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Scientific Research

Determination of Reheating Time and Thickness Effects on Sensory Quality of Chicken Kebabs During Flight

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ABSTRACT

The process of reheating food for consumption has gained particular attention in meal preparation, as it significantly affects food quality and structure. According to the US Food and Drug Administration (2013), the internal temperature of reheated food should reach 74 degrees Celsius for safety. Due to the limited time available for reheating food during flights by flight crew personnel, failure to meet this standard pose safety hazards and diminishes food quality and sensory properties. This study examines the effects of pH, acidity, moisture content, reheating time, and reheating temperature on the sensory evaluation of chicken kebabs, focusing on different piece thicknesses (1.5, 2, and 2.5 cm) and reheating temperatures (150 and 230 °C). Results indicate that increasing the thickness of chicken pieces and reheating temperature from 150 to 230 °C extended the reheating time, which did not exceed the standard limit of 2 hours; the maximum reheating time recorded was 18.58 minutes for 2.5 cm thick pieces at 150 °C. Additionally, as thickness and reheating temperature increased, surface moisture decreased, leading to greater degradation of taste characteristics and lower acceptability. The highest sensory evaluation score of 8.38 was achieved with 1.5 cm thick pieces reheated at 150 °C. Notably, pH values increased with thickness, peaking at 2.5 cm and 230 °C, while acidity decreased, with the lowest value observed at 2.5 cm and 230 °C (1.51%). Moisture content varied, with the highest value of 38.04% at 2.5 cm thickness and 230 °C, compared to the lowest of 34.36% at 150 °C. Furthermore, results demonstrated that as the thickness of chicken pieces increased, heat loss decreased, with the highest value of 0.968 recorded at 150 °C.

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1-Introduction

Air transportation is one of the growing industries in the world, and it is undoubtedly one of the most important and popular means of human transportation [1], but despite this, there is a set of unique risks caused by diseases related to substances. They provide food and poisoning that may have serious consequences on the health of passengers and flight crew. Therefore, high-quality and safe catering in flight relies on compliance with the correct standards of preparation, storage and distribution of food [2]. The process of reheating food for consumption has recently brought a special use in public meals. This process can affect the quality and structure of food [3]. Also, this process can reduce the microbial load of frozen foods or foods that have not been kept and stored at a suitable temperature [4]. To prevent the growth of pathogenic microorganisms, food should be reheated at the right temperature and time [5].

According to the rules of the US Food and Drug Administration (2013), in terms of food safety, the temperature of the food center during reheating should reach 74 degrees Celsius [6]. Due to the short time of most flights, which limits the reheating time of food on the plane by the flight crew personnel, failure to meet the standard requirement in the field of reheating, in addition to safety risks, will also result in the loss of quality and sensory characteristics of food. . Therefore, in order to adjust this problem, it is necessary to optimize the parameters that are effective during reheating (thickness of food) to meet the standard requirement. Considering that the thermal penetration in food changes logarithmically with the change of thickness [7], therefore, checking different thicknesses and determining their optimum in order to achieve the minimum required reheating time can be the most important and valuable safe and economical method. In estimating this, it is important in the airline catering industry and related standards. The nutritional value and the pleasant taste of poultry meat, ease of cooking, the proportion of amino acids in it, low cholesterol, less diseases that can be transmitted from this meat to humans compared to red meat, etc. have made poultry meat in the basket. Household food should be given more attention [8]. White meats such as breast have soft texture, light color, low fat and high protein [9]. Studies related to food safety in air catering are limited and related cases are mentioned below.

Bori Pakri[1]and Adoliyatham[2] (2015) investigated the effects of salt, polyphosphates and reheating on the quality of ready-to-eat frozen fried chicken. After baking, the color brightness (L*) decreased in all samples, while reheating did not show any significant difference in color. The loss of cooking after reheating fried chicken showed that the samples formulated with 1% salt and 0.3% polyphosphate respectively showed the best results compared to the control sample. After reheating, frozen fried chicken without salt and polyphosphate injection showed the highest weight loss compared to injected samples. L. Chemistry[3](1992) investigated the sensory properties and chemical composition of beef slices cooked and reheated in a microwave and traditional oven. Sensory evaluation showed that samples cooked with microwaves had higher flavor scores and lower moisture content compared to samples cooked with a conventional oven. The amount of total moisture was slightly higher for samples cooked in the traditional way and reheated compared to meat cooked and reheated with microwave [10]. Measurement of pH values, acidity, reheating loss and checking the time required to reheat cooked and cooled chicken breast in the range of investigated thicknesses and checking to determine the optimal thickness of cooked and cooled chicken breast to meet the safety requirements of reheating cost-effective production and checking Qualitative effects (moisture percentage, moisture content, sensory evaluation) for serving food in airplanes are the main goals of this research.

2- Materials and methods

1-2- Preparation of samples

In this research, fresh chicken breast with the Akhwan brand, Iranian rice with the Hashemi brand, tomatoes from Tere Bar in the western region of Tehran province, saffron with the Nik Menesh brand, New Zealand butter with the brand NZMPMajid brand lemon juice, Golha spices and Fardaneh starch were used. The

1- Buree Pakdee
2- Adulyatham
3 -El-Shimi

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amount of 5 kg of chicken breast sampled from the shipment[4] 40 kg with thicknesses of 1.5, 2 and 2.5 cm with a temperature of less than 4 degrees Celsius in a tumbler machine[5] Construction company role[6] Germany was selected for cutting with desired dimensions. Rice separately in the Living rice cooker[7]It was made in China. Different thicknesses of grilled chicken individually inside the trays of the Rashnal oven[8] Made in Germany, a calibrated one whose center temperature reached 74°C was prepared. Sliced tomatoes were also cooked in Rashnal oven. Rice, chicken breast and tomatoes cooked separately in blast chillers[9]) cooled with a temperature of less than 5 degrees Celsius and then a portion of food with a constant weight of Iranian white rice 120 grams, sliced tomatoes 30 grams, different thicknesses of chicken breast with a constant weight of 100 grams, butter and lemon sauce[10][11]30 grams, saffron rice for decoration, 10 grams inside special serving containers. Rational ovens were used to cook the grilled chicken samples and special airplane ovens were used to reheat the samples so that the temperature of the center of the grilled chicken was brought to the standard temperature of 74 degrees Celsius. Measuring the temperature of food using a data logger[7] A special German four-channel needle model 4T176 with Testo brand, which is calibrated with five repetitions, was performed. It is worth mentioning that the thermometer inside the roast chicken and data recording was done in the data logger.

Tests related to determining pH, acidity, moisture content, reheating time and reheating loss as well as 9-point hedonic sensory evaluation were performed on the samples with five repetitions. All samples were kept inside the cold room with a temperature of less than 4 degrees Celsius during the monitoring period.

2-2- measurement pH

To measure the pH of chicken breast tissue, a pH meter probe of the German company Testo with Testo model 205 was used. For this purpose, the sensor of the device was inserted into the tissue from the shoulder part of the chicken breast and kept inside the tissue until the device announced the final value by fixing the number [11].

3-2- Acidity measurement

5 grams of sample was weighed in Erlenmeyer. 20-30 ml of neutral alcohol was added to it. By adding a few drops of phenolphthalein reagent, titrate it with 0.1 normal interest until the resulting pale pink color is stable for at least 30 seconds. The consumption volume is placed in the following formula.

$$Oleic\ acid\ according\ to\ free\ fatty\ acids \frac{282 * N * 100 * V}{1000 * W}$$

N = normal consumption profit
V = volume of consumer interest
W= sample weight
The calculation of acid index measurement is done from the following formula.

$$\frac{56.1 * N * V}{IN} = Andis\ acid$$

4-2- Measurement of moisture content

The amount of 5 grams of cooked and reheated chicken breast samples was placed separately with the investigated thicknesses (1.5, 2.5 and 2.5 cm) with 3 repetitions in a uniform manner inside the Madam digital moisture meter and the moisture content of the samples It was measured at a temperature of 110 degrees Celsius.

5-2- Measure rewarming time To measure the reheating time, food samples with a weight of 290 grams and with different dimensions of chicken thickness (1.5, 2.5 and 2.5 cm) inside a standard and calibrated oven of Rational model[12] It was made in Germany and the oven temperature control probe was inserted into the chicken tissue by the data logger model 4T176. The baking temperature was set at 150 and 230 degrees Celsius. The time it took for the temperature inside the tissue to reach from 5 to 74 degrees Celsius was determined as rewarming time.

6-2-Measuring the percentage of reheating loss

The percentage of reheating loss of chicken breast samples with different thicknesses was calculated by calculating the difference in the weight of cooked and reheated chicken breast according to the following formula.

4-Batch
5 -Tumblr
6- Ruhle
7- Leying
8 -Rational
9 -Blast Chiller

2-ingredients of butter and lemon sauce including butter 0.035%, diluted saffron 10%, water 80%, iodized salt 0.004%, butter flour 0.08%, starch 0.01%, red pepper 0.0003% and lemon juice 0.04%
3 - Dataloger

12 -Rational

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Weight of cooked chicken breast - weight of reheated chicken breast= Weight of reheated chicken breast

7-2- Sensory evaluation

7 evaluators consisting of quality experts and experienced and trained cooks in the age range of 35 to 55 years and 2 women and 5 men were selected to evaluate the samples after cooking and after reheating. From the nine-point hedonic scale method (1-extremely bad, 2-very bad, 3-moderately bad, 4-slightly bad, 5-indifferent, 6-slightly lovely, 7-moderately lovely, 8-very Very lovely, 9-extremely lovely) was used for sensory evaluation. In this review, the evaluators evaluated the factors of taste, color, texture, mouthfeel and overall acceptability. Finally, the comparison of the average scores related to taste in the nine-point hedonic test was done using the analysis of variance method.

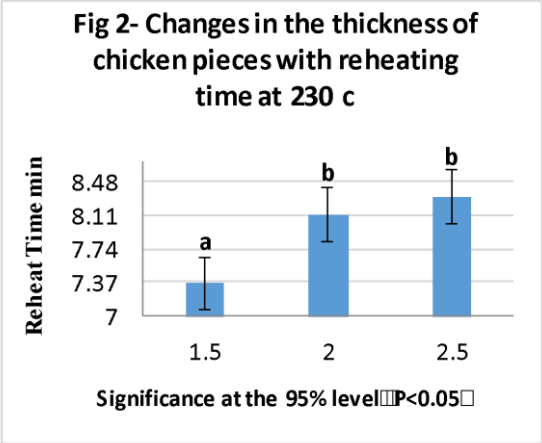
8-2- Statistical analysis

Data obtained using software SPSS It was subjected to statistical analysis and completely randomized factorial design in five repetitions was used to design the tests and Duncan's method was used to compare the means. In this research, chicken breast is an independent variable with three levels (thickness 1.5, 2, 2.5 cm). The reheating temperature is independently variable with two levels (150 and 230 degrees Celsius). Acidity, pH, moisture content, reheating loss, reheating time and sensory evaluation are among the dependent variables of this research.

3-Results and discussion

3-1-Physical tests

3-1-1- Evaluation of the thickness of chicken pieces with reheating time at 230 and 150 degrees Celsius



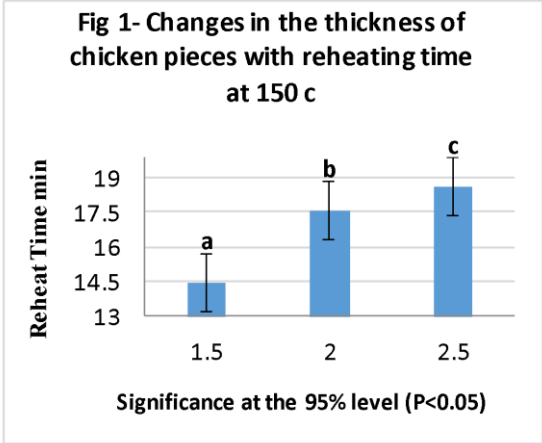


Fig 1- Changes in the thickness of chicken pieces with reheating time at 150 ºC

Fig 2- Changes in the thickness of chicken pieces with reheating time at 230 ºC

As shown in Figures 1 and 2, the changes in the slope of the graph with increasing thickness indicate that the reheating time will increase in high thicknesses. It is worth mentioning that compared to the temperature of 230°C, the slope of changes at the temperature of 150°C is lower, which can be attributed to the long time the samples remain at the reheating temperature. The reheating time is affected by two factors, the thickness of the food and the reheating temperature.

Abu[13]et al. (2003) stated in their study that low temperature and long cooking time improves crispness and reduces cooking loss due to the change in connective tissue and myofibrillar protein and the dissolution of collagen due to heat, which causes crispness. There is a discharge of myofibrillar proteins that causes the tissue to stiffen in this process, and these cases may continue during rewarming, and the results of this study are consistent with the current research [12].

13- Shell

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3-1-2- Evaluation of the thickness of chicken pieces with reheating loss at 230 and 150 degrees Celsius

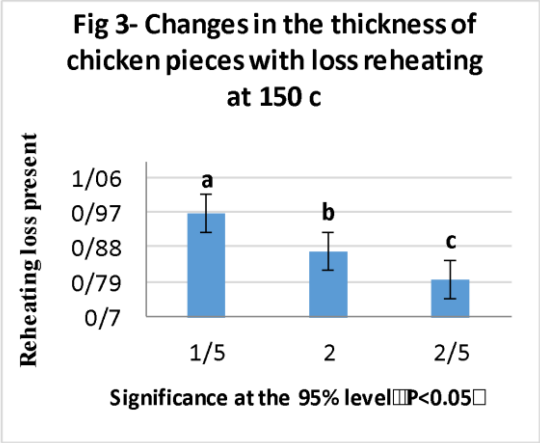

Fig 3- Changes in the thickness of chicken pieces with reheating loss at 150 °C

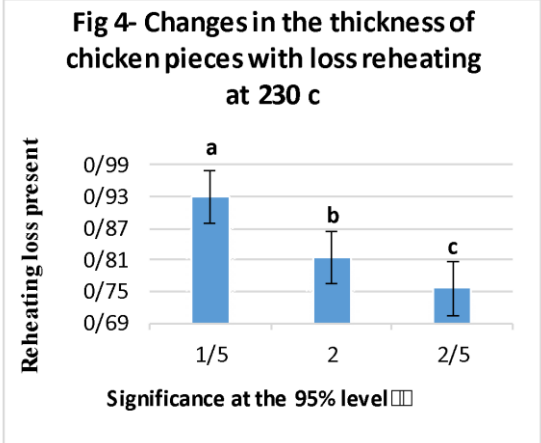

Fig 4- Changes in the thickness of chicken pieces with reheating loss at 230 °C

According to Figure 3 and 4, this study shows that the percentage of reheating loss increases with the increase of the thickness of the tested chicken pieces (1.5, 2 and 2.5 cm) and this relationship is statistically at the 95% level. Confidence is significant (0/05). Reheating Loss Present. As can be seen in Figures 3 and 4, with the increase in the thickness of the chicken pieces from 1.5 cm to 2.5 cm, the reheating loss of the samples decreases at both temperatures of 150 and 230 degrees Celsius, but the slope of the graph at 150 degrees Centigrade will be lower compared to 230 degrees Centigrade, which is probably because the surface-to-volume ratio will decrease with the increase in thickness, and therefore the time required for the temperature of the center of the chicken piece to reach the temperature 74 degrees Celsius will increase.

One of the factors that is effective in the reheating loss in this study includes an area of the thickness of the chicken pieces that is exposed to hot air. The flow of hot air removes moisture from the surface of the chicken pieces and the moisture content of these pieces decreases and the surface becomes dry and hard. By increasing the temperature up to 230°C, taking into account that less time is spent to reach the standard temperature of 74°C in the center of the chicken pieces, and mentioning that the humidity in the depth of the chicken pieces is done by the conduction method. The humidity in the center of the food is better and leads to a reduction in the reheating loss of the chicken.

2-3- Chemical tests

3-2-1 Evaluation of the thickness of chicken pieces with percentage of moisture content at 230 and 150 degrees Celsius

[DOI: 10.22034/FSCT.22.158.1]

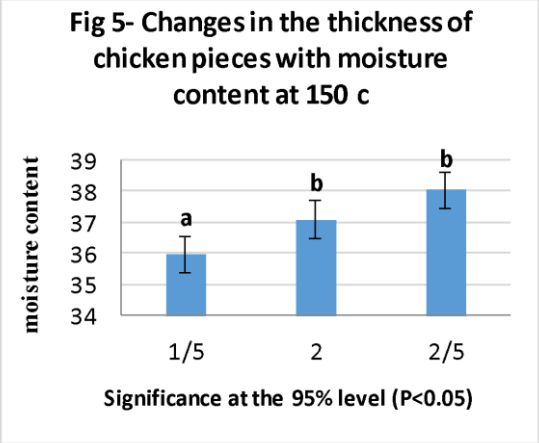

Fig 5- Changes in the thickness of chicken pieces with moisture content at 150 ºC

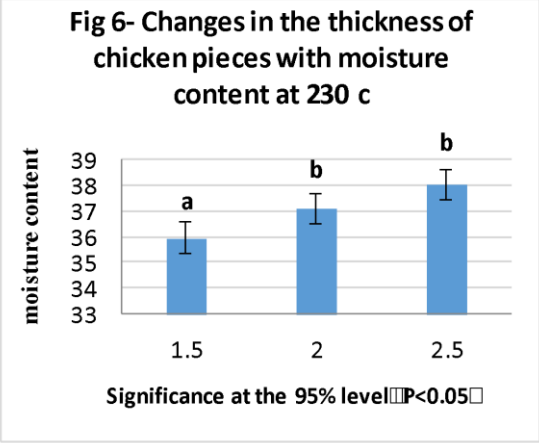

Fig 6- Changes in the thickness of chicken pieces with moisture content at 230 c

According to Figure 5 and 6, this study shows that the percentage of moisture content increases in the chicken pieces with the increase of the thickness of the test (1.5, 2 and 2.5 cm) and this relationship is statistically at the level of 95 The percentage of confidence is significant (p>0.05).

By comparing Figures 5 and 6, it is clear that the percentage of moisture content increases with the increase in the thickness of chicken pieces at 150 and 230 °C reheating temperatures, but the slope of the graph at 230 °C temperature is mild compared to 150 °C. It is moister and more uniform, which seems to be the reason for maintaining more moisture in the center of the chicken pieces due to the increase in temperature. Khalid[14] et al. (2011) studied the reheating process on the coating of frozen chicken nuggets using dough containing flours such as wheat and determining the content of moisture, fat andnSensory evaluation was done. Three frying temperatures of 150, 165, and 180 degrees Celsius were used. The results showed that increasing the reheating temperature leads to a decrease in surface humidity[15] and the increase in humidity was entered, but no significant difference was observed. In the sensory evaluation, there was no significant difference among all the traits in all the samples, except for the coating color and crispness characteristics. The same pattern of results was found for the crispiness characteristic of rice batter, with the highest score at 165°C frying temperature. The results of the present study are consistent with the results of Khalid et al.'s research (2011).

2-2-3-The relationship between the thickness of chicken pieces and pH at reheating temperatures of 150 and 230 degrees Celsius

According to Figure 7 and 8, this study shows that the pH increases in the chicken pieces with the increase of the tested thicknesses (1.5, 2 and 2.5 cm) and this relationship is statistically at the level of 95 The confidence percentage is significant (p>0.05).

14 -Khalid

15 -Coating

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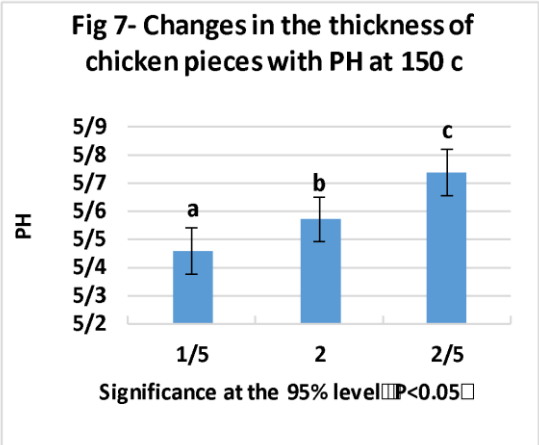

Fig 7- Changes in the thickness of chicken pieces with PH at 150 °C

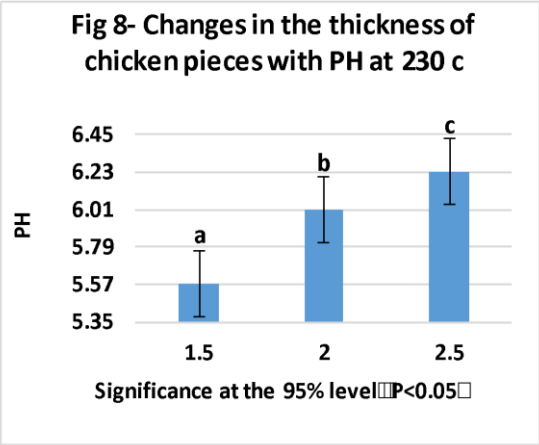

Fig 8- Changes in the thickness of chicken pieces with PH at 230 °C

The changes in the slope in Figure 6 and 7 with the increase in the thickness of the chicken pieces, indicate that the pH level increases at higher thicknesses (2.5 cm) and higher temperature (230°C). It is worth mentioning that compared to the low temperature of 150°C, the slope of changes is significantly higher at the temperature of 230°C, which can be attributed to the amount of penetration of the special sauce for grilled chicken into the chicken tissue. In the investigated low thicknesses, the penetration of the sauce into the tissue will be more compared to the higher thicknesses, and this will change the pH due to the presence of lemon juice in the ingredients of the grilled chicken sauce (acidifying agent). It is worth mentioning that at a higher reheating temperature due to the hardening of the surface of the food due to heat transfer, the penetration of the sauce into the tissue is less and the pH increases.

In their research, Kim et al. (2018) investigated the cooking methods before reheating and the quality of marinated pork and stated that the cooking methods and the temperature used have different effects on the pH of meat products.

The reason for this difference is the amount and type of cooking method. The results obtained from the method of cooking pork by boiling resulted in a higher pH than other methods of grilling, frying, and oven, and according to the different cooking temperatures used in the current research, the results are consistent with each other [13].

3-2-3- The relationship between the thickness of chicken pieces and acidity at reheating temperatures of 230 and 150 degrees Celsius

As can be seen in figures 9 and 10, the degree of acidity decreases with the increase of the thickness of the chicken pieces tested (1.5, 2 and 2.5 cm) and this relationship is statistically at the 95% level. Confidence is significant (p>0.05). As the thickness of the chicken pieces increases (2.5 cm), the acidity decreases. By increasing the temperature to 230°C compared to 150°C, the amount The acidity has decreased to a greater extent, and the difference in the data related to the temperature of 150 degrees in this study is more significant, which can probably be related to the amount of penetration of the barbecue chicken sauce into it, which is done more easily.

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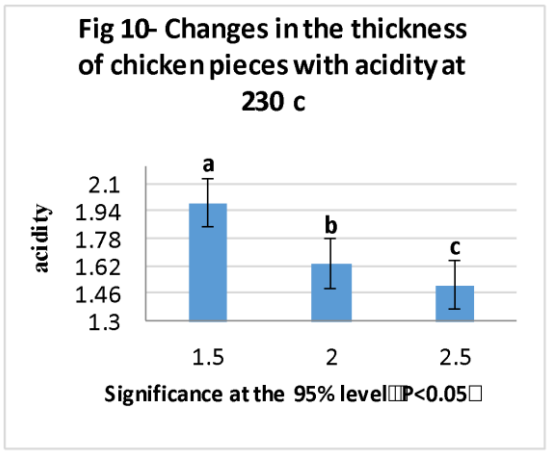

Fig 9- Changes in the thickness of chicken pieces with acidity at 150 ºC

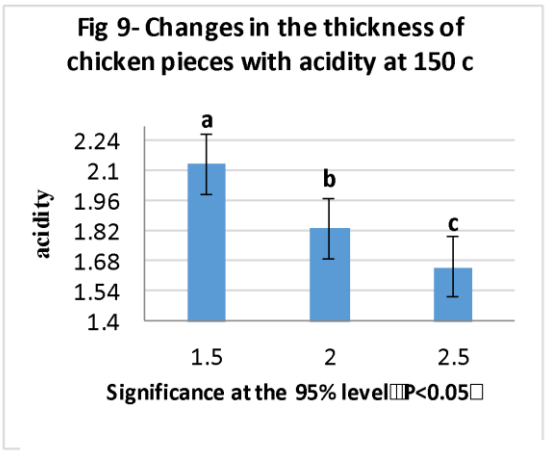

Fig 10- Changes in the thickness of chicken pieces with acidity at 230 ºC

3-3-Sensory evaluation

3-3-1 Evaluation of the thickness of chicken pieces by sensory evaluation (aroma and taste) in the open heating temperature of 150 and 230 degrees Celsius.

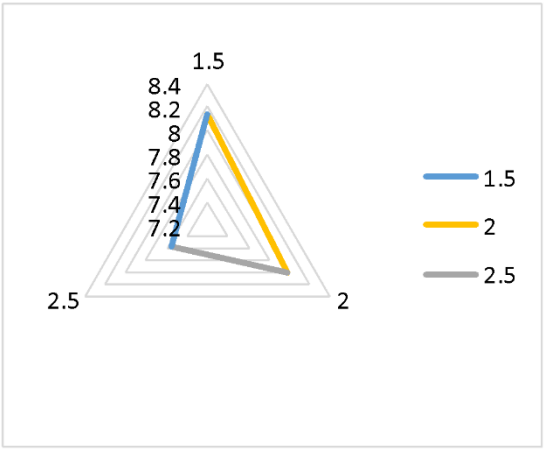

Fig 11- Changes in the thickness of chicken pieces by sensory evaluation (aroma and flavor) at 150 ºC

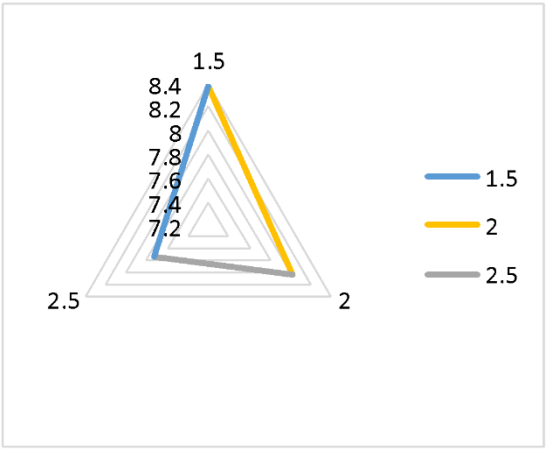

Fig 12- Changes in the thickness of chicken pieces by sensory evaluation (aroma and flavor) at 230 ºC

According to figures 11 and 12, it can be seen that with the increase in the thickness of the chicken pieces, the evaluation of the panel test and the acceptability of the texture has decreased, and this relationship is statistically significant at the 95% confidence level (p>0.05).

3-3-2- Evaluation of the thickness of chicken pieces by sensory evaluation (texture) at open heating temperatures of 230 and 150 degrees Celsius.

According to Figures 13 and 14, this study shows that with the increase in the thickness of the chicken pieces, the evaluation of the panel test and the acceptability of the color has decreased, and this relationship is statistically significant at the 95% confidence level (p>0.05).

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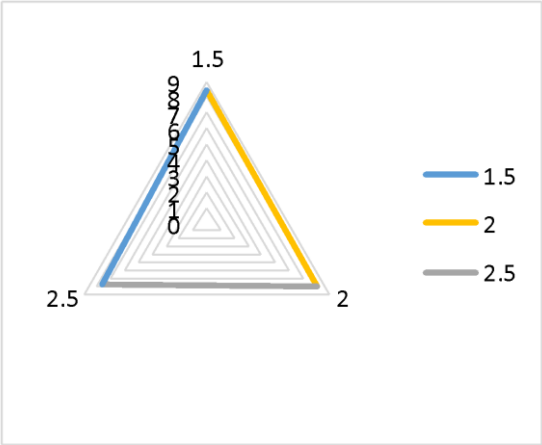

Fig 13- Changes in the thickness of chicken pieces by sensory evaluation (texture) at 150 ºC

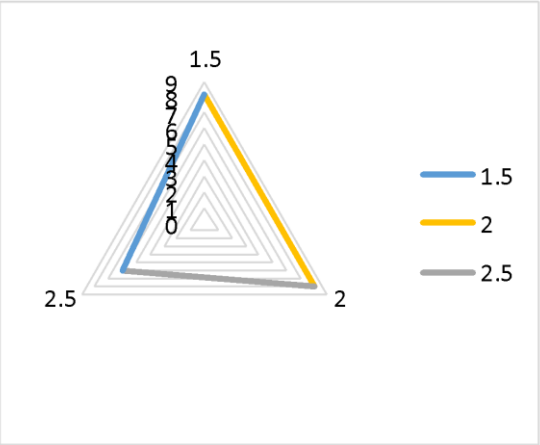

Fig 14- Changes in the thickness of chicken pieces by sensory evaluation (texture) at 230 ºC

3-3-3- Evaluation of thickness of chicken pieces by sensory evaluation (color) in open heating temperature of 230 and 150 degrees Celsius

According to Figures 15 and 16, this study shows that with the increase in the thickness of the chicken pieces, the evaluation of the panel test and the acceptability of the color has decreased, and this relationship is statistically significant at the 95% confidence level (p>0.05).

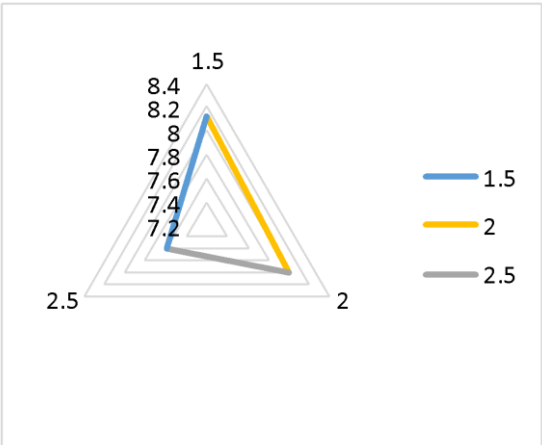

Fig 15- Changes in the thickness of chicken pieces by sensory evaluation (color) at 150 ºC

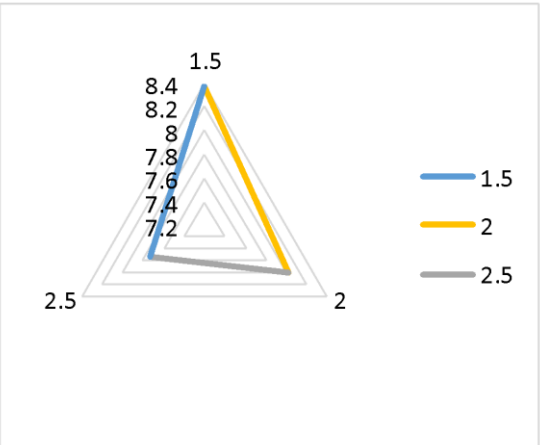

Fig 16- Changes in the thickness of chicken pieces by sensory evaluation (color) at 230 ºC

In general, with the increase in the thickness of the tested chicken pieces (1.5, 2 and 2.5 cm), the sensory evaluation in the investigated samples (aroma and taste, texture, color) decreases and with the increase of the reheating temperature from 150 degrees Celsius. to 230

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As can be seen in Figure 15, by reducing the thickness of the chicken pieces (1.5 cm) at a lower temperature (150 degrees Celsius), the characteristics of flavor and taste and the acceptability of the taste have increased. It should be noted that according to Figure 16, by

16 1- Organoleptic: the smell, taste, color, appearance, touch of food, which is actually the evaluation of food through the senses:

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increasing the thickness of the food and increasing the reheating temperature to 230 degrees Celsius, due to the hardening of the surface and As a result Reducing the penetration of the sauce (especially for grilled chicken) into the chicken tissue, the quality of flavor and aroma will be more damaged. They are less acceptable. Therefore, it seems that in the thickness and lower temperature of reheating the chicken pieces, the penetration of the sauce (especially for grilled chicken) into the tissue increases and the sensory desirability increases, and vice versa, with the increase of the thickness and the higher temperature of the reheating of the chicken pieces, the penetration of the sauce into the tissue is less. and the acceptability of the taste decreases.

The results of the current research are consistent with the results of the study by Klein et al. (1984) regarding the increase in the reheating temperature, which causes a significant decrease in the quality of the product due to excessive drying of the surface, loss of moisture, and change in color and texture [14].

4-conclusion

In general, the obtained results showed that by increasing the thickness of the studied chicken pieces (1.5, 2 and 2.5 cm) at 150 degrees Celsius, the duration increased with the increase in thickness. For example, it took about 14.43 minutes for a thickness of 1.5 cm and about 18.58 minutes for a thickness of 2.5 cm. It is worth mentioning that at 230 degrees Celsius, the duration increased with the increase in thickness, but this increase was 36.7 minutes in 1.5 cm thickness and 8.32 minutes in 2.5 cm thickness with a slower speed. increased Due to the high temperature used (230°C) and the increase in damage to the sensory characteristics and the decrease in taste acceptability among the evaluators, the samples of foods with a higher thickness of chicken pieces and a reheating temperature of 230°C had the lowest quality score. The reason is not suggested in this study, despite the reduction of reheating time and the increase of safety during the time of serving food on the plane. It is worth mentioning that by increasing the thickness of the investigated chicken pieces and increasing the reheating temperature to 230 degrees Celsius pH Due to the less penetration of the sauce into the chicken tissue, the amount of acidity increases and decreases. Also, with the increase in the thickness of the chicken pieces, the reheating time increases, but with the increase in temperature, this factor decreases significantly, so that in the thickness of 2.5 cm with a temperature of 150 degrees Celsius, the maximum amount of reheating time (18.58) minutes) was observed. It should be noted that with the increase in the thickness of the chicken pieces, the percentage of moisture content in the chicken tissue increases and this factor reaches the highest value at a temperature of 230 degrees. In conclusion, with the increase in the thickness of the chicken pieces, the reheating loss decreases and this case will have the lowest value at 150 degrees Celsius.

5- gratitude

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تعیین ضخامت بهینه و زمان بازگرمایش مواد غذایی پخته و خنک شده بر پایه گوشت سفید(سینه مرغ) در طول سفرهای هوایی

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چکیده

فرآیند بازگرمایش مواد غذایی برای مصرف در تهیه غذا مورد توجه ویژه ای قرار گرفته است، زیرا می تواند به طور قابل توجهی بر کیفیت و ساختار غذا تأثیر بگذارد. طبق گفته سازمان غذا و داروی ایالات متحده (۲۰۱۳)، دمای داخلی غذای بازگرمایش شده برای ایمنی باید به ۷٤ درجه سانتیگراد برسد. با توجه به زمان محدود موجود برای بازگرمایش مجدد غذا در طول پرواز توسط پرسنل خدمه پرواز، عدم رعایت این استاندارد نه تنها خطرات ایمنی را به همراه دارد بلکه کیفیت غذا و خواص حسی را نیز کاهش می دهد. این مطالعه اثرات pH، اسیدیته، میزان رطوبت، زمان و دمای بازگرمایش را بر ارزیابی حسی کباب مرغ، با تمرکز بر ضخامت های مختلف قطعه (۱.۵، ۲، و ۲.۵ سانتی متر) و دمای بازگرمایش (۱۵۰ و ۲۳۰ درجه سانتی گراد) بررسی می کند. نتایج نشان می دهد که افزایش ضخامت قطعات مرغ و دمای گرم کردن مجدد از ۱۵۰ به ۲۳۰ درجه سانتی گراد، زمان گرم کردن مجدد را افزایش داد که از حد استاندارد ۲ ساعت تجاوز نکرد. حداکثر زمان گرم کردن مجدد ثبت شده ۱۸.۵۸ دقیقه برای قطعات ۲.۵ سانتی متر ضخامت در ۱۵۰ درجه سانتی گراد بود. علاوه بر این، با افزایش ضخامت و دمای گرم کردن مجدد، رطوبت سطح کاهش می‌یابد که منجر به تخریب بیشتر ویژگی‌های طعم و مقبولیت کمتر می‌شود. بالاترین امتیاز ارزیابی حسی ۸.۳۸ با قطعات ۱.۵ سانتی متر ضخامت دوباره گرم شده در ۱۵۰ درجه سانتی گراد به دست آمد. قابل‌توجه، مقادیر pH با ضخامت افزایش یافت و در ۲.۵ سانتی‌متر و ۲۳۰ درجه سانتی‌گراد به اوج رسید، در حالی که اسیدیته کاهش یافت، که کمترین مقدار در ۲.۵ سانتی‌متر و ۲۳۰ درجه سانتی‌گراد (۱.۵۱ درصد) مشاهده شد. محتوای رطوبت متفاوت بود، با بالاترین مقدار ۳۸.۰٤٪ در ضخامت ۲.۵ سانتی متر و ۲۳۰ درجه سانتی گراد، در مقایسه با کمترین ۳٤.۳٦٪ در ۱۵۰ درجه سانتی گراد. علاوه بر این، نتایج نشان داد که با افزایش ضخامت قطعات مرغ، اتلاف حرارت کاهش می‌یابد و بالاترین مقدار ۰.۹٦۸ در دمای ۱۵۰ درجه سانتی‌گراد ثبت شده است.

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