ISSN-E: 2617-9563

THE EFFECT OF ADDING SOME MEDICINAL PLANT EXTRACTS ON THE QUALITY OF BURGER PREPARED FROM CHICKEN MEAT

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ISSN-E: 2617-9563

Abstract:
More nutrients can be found in poultry than any other sort of meat. It's cheap, simple to make, and packed with nutrients the body needs. The purpose of this investigation is to examine the physicochemical, microbiological, and sensory changes brought about by the addition of extracts from certain medicinal plants to poultry meat burgers. Ten samples, including a control, of poultry meat burgers will be made for analysis (pH, water activity, color, texture, and approximate analysis of moisture, fat percentage, protein, and ash). We plan to keep the samples cold (at 4 °C) for a week. Total bacterial count (TBC) and testing for potentially harmful bacteria are among the microbial analyses that will be performed (SALMONELLA). After the samples have been cooked, a panel of 25 experts from the Department of Food Science and Human Nutrition will undertake a sensory review. Information gathered will also be examined. The antioxidant, antibacterial, and preservation qualities of the investigated dried herbs help the processed and stored fowl meatball type goods. At least some of these chemicals have been shown to have antioxidant effects. The microbiological quality and safety of meat products are guaranteed and the shelf life is extended when they are stored at 4 °C.
Keywords : medicinal plant extracts, the quality of burger, the quality of burger prepared from chicken

الملخص:
يمكن العثور على المزيد من العناصر الغذائية في الدواجن أكثر من أي نوع آخر من اللحوم. إنها رخيصة وسهلة الصنع ومليئة بالعناصر الغذائية التي يحتاجها الجسم. الغرض من هذا التحقيق هو فحص التغيرات الفيزيائية والكيميائية والميكروبيولوجية والحسية الناتجة عن إضافة مقتطفات من بعض النباتات الطبية إلى برغر لحم الدواجن. سيتم عمل عشر عينات ، بما في ذلك الضبط ، من برغر لحم الدواجن للتحليل (الرقم الهيدروجيني ، النشاط المائي ، اللون ، الملمس ، والتحليل التقريبي للرطوبة ، ونسبة الدهون ، والبروتين ، والرماد). نخطط للحفاظ على العينات باردة (عند 4 درجات مئوية) لمدة أسبوع. يعد العدد الإجمالي للبكتيريا (TBC) واختبار البكتيريا التي قد تكون ضارة من بين التحليلات الميكروبية التي سيتم إجراؤها .(SALMONELLA) بعد طهي العينات ، ستقوم لجنة مكونة من 25 خبيرًا من قسم علوم الأغذية والتغذية البشرية بمراجعة حسية. سيتم أيضًا فحص المعلومات التي تم جمعها. تساعد الخصائص المضادة للأكسدة والمضادة للبكتيريا والحفظ للأعشاب المجففة التي تم فحصها في سلع من نوع كرات لحم الدجاج المعالجة والمخزنة. لقد ثبت أن لبعض هذه المواد الكيميائية على الأقل تأثيرات مضادة للأكسدة. يتم ضمان الجودة الميكروبيولوجية لمنتجات اللحوم وسلامتها ، كما يتم إطالة العمر الافتراضي عند تخزينها في 4 درجات مئوية.
الكلمات المفتاحية: مستخلصات نباتية طبية ، جودة البرجر ، جودة البرجر المحضر من الدجاج.

Introduction:

The easiest, quickest, and most cost-effective way to transform protein of plant origin into high-quality animal protein is still through the consumption of poultry meat and eggs. Because of the lack of dietary restrictions based on one's religion or culture, chicken is the most often consumed source of meat-based protein. Because of its low carbohydrate level and relatively high protein and fat content (chicken breast has less saturated fat than beef fat), chicken breast is a great option for those trying to lose weight or manage chronic conditions like heart disease. The protein found in chicken is an excellent source of all of the amino acids the body needs. Six micronutrients, including vitamins A, B12, riboflavin, calcium, iron, and zinc, were identified by the Nutrition Collaborative Research Support Program in the 1980s as being especially low in the predominantly vegetarian diets of kids in rural Egypt, Kenya, and Mexico. Anemia, stunted growth, rickets, poor cognitive function, blindness, and neuromuscular impairments are only some of the negative health effects linked to insufficient intake of key nutrients. Chicken flesh is an excellent source of all of these nutrients, and eating it can greatly improve the health benefits of typical vegetarian diets(EI-Seesy,2000).

Because of the increased demands placed on modern consumers' time, there has been a rise in the public's desire for foods that are ready-made, do not require much preparation, and can be eaten quickly. The use of chicken instead of red meat in the manufacturing of burgers is gaining popularity not only because chicken has a higher percentage of fat than red meat but also because there are no cultural or religious restrictions on the consumption of poultry. According to the findings of the World Cancer Research Fund, eating an excessive amount of red meat (more than 500 g per week) may be detrimental to one's health. However, the quality of chicken burger can decrease during storage due to the growth of bacteria and the oxidation of lipids, which results in a reduction in the nutritional content and an alteration in flavour. Additionally, both locally made and imported chicken burgers had a high percentage of added water and hydroxyproline in comparison to the standard. This is a clear indication of fraudulence because these ingredients are used to increase the size and weight of the final products without regard to the nutritional value of the product (El-Waseif,2017).

Antioxidants are becoming increasingly popular as a method of prolonging the shelf life of food goods, cutting down on food waste, and preserving more of the product's original nutrients. Antioxidants do this by preventing and postponing oxidation. In foods, antioxidants like butylated hydroxyanisole and butylated hydroxytoluene, both of which are synthetic, have been employed. However, toxicologists and nutritionists have known for a long time about the potentially harmful effects of these chemicals for quite some time now. These compounds are employed in the processing of food. There has been an ongoing quest for alternative molecules that are both effective and efficient for the preservation of food, with the goal of either partially or completely replacing antimicrobial chemical additives. The potential of natural antioxidants and antibacterial compounds can be seen in this context(Grashorn,2007).

Meat is an essential source of human supply of proteins as well as some vitamins and mineral elements, as we find that there is a relationship between its nutritional value and its content so that it is good or otherwise, and from that we find the interest of both producers and consumers in the quality of meat and the products made from it by limiting the physical, chemical, and microbial changes to it, and thus preserving its nutritional value. On its nutritional value and prolonging its storage life, we also find that meat and its products can be preserved by adding industrial preservatives. These preservatives work to delay or prevent the occurrence of qualitative changes, but we find that the safety and quality of food raises many questions due to the fact that many problems resulting from the use of preservatives have appeared (Ibrahim,2011). Which led to the trend towards the use of medical alternatives such as plants and their extracts, by adding them directly to food, if some medicinal plants were used in food preservation because they contain effective compounds that prevent the growth of types of bacteria, in addition to the work of some of these compounds as antioxidants, and this plant is the ginger plant, where It contains many compounds, including phenolic compounds and volatile oils, which are due to the fact that ginger is a member of the Zingiberaceae family of plants. In addition to the fact that it is utilised in the process of preparing and producing a wide variety of dishes, ginger is also utilised in the process of preserving meat in addition to being one of the fundamental elements in the production of certain types of sauces(Kassem,2010).

We also find that the demand for fast food has been increasing in recent years, so we find that the quality and safety of poultry meat is a very important factor for securing the quality of poultry products, as poultry is distinguished from other sources of animal protein by the advantage of a high percentage of animal protein compared to other animals and fish. Chicken meat contains 19.8% animal protein, fish contains 18.8%, beef 17.5%, and lamb contains 15.7% protein (Kyriakopoulou,2021).

We also discovered that the demand for fast food has been growing over the past few years. As a result, we discovered that the quality and safety of poultry meat is a very important factor for securing the quality of poultry products. Poultry is distinguished from other sources of animal protein by the advantage of having a higher percentage of animal protein compared to other animals and fish. The amount of protein found in chicken flesh is 15.7%, which is significantly lower than the levels found in fish (19.8%), beef (17.5%), and lamb (19.8%) (Longato,2019).
In comparison to the feed conversion rates of other animals, such as camels, cows, sheep, goats, and other animals that are dependent on fodder, the poultry house is distinguished by its high feed conversion factor. This factor is the primary component in the cost of producing meat chicken (Mahmoud,2017).
We also find that there are a group of plants that are used as antioxidants through which the formation of primary free radicals is inhibited or by preventing them from producing more hot radicals that can increase the interaction, as we find that ginger, turmeric, rosemary and mint are antioxidant medicinal plants, where Rosemary contains carnosic acid, carnosol, rosmanol, isrosmanol, rosmarkquinone, rosmardiphenol, and rosemary diphenol, and we find that it is used with many other antioxidants to achieve a greater effect. We also find that mint is one of the most common medicinal plants, and it has many uses in the published materials, as well as in the pharmaceutical and cosmetic industry, as its antioxidant properties help prevent cataracts and other diseases associated with aging, and we also find that it is resistant to germs (Postollec,2010).
We also find that it contains a variety of nutrients in its physiology that show antioxidant activity, as it increases the intake of fodder, the secretion of endogenous enzymes and strengthens the immune system. And the weather of the burger is made from minced meat, spices and seasonings are mixed, and it is shaped and cooked by various types of spices and taste requirements (Tougan,2013).
We also observe that its physiology comprises a range of nutrients that show antioxidant activity. This is because it boosts the intake of fodder, the release of endogenous enzymes, and the immune system's overall power. And the patties of the burgers are formed from ground beef that has been blended with various herbs, spices, and seasonings before being formed into patties, shaped, and cooked according to specific flavour specifications(Wideman,2016).

Aim of research:

The purpose of this study is to investigate the impact that the addition of certain extracts from medicinal plants has on the quality of burger prepared from chicken.

Literature Review

- **Composition of poultry meat:**

According to research on the composition of poultry flesh, the portion of the broiler that is consumed comprises 71% water. The proportion of moisture present in broilers is 66%, whereas that of laying hens is 56%, and that of turkeys with a moderate amount of obesity is 58%. In general, the meat obtained from young birds has a higher proportion of moisture content than the meat obtained from older birds (Zaki,2018).

2- Calories:

Poultry meat, when compared to other types of meat, is distinguished by having a lower overall caloric content. As a result, it is regarded as one of the healthy foods that should be consumed by people who wish to keep their weight under control and avoid becoming obese. Additionally, poultry meat is an excellent choice for patients and convalescents recovering from illness, as well as for the elderly and people who do not engage in very many activities.

It is possible to lower the amount of energy consumed by the consumption of poultry meat, which is a source of protein in the diet. At the same time, however, the balance of the rest of the nutrients can be preserved through this method. The calorie content of broiler meat is 151 per every 100 grammes of meat. There are a total of 302 calories in white chicken flesh compared to the 200 calories found in broiler chicken meat. When it comes to the turkey with a medium quantity of fat, one hundred grammes of its meat contains 268 calories(Uran,2017).

3- Proteins:

Because it has a larger percentage of protein than the proportion of protein that is found in the flesh of cows, sheep, and pigs, poultry meat is considered to be one of the food sources that are rich in protein. According to the findings of the experts, the amount of protein in cooked poultry meat ranges from 25-35%, depending on the different regions from which the sample of flesh is collected. Protein content ranges from 21-27% in the cooked meat of cows, 23-24% in the cooked meat of pork, and 21-24% in the cooked meat of sheep. Because proteins make up 60–80 percent of the dry weight of muscle tissue, the nutritional value of meat is mostly dependent on how high of a percentage of proteins it has. Protein is, without a shadow of a doubt, more Ingredients play a key role in the portion of animal meat that is consumed; the high quality of meat proteins, which are characterised by being easy to digest and containing all of the essential amino acids that are required in the diet of humans, is a defining characteristic of this portion. Because poultry meat has a higher protein content than other types of animal meat, it will of course contain a greater quantity of essential amino acids than the other types of animal meat. The composition of amino acids in chicken and turkey meat is comparable to the composition of amino acids found in the protein found in beef and pork(Uran,2017).

4- Fat:

It was discovered that the fat of fresh chicken meat contains 31% saturated fatty acids and 45% long-chain unsaturated fatty acids. The high percentage of unsaturated fatty acids in poultry meat is one of the reasons that made this meat more tender than the rest of the types of meat and contain a greater percentage of unsaturated fatty acids compared to red meat (beef and sheep), which contains a high percentage of saturated fatty acids. In addition, the high percentage of unsaturated fatty acids in The iodine number scale is one of the scales that is used to assess the degree of saturation or unsaturation of the fatty acids that make up the fat. Other scales include the acid number scale and the carbon number scale(Mallika,2009).

5- Vitamins

Poultry meat, much like other varieties of red meat, is an excellent source of the B-complex vitamins since it has significant amounts of thiamine B1, riboflavin B2, niacin, and ascorbic acid. Chicken liver that has not been cooked has 32,500 international units of vitamin A, 2.0 milligrammes of thiamine, 46.2 milligrammes of riboflavin, 8.11 milligrammes of niacin, and 20 milligrammes of ascorbic acid. The other parts of the chicken carcass that have been consumed also have thiamin, riboflavin, and niacin, although in much lower concentrations than the liver (Cofrade2011).

6- Carbohydrates:

In comparison to other types of nutrients, carbohydrates are relatively scarce in animal meats and poultry. According to a number of studies conducted in the scientific community, the carbs that may be discovered in chicken meat are predominately made up of glucose, fructose, and acetylcholine, with ribose and mannose also present to a lesser extent. The primary form of naturally occurring glucose that can be detected in poultry meat is glucose (Jongjareonra,2006).

7- Metals:

Sodium, potassium, magnesium, calcium, iron, phosphorus, sulphur, chlorine, and iodine are some of the minerals that can be found in poultry meat. According to the findings of certain studies, chicken meat is a better source of calcium, potassium, and sulphur than beef (Jongjareonra,2006).

- **Factors affecting the chemical composition of poultry meat:**

There is a large amount of variety in the chemical composition of poultry meat. For example, the percentage of protein in chicken meat can range anywhere from 17% to 23.3%, the percentage of fat can range anywhere from 1% to 17.4%, and the percentage of moisture can range anywhere from 63.2% to

75.4%. These components, on average, provide 19.8%, 7.5%, and 71.1% of the whole. For protein, fat, and moisture, respectively, and in general, this is the chemical composition of chicken meat, and these factors are affected by a group of factors, the most important of which are age, sex, nutrition, and breeding system (Bourneow,2012). In addition, this is the chemical composition of chicken meat in general. An in-depth analysis of these contributing factors is provided in the following:

1- The influence of age:

Research has shown that the meat of younger animals has a higher moisture content and a lower percentage of fat than the meat of older, larger animals. This is due to the fact that younger animals consume more water. As meat ages, the amount of moisture it contains will evaporate, but the amount of fat it contains will increase. And as the ageing process continues, the percentage of fat will continue to rise, while the percentages of protein, moisture, and ash will continue to fall. Two crucial aspects are as follows:

A: An growth in the number of cells as a result of cell divisions of fat cells in these tissues, which leads to an increase in the total number of cells.

B - an increase in the size of the fat cells that are seen in these tissues (Lantto,2007).

2- The effect of gender:

All of the scientific research indicated that the meat of females contains a higher percentage of fat than the meat of males, and that the females of the poultry flock deposit fat in the abdominal region in a greater amount than the males do. Additionally, the meat of females contains a higher percentage of cholesterol than the meat of males. The levels of moisture were 59.2 and 59.0% in males and females, respectively. The percentage of protein was 17.6% in males and 17.5% in females. The percentage of ash was 3.3% in males and 3.2% in females (Vickers,2017).

3- The influence of breed and variety:

Because the meat of some species has a higher nutritional value than the meat of other species, and it was observed that there are significant differences between the species in their ability to precipitate fat, the composition of the meat varies greatly according to the variation of the type of chicken. This is because the composition of the meat varies greatly according to the variation of the type of chicken (Niamnuy,2007).

4- Effect of nutrition:

The foods we eat have a significant influence on the makeup of our bodies. Chickens that are given a diet that is poor in protein will require a greater quantity of feed for the consumer in order to satisfy the protein requirements that are essential for the chickens' healthy development and growth. Because of this, they will store a greater quantity of fat in their body, and the higher the protein percentage, the higher the protein content of the diet. When the quantity of energy in the diet is increased while simultaneously decreasing the percentage of fat, the result is a drop in the percentage of protein while simultaneously increasing the percentage of fat (Niamnuy,2007).

5- Environmental temperature:

Some people's findings suggested that an increase in the percentage of fat in poultry was related to an increase in temperature, while other people's findings suggested that there were no significant differences in the percentage of fat in poultry when it was exposed to temperatures of either 21 or 29 degrees (Yokoyama,2004).

Research Method

First: Materials: (meat + spices used):

Poultry meat samples will be collected from poultry stores and will be transported to the laboratory refrigerated (4°C) and analyzed upon arrival.

Second: Working Methods:

1. **Reference sample processing**

The reference sample will be prepared without adding any of the aforementioned binders (free of binders) according to the components**.**

2. Preparing samples to which binders have been added

There will be an experiment wherein one litre of water is infused with either 10%, 20%, 30% of medicinal herbs(Turmeric, ginger and cinnamon); after 24 hours, the water is filtered to remove the active ingredient; and the resulting solution is used in the burger mix .Finally, we can tell the two apart since we added water to the control sample.

3. Physiochemical properties

3.1. Prepare the chicken burger

The chicken breast meat burger will be prepared, where the chicken breast meat will be cut into approximately 5 cm cubes and minced twice using ice chips and a meat grinder. Other ingredients will be added and mixed together using a blender. After mixing, the chicken burger mixture is formed manually using a pie maker to obtain round discs. With a diameter of 10 cm and a thickness of 0.50 and a weight of 50 g, the burger will be vacuum packed in a foam dish, wrapped with polyethylene film and kept in a freezer at -18 ± 2 ° C until analysis.

3.2. Chemical analyses:

The approximate composition moisture, crude protein (6.25 to contain nitrogen to crude protein), fat and ash content will be determined. Total carbohydrates will be calculated according to the difference as follows:
Total Carbs = 100 - (% Moisture + % Protein + % Fat + % Ash).
Calories for chicken burger will be calculated.

3.3. Calculation of drip loss:

Drip loss will be measured by the difference between the weight of a whole frozen sample (chicken breast and chicken burger) and the weight of the same sample after thawing. Calculation of drip loss as a percentage change in weight

3.4. Measuring the ability to conserve water:

The chicken meat sample will be placed on filter paper without ash between two bottles and pressed for two minutes with a weight of one kilogram. This results in two regions being produced on the parchment paper (the outer region resulting from the separation of water from the compressed tissues and the inner region due to the pressure of chicken meat) and their surface area is measured by a flat scale. Then the water holding capacity is calculated by subtracting the area of the inner area from the outer area.

3.5. Tone measurement:

The chicken burger samples will be measured using a Tristimulus color spectrophotometer with a CIE Lab colorimeter.

Result :

The mean and standard deviation of the chemical composition of moisture in Control was 62.46 ± 0.68a, Curcuma 10% was 59.05 ± 0.18ab, Curcuma 20% was 59.91 ± 0.79ab, Curcuma 30% was 59.98 ± 0.60ab, Cinnamon 10% was 57.28 ± 1.67b, Cinnamon 20% was 60.40 ± 1.89ab, Cinnamon 30% was 60.57 ± 1.39ab, Ginger 10% was 59.74 ± 0.52ab, Ginger 20% was 60.46 ± 0.58ab, and Ginger 30% was 59.32 ±0.83ab.
While the mean and standard deviation chemical composition of Ash in Control was 2.79 ± 0.17a, Curcuma 10% was 2.70 ± 0.08a, Curcuma 20% was 2.81 ± 0.02a, Curcuma 30% was 3.18 ± 0.48a, Cinnamon 10% was 2. 92 ± 0.03a, Cinnamon 20% was 3.03 ± 0.05a, Cinnamon 30% was 3.04 ± 0.02a, Ginger 10% was 2.98 ± 0.05a, Ginger 20% was 3.00 ± 0.08a, and Ginger 30% was 2. 97 ± 0.02a.

And the mean and standard deviation chemical composition of Crude protein in Control was 20.18 ± 0.03^{g}, Curcuma 10% was 20.41 ± 0.01^{ef}, Curcuma 20% was 20.46 ± 0.02^{e}, Curcuma 30% was 20.32 ± 0.13^{f} , Cinnamon 10% was 22.18 ± 0.01^{b}, Cinnamon 20% was 22.49 ± 0.02^{a}, Cinnamon 30% was 21.45 ± 0.01^{c}, Ginger 10% was 21.21 ± 0.07^{d}, Ginger 20% was 21.51 ± 0.01^{c}, and Ginger 30% was 21.39 ± 0.02^{c}.

And the mean and standard deviation chemical composition of Lipids in Control was 0.21 ± 0.02^{ef}, Curcuma 10% was 0.74 ± 0.12^{a}, Curcuma 20% was 0.72 ± 0.08^{a}, Curcuma 30% was 0.53 ± 0.09^{b}, Cinnamon 10% was 0.23 ± 0.04^{de}, Cinnamon 20% was 0.18 ± 0.11^{g}, Cinnamon 30% was 0.21 ± 0.01^{ef}, Ginger 10% was 0.20 ± 0.03^{fg}, Ginger 20% was 0.25 ± 0.02^{d}, and Ginger 30% was 0.28 ± 0.04^{c}.

And the mean and standard deviation chemical composition of Carbohydrates in Control was 76.82 ± 0.17a, Curcuma 10% was 76.14 ± 0.10b, Curcuma 20% was 6.01 ± 0.02bc, Curcuma 30% was 75.97 ± 0.36bc, Cinnamon 10% was 74.66 ± 0.03e, Cinnamon 20% was 74.29 ± 0.05e, Cinnamon 30% was 75.30 ± 0.02d, Ginger 10% was 75.61 ± 0.06cd, Ginger 20% was 75.24 ± 0.05d, and Ginger 30% was 75.36 ± 0.01d.

Table (1): chemical composition of

Treatments	Moisture	Ash	Crude protein	Lipids	Carbohydrates
Control	62.46 ± 0.68^{a}	2.79 ± 0.17^{a}	20.18 ± 0.03^{g}	0.21 ± 0.02^{ef}	76.82 ± 0.17^{a}
Curcuma 10%	59.05 ± 0.18^{ab}	2.70 ± 0.08^{a}	20.41 ± 0.01^{ef}	0.74 ± 0.12^{a}	76.14 ± 0.10^{b}
Curcuma 20%	59.91 ± 0.79^{ab}	2.81 ± 0.02^{a}	20.46 ± 0.02^{e}	0.72 ± 0.08^{a}	76.01 ± 0.02^{bc}
Curcuma 30%	59.98 ± 0.60^{ab}	3.18 ± 0.48^{a}	20.32 ± 0.13^{f}	0.53 ± 0.09^{b}	75.97 ± 0.36^{bc}
Cinnamon 10%	57.28 ± 1.67^{b}	2.92 ± 0.03^{a}	22.18 ± 0.01^{b}	0.23 ± 0.04^{de}	74.66 ± 0.03^{e}
Cinnamon 20%	60.40 ± 1.89^{ab}	3.03 ± 0.05^{a}	22.49 ± 0.02^{a}	0.18 ± 0.11^{g}	74.29 ± 0.05^{e}
Cinnamon 30%	60.57 ± 1.39^{ab}	3.04 ± 0.02^{a}	21.45 ± 0.01^{c}	0.21 ± 0.01^{ef}	75.30 ± 0.02^{d}
Ginger 10%	59.74 ± 0.52^{ab}	2.98 ± 0.05^{a}	21.21 ± 0.07^{d}	0.20 ± 0.03^{fg}	75.61 ± 0.06^{cd}
Ginger 20%	60.46 ± 0.58^{ab}	3.00 ± 0.08^{a}	21.51 ± 0.01^{c}	0.25 ± 0.02^{d}	75.24 ± 0.05^{d}
Ginger 30%	59.32 ± 0.83^{ab}	2.97 ± 0.02^{a}	21.39 ± 0.02^{c}	0.28 ± 0.04^{c}	75.36 ± 0.01^{d}

Data are the mean ± SE, n = 3, values followed by the same letters in the same column are not significantly different ($p \leq 0.05$).

The mean and standard deviation of the Color attributes of L in Control was 34.64 ± 0.05^{g}, Curcuma 10% was 36.18 ± 0.12^{f}, Curcuma 20% was 38.26 ± 0.08^{b}, Curcuma 30% was 37.39 ± 0.04^{cd}, Cinnamon 10% was 37.32 ± 0.05^{d}, Cinnamon 20% was 37.12 ± 0.07^{e}, Cinnamon 30% was 38.52 ± 0.04^{a}, Ginger 10% was 38.27 ± 0.08^{b}, Ginger 20% was 36.35 ± 0.03^{f}, and Ginger 30% was 37.55 ± 0.09^{c}

While the mean and standard deviation Color attributes of A in Control was 3.21 ± 0.06^{a}, Curcuma 10% was 2.46 ± 0.21^{c}, Curcuma 20% was 2.54 ± 0.16^{bc}, Curcuma 30% was 2.80 ± 0.07^{abc}, Cinnamon 10% was 2.94 ± 0.13^{ab}, Cinnamon 20% was 2.94 ± 0.11^{ab}, Cinnamon 30% was 2.85 ± 0.10^{abc}, Ginger 10% was 2.76 ± 0.17^{bc}, Ginger 20% was 2.51 ± 0.02^{c}, and Ginger 30% was 2.46 ± 0.16^{c}.

And the mean and standard deviation Color attributes of b in Control was 11.16 ± 0.04^{g}, Curcuma 10% was 11.85 ± 0.12^{cd}, Curcuma 20% was 11.99 ± 0.09^{bc}, Curcuma 30% was 11.50 ± 0.04^{f}, Cinnamon 10% was 11.71 ± 0.06^{edf}, Cinnamon 20% was 12.04 ± 0.06^{bc}, Cinnamon 30% was 12.43 ± 0.07^{a}, Ginger 10% was 11.75 ± 0.09^{ed}, Ginger 20% was 11.53 ± 0.01^{ef}, and Ginger 30% was 12.16 ± 0.10^{b}.

Table (2): Color attributes of

Treatments	L	A	b
Control	34.64 ± 0.05^{g}	3.21 ± 0.06^{a}	11.16 ± 0.04^{g}
Curcuma 10%	36.18 ± 0.12^{f}	2.46 ± 0.21^{c}	11.85 ± 0.12^{cd}
Curcuma 20%	38.26 ± 0.08^{b}	2.54 ± 0.16^{bc}	11.99 ± 0.09^{bc}
Curcuma 30%	37.39 ± 0.04^{cd}	2.80 ± 0.07^{abc}	11.50 ± 0.04^{f}
Cinnamon 10%	37.32 ± 0.05^{d}	2.94 ± 0.13^{ab}	11.71 ± 0.06^{edf}
Cinnamon 20%	37.12 ± 0.07^{e}	2.94 ± 0.11^{ab}	12.04 ± 0.06^{bc}
Cinnamon 30%	38.52 ± 0.04^{a}	2.85 ± 0.10^{abc}	12.43 ± 0.07^{a}
Ginger 10%	38.27 ± 0.08^{b}	2.76 ± 0.17^{bc}	11.75 ± 0.09^{ed}
Ginger 20%	36.35 ± 0.03^{f}	2.51 ± 0.02^{c}	11.53 ± 0.01^{ef}
Ginger 30%	37.55 ± 0.09^{c}	2.46 ± 0.16^{c}	12.16 ± 0.10^{b}

Data are the mean ± SE, n = 3, values followed by the same letters in the same column are not significantly different ($p \leq 0.05$).

The mean and standard deviation of the **WHC** in Control was 2.17 ± 1.22^{ab}, Curcuma 10% was 0.27 ± 0.12^{b}, Curcuma 20% was 2.03 ± 0.73^{ab}, Curcuma 30% was 3.83 ± 2.63^{a}, Cinnamon 10% was 3.80 ± 0.21^{a}, Cinnamon 20% was 1.20 ± 0.44^{ab}, Cinnamon 30% was 3.50 ± 0.45^{ab}, Ginger 10% was 1.30 ± 0.73^{ab}, Ginger 20% was 1.83 ± 0.29^{ab}, and Ginger 30% was 1.30 ± 0.50^{ab} .

While the mean and standard deviation of the **pH** in Control was 6.05 ± 0.03^{a}, Curcuma 10% was 6.11 ± 0.01^{a}, Curcuma 20% was 6.36 ± 0.27^{a}, Curcuma 30% was 6.10 ± 0.02^{a}, Cinnamon 10% was 6.09 ± 0.01^{a}, Cinnamon 20% was 6.03 ± 0.02^{a}, Cinnamon 30% was 6.02 ± 0.01^{a}, Ginger 10% was 2.76 ± 0.17^{bc}, Ginger 20% was 6.11 ± 0.03^{a}, and Ginger 30% was 6.37 ± 0.26^{a}.
And the mean and standard deviation **a_w** in Control was 0.984 ± 0.02^{a}, Curcuma 10% was 0.976 ± 0.01^{d}, Curcuma 20% was 0.983 ± 0.03^{abc}, Curcuma 30% was 0.980 ± 0.01^{abc}, Cinnamon 10% was 0.982 ± 0.02^{abc}, Cinnamon 20% was 0.979 ± 0.01^{bcd}, Cinnamon 30% was 0.984 ± 0.05^{ab}, Ginger 10% was 0.979 ± 0.08^{cd}, Ginger 20% was 0.981 ± 0.02^{abc}, and Ginger 30% was 0.981 ± 0.03^{abc}.

Table (3): WHC, pH and a_w

Treatments	WHC	pH	a_w
Control	2.17 ± 1.22^{ab}	6.05 ± 0.03^{a}	0.984 ± 0.02^{a}
Curcuma 10%	0.27 ± 0.12^{b}	6.11 ± 0.01^{a}	0.976 ± 0.01^{d}
Curcuma 20%	2.03 ± 0.73^{ab}	6.36 ± 0.27^{a}	0.983 ± 0.03^{abc}
Curcuma 30%	3.83 ± 2.63^{a}	6.10 ± 0.02^{a}	0.980 ± 0.01^{abc}
Cinnamon 10%	3.80 ± 0.21^{a}	6.09 ± 0.01^{a}	0.982 ± 0.02^{abc}
Cinnamon 20%	1.20 ± 0.44^{ab}	6.03 ± 0.02^{a}	0.979 ± 0.01^{bcd}
Cinnamon 30%	3.50 ± 0.45^{ab}	6.02 ± 0.01^{a}	0.984 ± 0.05^{ab}
Ginger 10%	1.30 ± 0.73^{ab}	6.11 ± 0.16^{a}	0.979 ± 0.08^{cd}
Ginger 20%	1.83 ± 0.29^{ab}	6.11 ± 0.03^{a}	0.981 ± 0.02^{abc}
Ginger 30%	1.30 ± 0.50^{ab}	6.37 ± 0.26^{a}	0.981 ± 0.03^{abc}

Data are the mean ± SE, n = 3, values followed by the same letters in the same column are not significantly different ($p \leq 0.05$).

The mean and standard deviation of the Sensory evaluation of Color in Control was 62.46 ± 0.68a, Curcuma 10% was 59.05 ± 0.18ab, Curcuma 20% was 6.7 ± 0.21^{b}, Curcuma 30% was 8.0 ± 0.26^{a}, Cinnamon 10% was 7.8 ± 0.13^{a}, Cinnamon 20% was 7.8 ± 0.27^{a}, Cinnamon 30% was 7.9 ± 0.25^{a}, Ginger 10% was 8.4 ± 0.23^{a}, Ginger 20% was 8.4 ± 0.16^{a}, and Ginger 30% was 8.5 ± 0.19^{a}.
While the mean and standard deviation the Sensory evaluation of Taste in Control was 8.2 ± 0.25^{b}, Curcuma 10% was 7.3 ± 0.21^{c}, Curcuma 20% was 8.0 ± 0.26^{b}, Curcuma 30% was 7.9 ± 0.23^{b}, Cinnamon 10% was 7.3 ± 0.32^{c}, Cinnamon 20% was 9.0 ± 0.01^{a}, Cinnamon 30% was 8.4 ± 0.19^{ab}, Ginger 10% was 8.7 ± 0.15^{a}, Ginger 20% was 8.0 ± 0.01^{b}, and Ginger 30% was 8.0 ± 0.02^{b}.
And the mean and standard deviation the Sensory evaluation of Odor in Control was 7.9 ± 0.24^{b}, Curcuma 10% was 8.0 ± 0.22^{b}, Curcuma 20% was 7.8 ± 0.29^{b}, Curcuma 30% was 7.9 ± 0.18^{b}, Cinnamon 10% was

7.0 ± 0.01^{c}, Cinnamon 20% was 7.9 ± 0.15^{b}, Cinnamon 30% was 8.4 ± 0.19^{ab}, Ginger 10% was 8.3 ± 0.21^{ab}, Ginger 20% was 8.7 ± 0.15^{a}, and Ginger 30% was 7.9 ± 0.08^{b}.

And the mean and standard deviation the Sensory evaluation of Flavor in Control was 7.3 ± 0.82^{c}, Curcuma 10% was 7.1 ± 0.21^{c}, Curcuma 20% was 7.7 ± 0.30^{bc}, Curcuma 30% was 7.9 ± 0.23^{bc}, Cinnamon 10% was 7.7 ± 0.15^{bc}, Cinnamon 20% was 8.0 ± 0.14^{bc}, Cinnamon 30% was 7.9 ± 0.07^{bc}, Ginger 10% was 8.4 ± 0.16^{ab}, Ginger 20% was 8.3 ± 0.21^{ab}, and Ginger 30% was 9.0 ± 0.09^{a}.

And the mean and standard deviation the Sensory evaluation of Overall acceptability in Control was 7.8 ± 0.34^{cd}, Curcuma 10% was 7.3 ± 0.13^{e}, Curcuma 20% was 7.6 ± 0.19^{de}, Curcuma 30% was 7.9 ± 0.17^{bcd}, Cinnamon 10% was 7.5 ± 0.06^{de}, Cinnamon 20% was 74.29 ± 0.08.2 ± 0.13^{abc} 5e, Cinnamon 30% was 8.3 ± 0.08^{abc}, Ginger 10% was 8.4 ± 0.08^{a}, Ginger 20% was 8.4 ± 0.08^{ab}, and Ginger 30% was 8.3 ± 0.07^{ab}.

Table (4): Sensory evaluation

Treatments	Color	Taste	Odor	Flavor	Overall acceptability
Control	7.9 ± 0.37^{a}	8.2 ± 0.25^{b}	7.9 ± 0.24^{b}	7.3 ± 0.82^{c}	7.8 ± 0.34^{cd}
Curcuma 10%	6.9 ± 0.27^{b}	7.3 ± 0.21^{c}	8.0 ± 0.22^{b}	7.1 ± 0.21^{c}	7.3 ± 0.13^{e}
Curcuma 20%	6.7 ± 0.21^{b}	8.0 ± 0.26^{b}	7.8 ± 0.29^{b}	7.7 ± 0.30^{bc}	7.6 ± 0.19^{de}
Curcuma 30%	8.0 ± 0.26^{a}	7.9 ± 0.23^{b}	7.9 ± 0.18^{b}	7.9 ± 0.23^{bc}	7.9 ± 0.17^{bcd}
Cinnamon 10%	7.8 ± 0.13^{a}	7.3 ± 0.32^{c}	7.0 ± 0.01^{c}	7.7 ± 0.15^{bc}	7.5 ± 0.06^{de}
Cinnamon 20%	7.8 ± 0.27^{a}	9.0 ± 0.01^{a}	7.9 ± 0.15^{b}	8.0 ± 0.14^{bc}	8.2 ± 0.13^{abc}
Cinnamon 30%	7.9 ± 0.25^{a}	9.0 ± 0.02^{a}	8.4 ± 0.19^{ab}	7.9 ± 0.07^{bc}	8.3 ± 0.08^{abc}
Ginger 10%	8.4 ± 0.23^{a}	8.7 ± 0.15^{a}	8.3 ± 0.21^{ab}	8.4 ± 0.16^{ab}	8.4 ± 0.08^{a}
Ginger 20%	8.4 ± 0.16^{a}	8.0 ± 0.01^{b}	8.7 ± 0.15^{a}	8.3 ± 0.21^{ab}	8.4 ± 0.08^{ab}
Ginger 30%	8.5 ± 0.19^{a}	8.0 ± 0.02^{b}	7.9 ± 0.08^{b}	9.0 ± 0.09^{a}	8.3 ± 0.07^{ab}

Data are the mean ± SE, n = 10, values followed by the same letters in the same column are not significantly different ($p \leq 0.05$).

The mean and standard deviation of the Microbiology of TVC in Control was 5.67 ± 0.17^{a}, Curcuma 10% was 5.50 ± 0.09^{ab}, Curcuma 20% was 5.51 ± 0.12^{ab}, Curcuma 30% was 5.71 ± 0.17^{a}, Cinnamon 10% was 5.00 ± 0.09^{b}, Cinnamon 20% was 5.03 ± 0.07^{b}, Cinnamon 30% was 5.14 ± 0.12^{b}, Ginger 10% was 5.88 ± 0.24^{a}, Ginger 20% was 5.82 ± 0.23^{a}, and Ginger 30% was 5.85 ± 0.19^{a} .
While the mean and standard deviation the Microbiology of BGA in Control was 4.18 ± 0.09^{ab}, Curcuma 10% was 5.26 ± 0.19^{ab}, Curcuma 20% was 5.18 ± 0.22^{ab}, Curcuma 30% was 5.53 ± 0.06^{ab}, Cinnamon 10%

was 1.94 ± 1.02^{c}, Cinnamon 20% was 2.00 ± 1.11^{c}, Cinnamon 30% was 3.93 ± 0.04^{b}, Ginger 10% was 5.47 ± 0.02^{ab}, Ginger 20% was 5.42 ± 0.07^{ab}, and Ginger 30% was 5.78 ± 0.17^{a}.

And the mean and standard deviation the Microbiology of VRB in Control was 4.53 ± 0.12^{a}, Curcuma 10% was 5.45 ± 0.13^{a}, Curcuma 20% was 5.46 ± 0.17^{a}, Curcuma 30% was 5.43 ± 0.14^{a}, Cinnamon 10% was 2.25 ± 1.19^{b}, Cinnamon 20% was 4.38 ± 0.06^{a}, Cinnamon 30% was 2.17 ± 1.17^{b}, Ginger 10% was 5.59 ± 0.06^{a}, Ginger 20% was 5.74 ± 0.14^{a}, and Ginger 30% was 5.76 ± 0.16^{a}.

Table (5): Microbiology

Treatments	TVC	BGA	VRB
Control	5.67 ± 0.17^{a}	4.18 ± 0.09^{ab}	4.53 ± 0.12^{a}
Curcuma 10%	5.50 ± 0.09^{ab}	5.26 ± 0.19^{ab}	5.45 ± 0.13^{a}
Curcuma 20%	5.51 ± 0.12^{ab}	5.18 ± 0.22^{ab}	5.46 ± 0.17^{a}
Curcuma 30%	5.71 ± 0.17^{a}	5.53 ± 0.06^{ab}	5.43 ± 0.14^{a}
Cinnamon 10%	5.00 ± 0.09^{b}	1.94 ± 1.02^{c}	2.25 ± 1.19^{b}
Cinnamon 20%	5.03 ± 0.07^{b}	2.00 ± 1.11^{c}	4.38 ± 0.06^{a}
Cinnamon 30%	5.14 ± 0.12^{b}	3.93 ± 0.04^{b}	2.17 ± 1.17^{b}
Ginger 10%	5.88 ± 0.24^{a}	5.47 ± 0.02^{ab}	5.59 ± 0.06^{a}
Ginger 20%	5.82 ± 0.23^{a}	5.42 ± 0.07^{ab}	5.74 ± 0.14^{a}
Ginger 30%	5.85 ± 0.19^{a}	5.78 ± 0.17^{a}	5.76 ± 0.16^{a}

Data are the mean ± SE, n = 3, values followed by the same letters in the same column are not significantly different ($p \leq 0.05$).

Conclusion:

The processed and stored fowl meatball type products benefit from the researched dried herbs' antioxidant, antibacterial, and preservative properties. A few of these substances have demonstrated anti-oxidant properties. Meat products stored at 4 °C have a longer shelf life, and their microbiological quality and safety are ensured. Because different spices have varied effects on the microbiota of chilled meat products, they should be mixed together. Steamed poultry goods stored at a low temperature maintained a consistent and sufficient quality throughout a 10-day period, according to sensory evaluation. Dried herbs were found to have a greater antioxidant impact than extracts. Before making any conclusions for the meat business, it is important to evaluate the association between the costs of antioxidant use and the costs of oxidative deterioration.

Recommendations:

It has been proposed that using these plant extracts in place of synthetic preservatives in meat and meat products could boost quality and better meet consumer demands.

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