hawaii (10). Many studies indicated that Alpinia have an antimicrobial activity against many microorganisms, especially Gram-positive bacteria (Chen *et al*, 2008; Curiel Lopez *et al*, 2017). The

antimicrobial activity depends on the used part of the plant; its rhizomes have wide applications in traditional medicine (Umer *et al*, 2011). While, the essential oil has demonstrated an ability against Gram-positive bacteria, yeasts and dermatophytes (Zhang *et al*, 2010). Food is a very important basic requirement of man and therefor preserving them is of utmost necessary and is one of the oldest technology. Food borne diseases from eating of spoilage food has been concern for consumers about the use of various preservative (Shan *et al*, 2007). Food quality control researchers are concerned about increase the incidence of food poisoning and spoilage caused by gastrointestinal pathogens (Meng *et al*, 1998). The development of resistant of pathogens against antibiotics can amplify food poisoning is also another problem (Stermitz *et al*, 2000). The need for food with extended shelf life and with minimum chemical preservatives and decrease, the risk causing by food borne infections lead to find naturally preservatives. Herbs have been use in food for a long time, not only as folk medicine but also as spices and food preservatives by their antimicrobial action against some pathogens (Tepe *et al*, 2004). Medical plants and spices do not show toxicity at levels consumed, so we can consider as GRAS (Generally Recognized as Safe) substance (Souza *et al*, 2005). Artificial preservatives mostly used in food processing, and there are another preservatives have been found in many plants especially herbs and spices users understanding regarding the benefits of the naturals additives has created interest for the researchers in their improve and use in processed foods. The probability of health risk by eating foods content artificial preservatives has made significant changes in the action of people towards such foods. Therefore, safe and effective natural additives are consistently in demand. Natural antimicrobial structures are present in plant root, stem, leave, fruit and flower. Some scientists considered that the plants are a poor source of antimicrobial agents because the chemical structure and the mechanisms of action are unknown (Nychas, 1995). More than 1300 plants could be a possible source of antimicrobial substances (Gould, 1996). Herbs and spices are the noted sources of the antimicrobial and antioxidant agents (Sharma and Hashinaga, 2004). A topical preservative have to kill or suppress the growth of various microorganisms in the food and should not affect the taste, odor and color to the food product. In this study, a possibility was explore to investigate the antimicrobial and antioxidant activity of the Alpinia rhizomes extract to use as natural preservative against bacteria, Yeasts and molds during the refrigerator store of meat.

MATERIALS AND METHODS

Preparation the samples

This study was conducted at the College of Agriculture, Anbar University in 2018, cutting, physical separation and skin removal were performed for the main pieces of slaughtered chickens. The cutting was done into small cubes and mechanically chopped using a meat grinder with a diameter of 8 mm holes and had been divide into 1 kg per group. Two types of extracts were added to the studied samples in quantities of 50, 75 and 100 mg/kg, then the mixture was mixed well by hand and using sterile medical gloves for the purpose of homogeneity in the distribution of the extracts, then the meat was minced again. Samples were distributed in transparent plastic boxes and kept in the refrigerator at 4°C for 10 days. Samples were withdrawn for examination at 0, 4, 7 and 10 days for examination and sensory evaluation. Ethanol extract and petroleum ether were added to the samples at 50 mg / kg (T_1) (T_4), 75 mg / kg (T_2) (T_5) and 100 m /kg (T_3) (T_6), respectively and the control treatment was left without additives (T_7).

Preparation the rhizomes

Dry rhizomes of Alpinia (*Alpina galangal*) had been bought from the locally markets of Anbar city on May 2018. The rhizomes were washed under water stream to remove the dust and dirt. The rhizomes were sliced thinly then it crushed by handle coffee grinder (Kita and Pippen, 2006).

Extraction

For methanol extraction each 100 gram of rhizomes powder were mixed with 200 ml of methanol in a rotary shaker for 12 h. Then the mixture was filtrated through watman No.1. Then the supernatant was concentrated under vacuum at 35°C by rotary evaporator until dried. The yield of methanolic extract was estimated as milligram of extract per gram of Alpinia calculated as follows (Chen *et al*, 2008). For petroleum ether extraction 100 gram of Alpinia dry powder mixed with the 100 ml of petroleum ether foe 3 days. Then the extracted was concentrated in vacuum evaporator at 40°c to dryness (Sarman and Hashinga, 2004).

Antimicrobial activity

The number of total count, coliform, psychrophilic bacteria, molds and yeasts have ben determent according to Pour-Plate Method procedure described by A.O.A.C (A.O.A.C, 2005), both total count and psychrophilic bacteria had been estimated by cultured on Nutrient Agar with incubation time 24h at 37°C and 7days at 7°C, respectively. The number of coliform had been estimated

by cultured on MacConkey Agar and incubation time 24 h at 37°C (A.P.H.A., 1992). Molds and yeasts had been estimated by cultured on Potato Dextrose Agar with 5 days incubation period at 22°C (Yingying *et al*, 2008).

Sensory evaluation

After the Storage cooling period Chicken meat were served to an experienced panel to determine their sensory characteristics. The sensory attributes as appearance and color, flavor, juiciness, texture and overall acceptability were evaluated on 10 point descriptive scale as suggested by Keeton (1983). The sensory score of 10 was extremely desirable, where as one was extremely undesirable.

Statistical analysis

The data were analyzed using completely randomized design and the differences between the averages of the different treatments were compared using the Duncan test using the ready-made statistical program (SAS) (SAS, 2001).

RESULTS AND DISCUSSION

The amount of alcoholic extract (Ethanol) and petroleum added to the meat samples was determined as mg of powder after extraction by oven with vacuum. The results in Fig. 1 showed a significant decrease ($p<0.01$) in the total numbers of bacteria in the meat that was treated with ethanol extract for Alpinia rhizomes compared with the numbers of bacteria in meat treated with petroleum ether extract for Alpinia rhizomes and the control treatment. The results also showed a significant superiority of the treatment of 100 mg/kg (T_3) compared with treatments T_1 and T_2, where the total number of bacteria was 17×10^6 c.f.u\g in treatment T_3 compared with 79×10^6 c.f.u.\g and 35×10^6 c.f.u.\g in T_1 and T_2, respectively. The results indicated to the superiority of treatment T_2 compared with treatment T6 in which the total number of bacteria was 50×10^6c.f.u.\g. These results are consistent with what was indicated by (Sunilson *et al*, 2009) that Alpinia rhizomes contain many phenolic substances and essential oil that acts as antmicroorganisms and antioxidants.

Psychrophilic bacteria is one of the causes of meat spoilage during refrigerated and frozen storage because it prefer to grow at lower temperatures (Margesin, 2009).

Fig. 2 shows a significant decrease ($p<0.01$) in the number of psychrophilic bacteria in the meat samples with Alpinia rhizomes extracts added during the cold storage periods. The figure also indicates that the ethanol extract gave a significant superiority over the petroleum ether extract compared to the control treatment. The table also indicated that the antimicrobial activity of both extractions increased with the increase in their concentrations significantly ($p<0.01$). It can be seen that treatment T_3 was superior in inhibiting the growth of psychrophilic bacteria compared with other treatments. The antimicrobial activity may be due to the essential oil of galangal because it is one of compounds that herbs contain such as flavonoids, phenols and glycosides (Ahnm *et al*, 2007), because the decomposition of glycosides in plant tissues by the action of Myroisinase gives many products containing Sulpha in their composition, which have antimicrobiological activity (Abd El-hamied *et al*, 2009).

Fig. 3 noticed that there was a significant decrease ($p<0.01$) in the numbers of coliform bacteria growing on the meat samples treated with methanol and petroleum ether extracts of Alpinia rhizomes compared with the control model. This inhibition increased with increasing the concentration of the added extract. Same table showed that treatment T_3 is superior to the rest of the other treatments in its inhibitory capacity, and that the ethanol extracts were the most effective in inhibiting bacteria compared with the petroleum ether extracts. The same table indicates a significant increase ($p<0.01$) in the number of coliform bacteria after the end of the cold storage period (10 day) and this due the high quality of the nutrients in the meat such as proteins and energy sources in addition to the minerals that greatly support the growth of bacteria. These results are agree with what was indicated by Sunilson *et al* (2009) that the alcoholic extract of Alpinia rhizomes has a inhibitory effect against coliform bacteria as well as other types of bacteria gram positive and negative. The reason for the antmicroorganisms of Alpinia against wide spectrum of bacteria is because it contains many essential oils, resins, galangol, kaempferid, galangin, alpinin, in addition to significant amounts of β-farnesene, myrcene, 1,8 cineole, β-bisabolene, β-caryophyllene and β-selinene, which may be responsible for its antibacterial ant antifungal activity.

Generally, most of the extracted evaluated were almost completely inactive against molds and yeasts. Fig. 4 indicated that there was no effect of Alpinia rhizomes extracts on the growth of molds and yeasts in refrigerated meat samples. No significant differences ($p>0.01$) were observed between the control treatment and the meat samples to which the extracts were added, whether ethanol or petroleum ether. These results consistent with what was mentioned by Habash *et al* (2000) that zingiberaceae extracts do not have the inhibitory effect against molds and yeasts.

The addition of extracts of Alpinia rhizomes preserved the organoleptic properties of the meat samples after 10

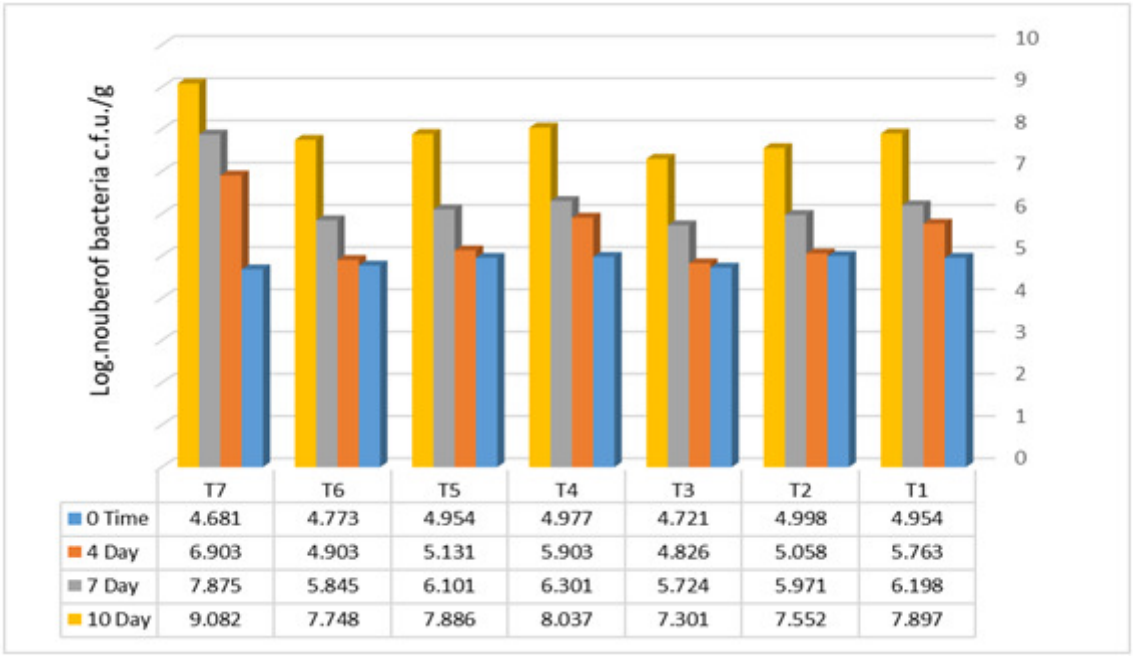


Fig. 1 : Effect of extraction solution and the addition of different percentages of the extract of Alpinia rhizomes on the total number of bacteria.

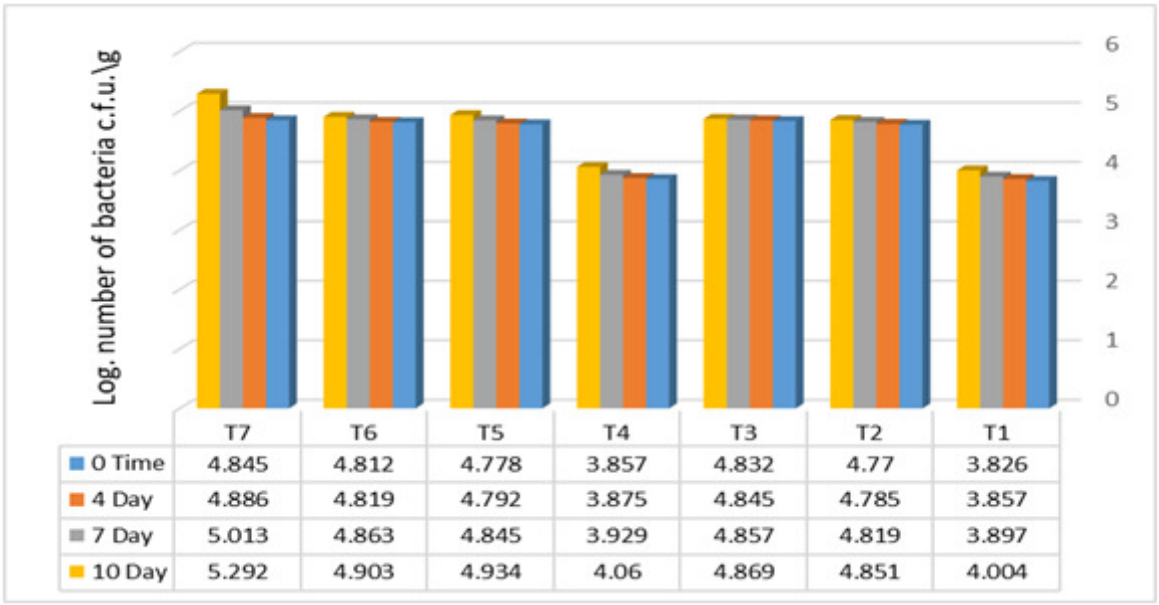
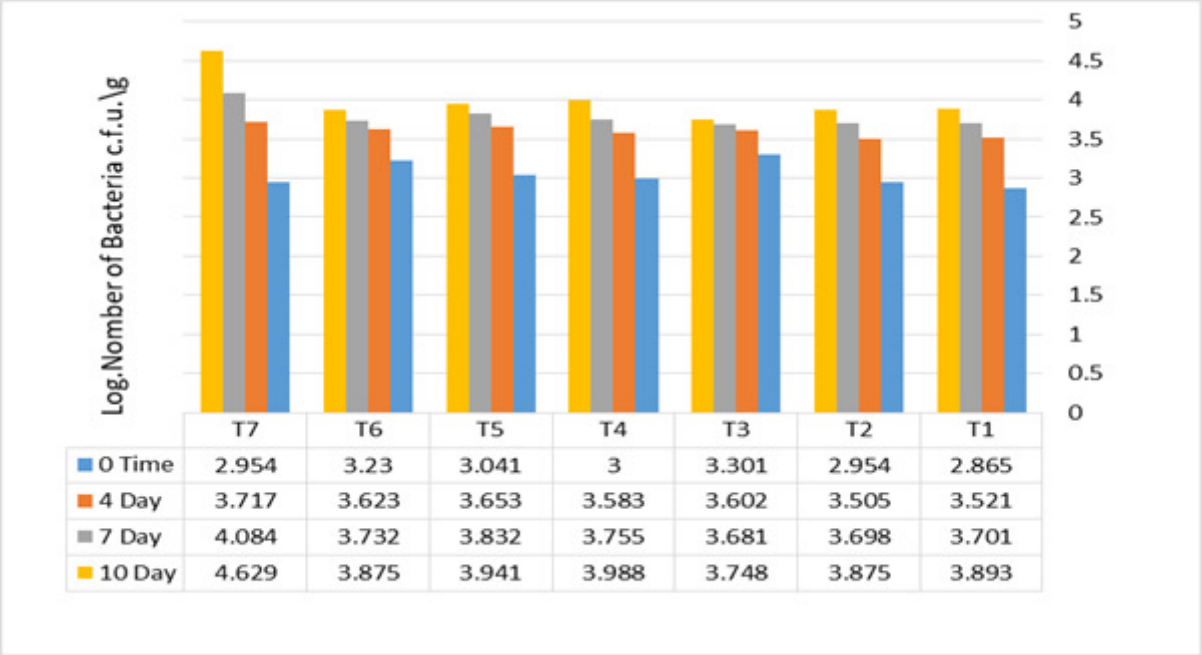


Fig. 2 : Effect of extraction solution and the addition of different percentages of the extract of Alpinia rhizomes on the psychrophilic bacteria.

Table 1 : Effect of Alpinia rhizomes extracts on consumer acceptability.

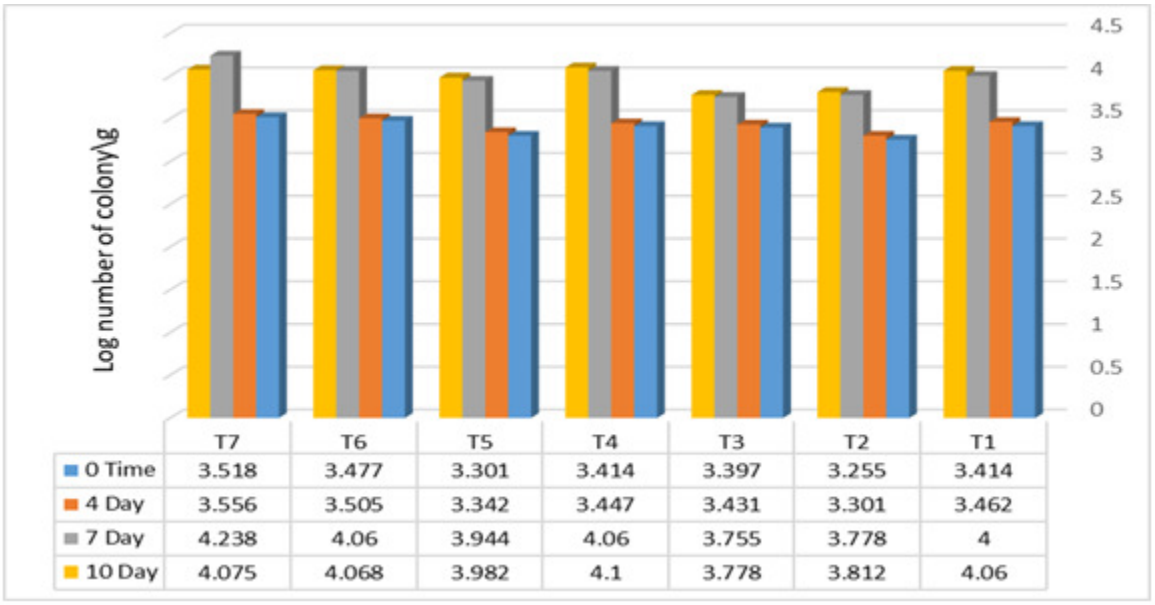
Treatments	Tests				
	Appearance & color	**Flavor**	**Tenderness**	**Juiciness**	**Overall acceptance**
T_1	6.60 ± 0.244*bc	6.40 ± 0.244b	6.60 ± 0.244bc	6.40 ± 0.244dc	6.60 ± 0.244cd
T_2	7.20 ± 0.200ab	7.00 ± 0.316ab	7.20 ± 0.200ab	7.00 ± 0.316bc	7.20 ± 0.200bc
T_3	7.80 ± 0.200a	7.60 ± 0.244a	7.80 ± 0.200a	8.20 ± 0.200a	8.20 ± 0.200a
T_4	6.20 ± 0.200c	6.40 ± 0.244b	6.00 ± 0c	5.80 ± 0.200d	6.20 ± 0.200d
T_5	6.60 ± 0.244bc	6.60 ± 0.244b	6.60 ± 0.244bc	6.80 ± 0.200c	6.80 ± 0.200cd
T_6	7.40 ± 0.244a	7.20 ± 0.200ab	7.60 ± 0.244a	7.60 ± 0.244ab	7.60 ± 0.244ab
T_7	5.00 ± 0.316d	4.60 ± 0.244c	5.00 ± 0.316d	4.60 ± 0.244e	5.20 ± 0.200e
***P*-value**	**<.0001**	**<.0001**	**<.0001**	**<.0001**	**<.0001**

* Means ± Standard Error.a, b, c: means in the same columns with different superscripts differ significantly at probability value (P≤0.05).



	T7	T6	T5	T4	T3	T2	T1
0 Time	2.954	3.23	3.041	3	3.301	2.954	2.865
4 Day	3.717	3.623	3.653	3.583	3.602	3.505	3.521
7 Day	4.084	3.732	3.832	3.755	3.681	3.698	3.701
10 Day	4.629	3.875	3.941	3.988	3.748	3.875	3.893

Fig. 3 : Effect of extraction solution and the addition of different percentages of the extract of Alpinia rhizomes on the coliform bacteria.



	T7	T6	T5	T4	T3	T2	T1
0 Time	3.518	3.477	3.301	3.414	3.397	3.255	3.414
4 Day	3.556	3.505	3.342	3.447	3.431	3.301	3.462
7 Day	4.238	4.06	3.944	4.06	3.755	3.778	4
10 Day	4.075	4.068	3.982	4.1	3.778	3.812	4.06

Fig. 4 : Effect of extraction solution and the addition of different percentages of the extract of Alpinia rhizomes on the molds and yeast.

days of cold storage. Wherein, Table 1 indicates the existence of significant differences ($p<0.005$) in the degree of color of samples containing extracts compared with the control treatment. These differences were directly proportional to the proportion of the extract concentration, where a concentration of 100 mg/kg gave the best results. Whereas, the control treatment scored the lowest among the samples. The treatment T6 recorded a significant superiority ($p<0.005$) over the rest of other treatments in the flavor after the end of the refrigerated storage period, followed by that treatment T_6, while no significant differences were recorded between the treatments T_1, T_4 and T_5, while the control treatment gave the lowest results among all the samples.

All the extracts additions, also improved significantly ($p<0.005$) the tenderness and Juiciness as well as the overall acceptance score for the meat treated samples and that all coincided with an increase in the percentage of extracts so that the treatment T_3, followed by T_6 treatment was seen as superior to the rest of the other transactions.

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