

# Determination of the optimal time for the heat treatment time of local canned river and marine fish products in Basra Governorate, knowledge of microbial analysis and sensory evaluation

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## Abstract

A microbial and sensory study was conducted to evaluate the final quality of the canned product of river Mullte fish, Mackrele marine fish, and Talange Queen marine fish. The fish were brought from the official areas designated for selling fish in Basra Governorate in fresh condition and placed in an ICE BOX with the addition of crushed ice at a temperature of  $4\pm 1$ . The microbial composition was studied before and after processing and during storage periods (0, 15, 30, 45 and 60) days. At the end of the storage period, a sensory evaluation of canned fish was conducted. By conducting tests, it was found that Mullte fish, Mackrele fish, and Talange Queen marine fish are suitable for a process in the fish canning industry because it retains the largest amount of nutritional value. The D value was (0.88, 1.64, and 1.67) minutes for canned fish, respectively, that were canned with 2% saline solution and during storage periods of (0, 15, 30, 45, and 60) days. The F<sub>0</sub> values were (3.75, 6.96 and 7) minutes, respectively. The highest sensory evaluation was for Talange Queen, Mackrele and Mullte fish. The product shall be free at each storage period of any microbial growth.

**Keywords:** D value, F value, microbial analysis, sensory evaluation, local fish, thermal penetration.

## Introduction

Kurniawan (2021), the first methods of heat treatment of food were reported by Nicholas Appert in 1810 AD, whose method aims to preserve and prevent the large economic loss associated with microbial spoilage and eliminate microorganisms as the canning process is one of the methods used to preserve food in tightly closed cans, to give the products a long shelf life. Knowing the heat coefficients for their time calculations is easy to predict the ability to preserve food, eliminate spoilage causes, reduce losses, and not rely on implied calculations. That heat treatments, which are one of the main techniques invented by man, helped to give a good taste and flavor, as both time and temperature are counted as Important factors to ensure thermal penetration of the food to eliminate the causes of enzymatic and microbial spoilage while avoiding excessive thermal treatments that may affect the properties of the product. As a result of the increased consumption of fish and its products while enjoying health and nutritional benefits and finding appropriate ways to extend their preservation periods for the longest period (Kurniawan, 2021; Phams, Afaghi et al., 2001). The province of Basra - southern Iraq, through its geographical location, which the Arabian Gulf from the southern borders, the Shatt al-Arabi from the east, and the Euphrates River from the north, was distinguished by the availability of different types of fish, which made the fish diversity in the local markets abundant through the contrast between saltwater and freshwater fish with its availability throughout the year. Ali et al. (2018) and Freyhof et al. (2021) indicated that the number of fish in Iraq is more than 322 species, while water and native fish amounted to 52 species, in addition to the presence of 14 species of exotic fish. The canning process is one of the traditional means of preserving food and prolonging its preservation period in the surrounding environmental conditions by eliminating microorganisms and enzymes that cause food spoilage, as well as the ease of exporting them to global markets and providing job opportunities.

Therefore, researchers and producers in the field of canning sought to find innovations and new and useful products to meet the increasing demand by consumers for good food with high nutritional value and quick preparation. The canning method has been adopted as a method of preservation through the use of tightly closed cans with heat treatments with time calculations, minimizing losses and prolonging storage life with guarantees of quality, taste and safety of the product. (El. -shehawy and Farage, 2019; Lordachw and maria, 2017). Fish has gained economic importance because it has a reputation for regeneration and rapid reproduction within short periods when compared to other animals, as well as its nutritional and health value because it contains essential amino acids and fatty acids, especially omega, vitamins and mineral elements that meet the body's need (FAO, 2018; Ward and Hackney, 2011).

### **Materials and Methods**

The current study was done with Mullet fish (*Liza* sp.), small in size, raw material (fresh fish). Mackerel fish (*Caranx* (paramalabaricus) and Talange Queen (Spotted leather skin) fish (*Scomberoides Commersonianus*). The study was conducted in the Department of Food Sciences, College of Agriculture, University of Basrah. The fish prepared for canning were transported after being placed in a refrigerated container Ice Box until they reached the laboratory, and the internal entrails were cleaned and removed and washed for packaging and conducting laboratory and microbial tests, chemical, physical and microbial tests before and after manufacturing and during storage periods (0, 15, 30, 45 and 60) days.

### **Canning process**

The fish were cleaned by removing the head, fins, scales and internal entrails, washed well with tap water, placed in the containers intended for canning, subjected to the initial heat treatment at a temperature of 50 °C for 5 minutes, and saline solution was added to the cans at a concentration of 2%, leaving a vertical space. The cans were transferred to an autoclave sterilizer with thermocouples placed inside the cans and connected with a device to record the temperature inside the cans and the sterilization device every 2 minutes; then the sterilization was stopped at sterilization ranges of (5 and 10) minutes, respectively for Mullet and Talange Queen fish, Halfi et al. (2011), and Lahamy et al. (2020). Then, the cans were cooled abruptly by pumping cold water until the temperature dropped to the required level.

### **Microbial Test**

The culture media was prepared according to the manufacturer's recommendations after adjusting the pH and sterilized by autoclave at a temperature of 121 °C for 5 minutes. The 0.1% peptone solution was well-filled, and the volume was increased to 100 ml. Dilutions of 10 to 6 decimal places were prepared from it. The tubes were cultured using the L-shape diffusion method. The microbial numbers were estimated in CFU/gm.

### **Total plant count**

The culture medium was used (N.A) Nutrient Agar by dissolving 28 gm in 500 ml distilled water, adjusting the pH of the medium and completing the volume to 1000 ml, sterilizing the medium, pouring it into dishes and leaving it until solidification, the dishes were inoculated and incubated at a temperature of 37 °C, this test was conducted for fresh and canned fish and during different storage periods (Andrews 1992).

### **Total coli form**

The total number of coliform bacteria was estimated in fresh and canned fish and during different storage periods according to the Harya (2010) method by transferring 0.1 ml from the dilution tubes mentioned in paragraph 3.2.1.1. The dishes containing sterile MacConky Agar culture medium were incubated at 37 °C for 24-48 hours (Andrews, 1992).

### **Proteolytic bacteria**

The method mentioned above was adopted by (Speck (1976) by using a Caseinate Agar culture medium prepared by the British Oxford company, as colonies surrounded by a transparent halo were calculated for fresh and canned fish during storage periods.

### **Lipolysis bacteria**

The numbers of lipolytic bacteria were estimated for all stages before and after packaging and during storage periods, according to Cempírková and Mikulová (2009), using the culture medium Tributryin Agar prepared from the British Oxford Company, as the colonies surrounded by a transparent halo were counted

**Detection of Salmonella**

1 gm of canned fish samples was added to a tube of Akhtar containing the activation medium Tetrathionate Broth prepared by dissolving 46.0 gm in 1000 ml distilled water and boiling it using a rotary heater without subjecting the medium to sterilization, incubating the tube at a temperature of 35 °C for 24 hours and then cultivating 1 ml of the suspension bacteria on the culture medium (SSA), which was prepared by dissolving 63.0 g in 1000 ml, according to the manufacturer's instructions, boiling it using a rotary heater, and not using an autoclave to sterilize the medium. The dishes were incubated at a temperature of 37 C for a period of (24-48) hours, after which the numbers of bacteria were calculated (Andrews, 1992).

**Detection of Bacilli bacteria**

The culture medium N.A was used to detect the bacteria that form plaques by transferring 1 g of canned fish meat samples in a test tube containing peptone water and placing it in a water bath at a temperature of 80 °C for 10 minutes after transferring 0.1 m of decimal dilutions and planting it on the surface of the previously prepared culture medium and incubating it. Dishes at a temperature of 37°C for a period of (24-48) hours and counting the growing colonies using a colony counting device (Andrews, 1992).

**Detection of the anaerobic bacteria Clostridium**

P.A culture medium was prepared according to the manufacturer's instructions, dissolving 23.5 g of the medium in 475 ml of distilled water and sterilizing the medium using an electric autoclave, transferring 0.1 ml of the pre-prepared dilution onto the surface of the medium and placing the dishes in an anaerobic incubator with the provision of tight anaerobic conditions and incubation at a temperature of 55 °C for a period of (24-48 hours).

**Calculate D value for canned fish**

The value of D was calculated based on what was mentioned by Valentas et al. (1997).

D value - decimal reduction time: the time required for approximately 90% of microbes to die for one logarithmic cycle, which is calculated from the following equation:

$$D = (t_2 - t_1) / \{\log(a) - \log(b)\}$$

Where T1-T2 represents the difference in time for the min sterilization period time

= log (a) represents the initial number of microorganisms before sterilization.

Log (b) = represents the final number of microorganisms after sterilization

Calculate the value of F0:

$$F_0 = D_r \{\log(a) - \log(b)\}$$

**Sensory evaluation**

The sensory evaluation of canned fish was conducted by 10 arbitrators of professors and graduate students in the Department of Food Sciences, College of Agriculture, University of Basra, according to the sensory evaluation form proposed by Naik et al. (2014).

Sensory evaluation form

trait	degree	trait	degree
Excellent	10	Very good <sup>l</sup>	9
good	8	Quite acceptable	7
Quite acceptable	6	Rancidity, bitterness, or the presence of odors	5
Medium rancidity or bitterness	4	Very rancid	3
Very rancid	2	Absolutely unacceptable	1

Attributes Sensory form

Taste	smell	texture	color	appearance	general acceptance
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## Results and discussion

### Microbial analysis

Table (1) Microbial content of fresh fish to be canned before processing, CFU/gm Log

class	total count	Lipolysis bacteria	Proteolytic bacteria	coli bacteria	bacteria Salmonella
Mullte	115×10 <sup>3</sup>	33×10 <sup>3</sup>	32×10 <sup>3</sup>	28×10 <sup>3</sup>	Nil
Mackrele	193×10 <sup>3</sup>	43×10 <sup>3</sup>	52×10 <sup>3</sup>	41×10 <sup>3</sup>	Nil
Talange Queen	267×10 <sup>3</sup>	47×10 <sup>3</sup>	39×10 <sup>3</sup>	44×10 <sup>3</sup>	Nil

### The effect of the canning process on the microbial content during storage periods

Dengawy et al. (2012- El) showed that hermetic closure and anaerobic conditions distinguish the preservation process in the canned food industry.

Table (2) Decimal reduction time values D for canned fish at 118 °C

value (min)	Class		
	Mullte	mackerel	Talange Queen
	5-minute sterilization period		10-minute sterilization period
<b>D-Value</b>	<b>0.88</b>	<b>1.64</b>	<b>1.67</b>
<b>F-Value</b>	<b>3.75</b>	<b>6.97</b>	<b>7</b>

The calculation of the TDT value was based on referring to the initial numbers of microorganism growth and reducing them after the operation from 10<sup>12</sup> to 1, and this is known as the 12D value (meaning that the initial or original number of microbes decreases to 12 logarithmic cycles and the number of microbes reaches zero) (Stumbo 1973). Most treatment aims to prevent anaerobic bacteria' growth and production of toxins. These guidelines recommend that heat treatments, or the combination of processes used, reduce the number of viable spores of anaerobic bacteria by 6 logarithms. Accordingly, heat treatment of 90°C for 10 minutes or equivalent lethality is sufficient to slow down The slowest heating spot of the product, and the elimination of microorganisms is known as the slowest heating spot (the slowest heating point of the product is the place where the temperature is lowest during heating) (ACMSF, 2006).

The D value for Mullte fish agreed with (Yoon et al. 2015), where the D value was found to be (0.80) minutes. The D values for Mackrele and Talange Queen fish agreed with what was found by ACMSF (2006) as it was 1.6 min. The D values showed the objectives of the packaging process by eliminating microorganisms during storage periods. What worries producers in the canned food industry is how to eliminate the microorganisms that produce boards, especially the non-aerobic organisms that makeup boards Clostridium (as a dormant cell in a state of hibernation is highly resistant, produced under stress conditions and unsuitable environment for bacteria) in addition to other types of aerobic organisms that produce blackboards, such as Bacillus. The losses were great for the manufacturers until the solution came by the French scientist Abert in 1810 AD through heat, and after that, the canned food industry developed and canned sardines were produced for the first time in France in 1830 AD. Preservation by heat is one of the main ways to extend the storage life of fish products because of the high advantages of The high safety level of product health confidence, and the amount of heat treatment applied to canned food products can be measured using the F<sub>0</sub> concept, which can be defined (is the sterilization process equivalent to time, or it is the equivalent number of minutes at 121.1°C that are shed on food cans to make them commercially sterilized and safe for consumption ) and is considered as part of the HACCP system, taking into account the dependence of time and temperature on the characteristics of the product and the type of heating medium to retain the largest amount of the nutritional value of the canned product, and the fish canning industry adopts thermal processes ranging from (2.5-20) to the value of F minutes depending on on the type of product and technology used (Safefood, 2014; Gould, 2006; Carlin et al., 2000; Ababouch, 2000). Through the results of Table No. (2) the F<sub>0</sub> values for canned fish showed differences between riverine and marine varieties. The F<sub>0</sub> value for riverine Mullte fish was 3.75 minutes, while the F<sub>0</sub> values for Mackrele and Talange Queen

were 7 minutes. The results of the values agreed with the findings of Frott and Lewis (1994) in the range of F5 to F20 recommended for fish products. The results of the F value for Mullte fish differed, and the F values for Mackrele and Talange Queen fish converged with what was reached by Olusola (2017) for fish. Red and salt fish canned with brine, where the F values were (7.71 and 8.86) minutes, respectively, and the F values for the same fish canned with medium packing (were 6.52 and 6.9) minutes, respectively. Also, the results of the values converged with what was obtained by (2005) Ansar et al. The F values were (5 and 7) for canned sardines. Results The results converged with a similar study by Mesias et al. (2015) when canning yellowfin tuna (*Thunnus albacares*) and sardines (*Sardina pilchardus*) with three media filling each of the solutions. Salt, sunflower oil, and olive oil, where the values were in the range (of 5 to 20). Through the data of the results, the F values of fish canned with brine have an effective role in accelerating the heat and its penetration of the food, and this was confirmed by Ansar et al. (2005), indicating that the oil is a factor. An insulator slows down the heat penetration compared to the brine solution, hence the difference in F0 values.

#### **Total viable bacterial count (TVBC)**

It is noted in Table (1) the values of D that the time required to reduce the microbial numbers to 90% of the initial number per minute at a temperature of 118 °C during canning, where the average values are proportional to the type of variety and the chemical composition between the river and marine fish, and the time required for the thermal processes of Mullte fish was the requirement It has 5 minutes for eliminating any form of microbial growth, while the time required to conduct thermal operations for marine varieties is 10 minutes at a temperature of 118 °C, through which it achieved the required condition for eliminating microbial growth throughout the storage periods and maintaining the physical, qualitative and sensory characteristics. The laboratory tests of the fish after the canning process and during the storage periods showed that there was no microbial growth throughout the storage period for all fish (Mullte, Mackrele, Talange Queen); during the microbial examinations for the canning periods as a result of the heat treatments and their effect on the salt concentration from the precipitation of the brine solution through the diffusion within the meat food in addition to It is necessary to close tightly and prevent the entry of air, as each of (Peleg et al. 2005) Brown 2000 indicated that the main goal of thermal processes is to destroy life forms of microorganisms and reduce microbial and enzymatic activity with heat to ensure that food is preserved for the longest possible period and does not affect the health of the consumer. The study's data agreed with the concept of HACCP through the absence of fish products from pathogenic bacteria (Ababouch, 2002). The results of the study also agreed with Lahsen Ababouch (1999). The study's results agreed with reducing the number of microorganisms with Burns (1985) through the speed of movement of salt particles in meat. Canned fish through the sterilization process, which in turn helps to speed up the spread of salt within the biomass. The study's results differed from those (Shehata et al., 2005, Ghafour, 1999).

#### **lipolytic bacteria and proteolytic bacteria**

The results of the microbial examinations during the storage periods showed that there was no growth of fat-dissolving bacteria and proteolytic bacteria for canned fish varieties as a result of heat treatments and salt concentration and the role of heat from the acceleration of the brine solution from diffusion within the food item of meat, in addition to the airtight closure and preventing the entry of air, as noted by (Peleg et al. 2005; Majeed (1999). The main objective of thermal processes is to destroy life forms of microorganisms and reduce microbial and enzymatic activity through heat to ensure that food is preserved for the longest possible period and does not affect the consumer's health. In addition, preliminary or preliminary heat treatments have a role in inhibiting the reaction of Both lipase and protease, reducing the microbial load of food before additional processing, and expelling cellular gases, in addition to what the initial heat treatments provide in preventing the activity of enzymes during storage (Varzakas et al., 2014; Cyprian et al., 2017). The data of the study agreed with the concept of HACCP. By freeing fish products from disease-causing bacteria (Ababouch, 2002). The study's results also agreed with (Lahsen Ababouch, 1999; Shehata et al.2005) (AbdEl-Ghafour, 1999). The results of microbial analysis agreed with (Reddi et al. 1972; Sng, 2005) through sodium dichloride or sodium chloride solution and during the blanching process by inactivating autolytic enzymes.

#### **Coliform and Salmonella bacteria**

The microbial content of canned fish products reflects the processing and methods in the canning industry

(Oranusi et al., 2007). The study's results through microbial examinations showed that canned fish are free of Coliform bacteria. Salmonella. The study results for the microbial content of Mullte and Mackrele fish and canned ribs agreed with the International Committee for Microbial Standards (ICMSF1998); (Stannard, 1997) that they are free from salmonella bacteria for fresh and canned fish and coli during the storage period and anaerobic bacteria of canned Mullte fish. The study's data also agreed with the concept of HACCP through the absence of fish products from pathogenic bacteria (Ababouch, 2002). The study agreed with Al-Shatti et al. (2012) that fish products were free from salmonella bacteria. It also agreed with what was shown by the Egyptian General Authority for Standardization and Metrology, the microbiological aspects of fish products such as canned tuna and canned sardines, and their absence from Escherichia coli in fish canned with brine (; Adel A (El Lahamy and Mohamed, 2020, EL-Dengawy et al. 2012). Weakness of Salmonella bacteria towards heat treatments and salt concentrations leads to its destruction. The results are also consistent with what was recommended by Nguyen et al. (2014) On canning mackerel. It also agreed with El-Shehawy and Farag (2019) when studying imported canned fish in Egypt. The study's results also agreed with (Al-Rubaiy *et al.*, 2020) when studying some biochemical and microbiological characteristics of some Mediterranean mullet fish. The study's results differed from (Agwa and Solomon (2016) in studying the microbial quality of canned fish stored at low temperatures and Laboratory temperatures and its public health importance.

#### **Bacillus bacteria**

The results of the microbial tests showed no appearance or evidence of any spot growth of any bacteria of anaerobic microorganisms during the end of the storage periods of the processed fish. This indicates the correctness or goal of the thermal process by reducing 90% of the microbial load during one logarithmic cycle (Li et al., 2018). In addition to the benefit of steam resulting from high pressure during the sterilization process in the elimination or destruction of organisms producing blackboards, Knorr et al. (2006) that the use of high pressure in food processing is sufficient to eliminate microorganisms and stop the enzymatic activity of microorganisms, which helped in prolonging the storage life For canned food fish. Study results differed from Cruz et al. (2022) in studying the microbial stability of canned sardines with three types of preservation medium.

#### **Anaerobic bacteria**

The results of the microbial examinations indicated that there was no growth of anaerobic bacteria for canning and that no variety was superior to the other through the least significant difference test schedule. Where it did not appear or indicate the presence of any spot growth of any bacteria for anaerobic microorganisms during the end of the storage period of the processed fish, this indicates the correctness or goal of the thermal process by reducing 90% of the microbial load during one logarithmic cycle (Li et al., 2018). In addition to the benefit of steam resulting from high pressure during the sterilization process in the elimination or destruction of living organisms producing blackboards, Knorr et al. (2006) that the use of high pressure in food processing is sufficient to eliminate microorganisms and stop the enzymatic activity of microorganisms, which helped in prolonging life Al-Khazni for canned food. The results of the study agreed with Fatma Arfat (1994). EOS (2005) and GCC Standardization Organization (GSO) (2012, 2013 and 2016). El-Shehawy and Farag (2019). Study results differed from Cruz et al. (2022) in studying the microbial stability of canned sardines with three types of preservation medium. Moreover, (Anwar et al. (2020) showed that the cooling process in cans after the sterilization process has an important role in inhibiting or eliminating microorganisms that are still alive.

#### **The effect of the canning process on the sensory characteristics of canned fish**

Organoleptic properties determine consumer acceptance of a product. During a sensory evaluation, a clear picture is formed in the consumer's mind through data collection, which produces a general perception of the product in terms of texture, colour, aroma and flavour. The sensory evaluation of the product was based on sensory scores given on a specified scale of values for tests for quality changes after storage

Table (3) Sensory evaluation of canned fish

class trait	average acceptance rate		
	Mullte	mackerel	Talange Queen
taste (10)	8.10	8.60	9.00
Smell(10)	7.70	8.60	8.70
Texture(10)	7.80	8.80	8.90
Color(10)	8.00	8.20	8.90
Appear(10)	7.90	8.20	8.80
General cceptance(50)	41.30	46.00	44.90
Total average(100)	80.8	88.4	89.2
<b>LSD=NS</b>			

## Taste

### 1: Taste

Table (3) shows that the Talange Queen fish was superior to the other varieties in terms of taste. The results of the statistical analysis showed that there were no significant differences at the level ( $p \leq 0.05$ ) between the varieties, and the average acceptance of the taste between the varieties for Talange Queen, Mackrele, and Mullte was (9.00, 8.60, 8.10), respectively, with an acceptance score of (10), and the average scores are very acceptable to me. They canned fish products. This is due to the reliance on the quality of the raw materials used in the canning industry, the packaging conditions, and the lack of excessive-high thermal treatments. Furthermore, Medina et al. 1998); Schellekens 1996). Heat treatment (cooking and sterilization) can stabilize, decompose, or further react to many fish components. The researchers also confirmed (Varzakas et al., 2014; Cyprian et al., 2017) that when using accurate conditions of time and temperature during both heat treatments, the degree of retention of most components of fish remains at an acceptable level provided that high-quality raw materials are used. In order to obtain maximum nutrient retention. Blanching offers many functions, the most important of which is inhibition of enzymatic reaction, reducing the microbial load of food before additional processing, expelling cellular gases, and improving the flavor and color of the food. Blanching is used to prevent enzyme activity during storage. However, most foods suffer a significant loss in quality if they are not boiled. Therefore, the food is heated to a predetermined temperature to achieve proper enzyme inactivation, then rapidly cooled to near-ambient temperatures. This step is a pre-treatment that is normally performed between raw material preparation and subsequent processes. Moreover, by testing the least significant difference L.S.D, it was observed that the Talange Queen variety excelled over the rest of the varieties, the taste acceptance rate was (9.00), and the lowest value was for the Mullte variety, where the average taste was (8.10). The taste character was not affected during the preservation period. The sensory evaluation results of the taste or taste characteristic agreed with (El-Shehawy and Farag (2019) in a study evaluating the safety of some imported canned fish using chemical, microbiological and sensory methods. The study's results differed with (Naik et al. (2014) to study the quality of canned fish during storage.

### 2- Smell

The smells of fish products play a major role in consumers' lives, stimulating or reducing appetite or acceptance of the product. Testing the smells of canned products is important due to the possibility of knowing spoiled food by consumers. The statistical analysis results showed no significant differences at the level ( $p < 0.05$ ) between varieties of canned fish for the characteristic of smell. The results of the evaluation of odor tolerance were consistent with (Triqui and Bouchriti (2003) in a study evaluating the freshness of Moroccan sardines, where it was shown that fresh fish leads to a decrease in the amount of volatile substances, which mostly consist of trimethylamine and carbonyl compounds. The study's results agreed

with (Maheswara et al. (2011) in a study on heat treatments in tuna canning. The results of the study also agreed on the values of odor evaluation with (El-khamisy et al. (2021) to study the physical, chemical, microbiological and sensory evaluation of tuna products.

### 3- Color

The results of the statistical analysis showed that there were no significant differences in the color characteristic between varieties of canned fish (Mullte fish, Mackrele fish, and Talange Queen fish) at a significant level ( $p \leq 0.05$ ). And between the L.S.D test, the Talange Queen fish was superior to the rest of the other two varieties. The color evaluation results are very acceptable. This is attributed to the reliance on the quality of the raw materials used in the canning industry. And among (Olusola and Jónsson 2019; Medina et al. 1998; Schellekens 1996) heat treatment (cooking and sterilization) can lead to the stabilization, decomposition or additional reactions of a large number of fish components. Actual research shows that when precise conditions of time and temperature are used during both heat treatments, the degree to which most components of fish are kept at an acceptable level provided high-quality raw materials. (Guinee, 2013). The goals of sterilization inside can include destroying pathogenic microorganisms to ensure food safety, inactivating enzymes and killing spoiling microorganisms to ensure the required shelf life, and producing the required organoleptic properties through proper cooking of the product without fundamental changes in nutritional quality. Blanching offers many diverse functions, the most important of which are inhibition of enzymatic reaction, reducing the microbial load of foods before further processing, expelling cellular gases, and improving the flavor and color of the food. Blanching inhibits enzyme activity during storage, but most foods suffer a significant loss in quality if they are not boiled. To achieve proper enzyme inactivation, the food is rapidly heated to a predetermined temperature and then rapidly cooled to near-ambient temperatures. As such, it is not intended as a sole means of preservation but as a natural pre-treatment between raw material preparation and subsequent processes (Varzakas et al., 2014; Cyprian et al., 2017). The results of the study to evaluate the color of canned fish agreed with (El-Shehawy and Farag (2019) in a study evaluating the safety of some imported canned fish using chemicals, microbiological and sensory methods. The study's results differed with (Naik et al. (2014), studying the quality of canned tuna during Storage extended.

### 4- Texture

Table (3) shows the texture rate and the role of the thermal process in preserving the texture of canned fish. The results of the statistical analysis showed that there were no significant differences at a significant level ( $p < 0.06$ ) between canned fish varieties for Mullte, Mackrele and Talange Queenfish. And between the L.S.D test, the Talange Queen canned fish excelled over the rest of the two classes, as the highest average value was (8.90), and the lowest average value was for Mullte fish, which reached (7.80). This may be attributed to the difference in the muscular composition of fish and other chemical components. The raters consider the results rate acceptable for canned fish products. The results of the study agreed on the acceptance of the texture when using accurate conditions of time and temperature appropriate during both heat treatments, the degree of retention of most components of fish remains at an acceptable level with the requirement to use high-quality raw materials, which in turn maintains the texture of the fish and not to be subjected to battering (Guiné, 2013). The results of the study to evaluate the color characteristic of canned fish agreed with (ElShehawy and Farag (2019) in a study evaluating the safety of some imported canned fish using chemicals, microbiological and sensory methods. The results of the study agreed with (Maheswara et al. (2011) to study studies on heat treatment of tuna. Also, the results of the study agreed with (El-Shehawy and Farag (2019) to study the safety of some imported canned fish by chemical, microbiological and sensory methods. The study's results differed with (Naik et al. (2014) to study the quality of canned tuna fish during storage.

### 5- The appearance

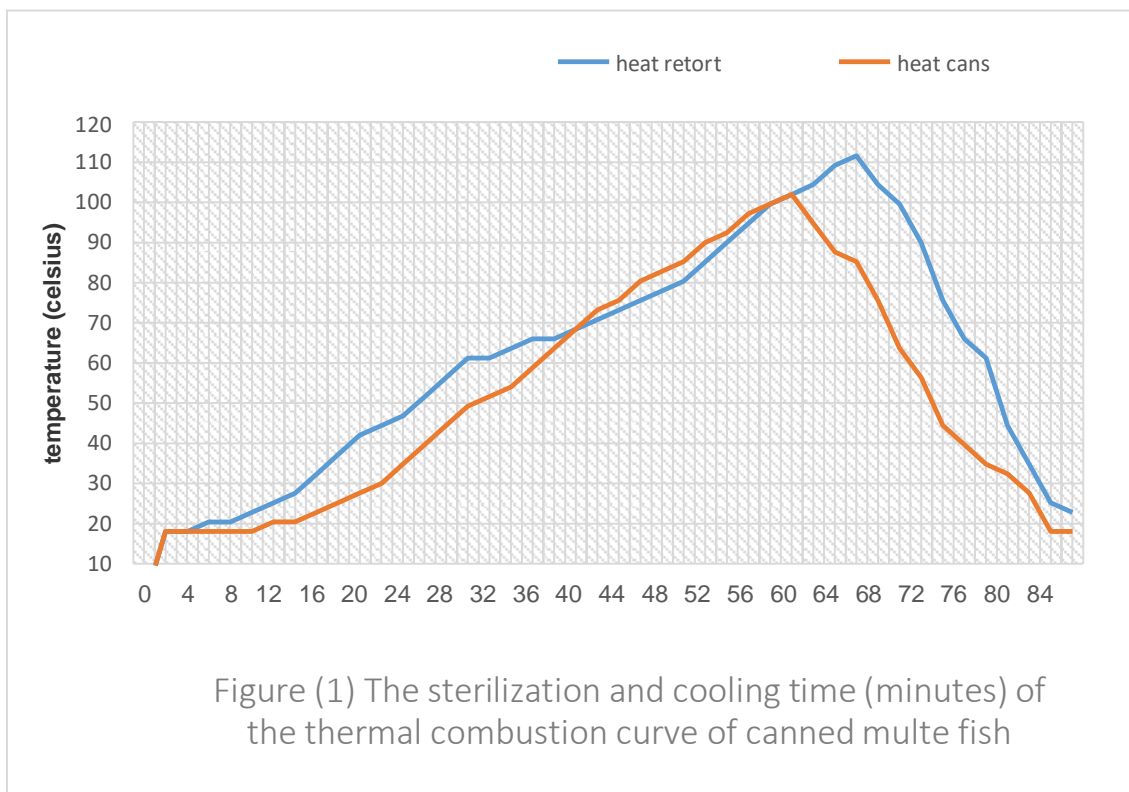
Table (3) shows the results of the appearance characteristic, as it is noted through the degrees of presentation with a very good estimate that the thermal process and storage time do not affect the appearance characteristic, as is the case with the percentage of salt concentration. The results of the study agreed with both (Maheswara 2009; Naik et al. 2014; George and Saralaya 1990; Suresh Kumar 1984) about the stability of canned fish products and their acceptability throughout the storage period, which depends on the extent of heat treatment design and its suitability for the food material, where heat treatment (cooking and

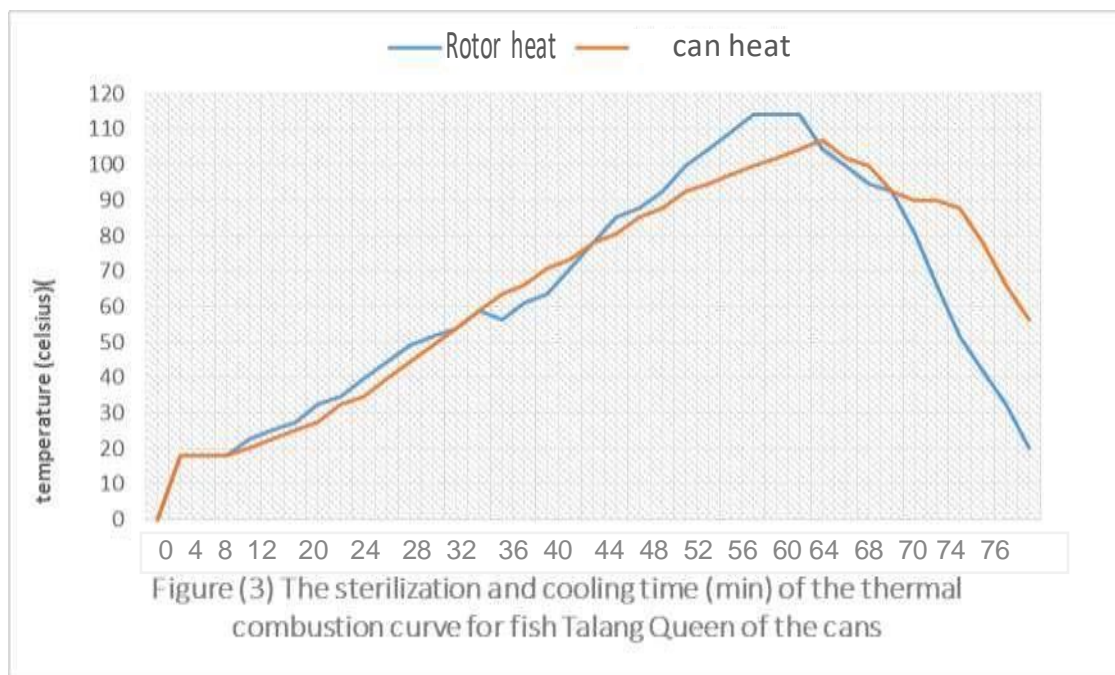
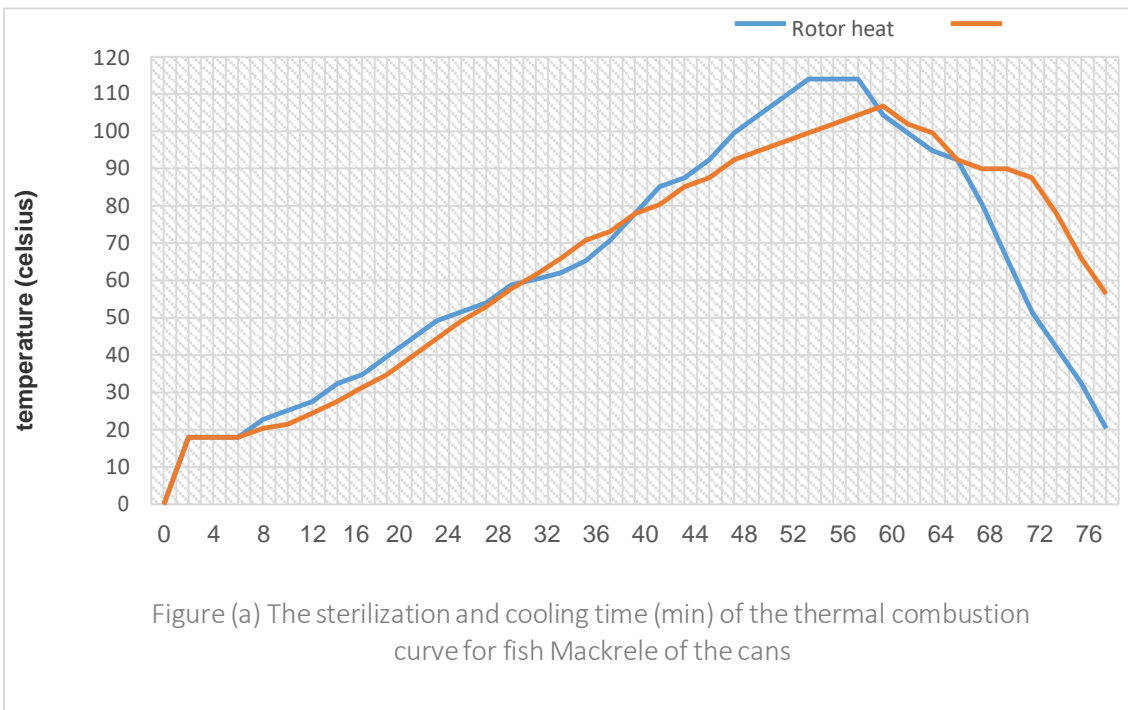


sterilization) leads to disintegration and different reactions for several With the use of precise conditions of time and temperature during both heat treatments, the degree to which most of the fish ingredients are kept at an acceptable level is conditional on the use of high-quality raw materials. In order to obtain maximum nutrient retention. The statistical analysis results showed significant differences at the level ( $p \leq 0.05$ ) between canned fish items.

### 6- General acceptance

The statistical analysis results showed slightly significant differences at the level ( $p \leq 0.05$ ) between canned fish items. Table (3) shows the superiority of the sensory characteristics of Talange Queen fish over other varieties; the reason for this may be attributed to the large pieces of Talange Queen fish in addition to the initial heat treatments that did not affect much the characteristics of texture, color, appearance and flavor, which made acceptance generally acceptable to the arbitrators. The decrease in the value of F had a role in producing safe microbial products that are safe and stable in storage without harming the flavor, texture, color and other nutrients (Ababouch, 2000).





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