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# Physicochemical Properties and Sensory Evaluation of Ready to Eat Tilapia in Tomato Sauces

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**Abstract**

This study examines the qualities and consumer appeal of ready-to-eat tilapia in tomato sauces, prepared using retort processing. By focusing on tilapia, a widely farmed and versatile freshwater fish, this research introduces a fresh approach to creating convenient, nutritious, and long-lasting food products that cater to modern consumer needs. The retort processing method using fresh fish, carried out at 121°C for 40 minutes, ensures the product quality and ideal texture. Key aspects of the product, including texture, moisture content, viscosity, colour, and pH, were carefully analysed to understand how different formulations impact its physical and chemical properties. The sensory analysis test was conducted with 40 panellists using a 7-point hedonic scale to evaluate product characteristics such as appearance, aroma, texture, taste, and overall acceptance. Among the formulations tested were the control formulation, the formulation with food additives and seasonings, and the formulation without food additives and seasonings. The results of the nutritional analysis show that tilapia in retort bags has an energy content of 106 kilocalories (kcal) per 100 grams, including a high protein quantity (10.3 g) and a fat content (1.9 g). Relatively, this product also contains a high salt content of 487 mg per 100 grams, which should be considered with nutritional considerations. Overall, formulation 2 is the best formulation in this study and this study highlights the potential of retort technology to make tilapia more accessible and versatile in the food market. It also shows opportunities for improvements in formulation to increase production rates and enhance consumer satisfaction. With the production of innovative products and ready-to-eat products like this, this study aligns with current trends in producing quality food for today's lifestyle.

## 1. Introduction

Tilapia, a group of freshwater fish, is highly valued in aquaculture for its adaptability and rapid growth. It includes several species, the most notable being Nile Tilapia (*Oreochromis niloticus*), Mozambique Tilapia (*Oreochromis mossambicus*), and Blue Tilapia (*Oreochromis aureus*). Nile tilapia, originally from Africa and the Middle East, is widely cultivated due to its robust nature and efficient conversion of plant-based diets into high-quality protein. Tilapia ranks as the second most cultivated fish globally, with its production increasing fourfold in the last ten years due to its adaptability to aquaculture, demand in the market and consistent pricing [1]. In Malaysia, red hybrid tilapia (*Oreochromis sp.*) and black tilapia are the second most farmed freshwater fish, following catfish. The fish is favoured for its sweet, mild flavour and flaky texture, which can vary depending on

water quality and diet. It is also an affordable source of nutrition, offering significant health benefits. For instance, a 3.5-ounce (100-gram) serving of red tilapia contains 26 grams of protein and only 128 calories, along with essential minerals like niacin, phosphorus, and potassium [2].

Tilapia fish is a highly perishable commodity, prone to rapid spoilage after death due to enzymatic and microbial actions. This spoilage can result in unpleasant taste, smell, and texture, significantly reducing consumer acceptability [3]. Tilapia is a widely used and well-liked fish in the worldwide market, known for being inexpensive, nutritious, and having a subtle taste. It is often available for purchase in different variations, such as fresh, frozen, filleted, and whole fish. The gentle flavour and delicate consistency of tilapia are popular for a variety of cooking methods, including grilling, baking, frying, and steaming. Tomato sauce serves as a popular gravy for ready-to-eat tilapia fish dishes. To prepare the sauce, tomatoes are cooked until they achieve the desired consistency, with or without added spices. Typical spices include onion, garlic, cloves, cardamom, black pepper, cumin, cinnamon, red chili, sugar, and salt. Tomato sauce is in high demand, with customer satisfaction closely tied to its quality attributes, including colour, flavour, and texture.

Thermal processing refers to the method of heating food in airtight containers for designated time and temperature combinations to eliminate harmful and spoilage-inducing microorganisms [4]. Retort pouch is a flexible package for ready to eat meals. It is made of aluminium foil and polymer that is resistant to sterilization processes. This pouch has been widely used for sterilized fish products to replace cans, therefore makes the products less expensive and more efficient. The thin profile of retort pouch permits a less heating time thus avoids over-cooking. Tilapia fed and grown in such unsanitary conditions may be more susceptible to bacterial infections such as salmonella. Despite those benefits, the production of retort pouches requires costly special machines, not to mention that the packaging process is slower and more complicated than that of cans. This investigation confirms that tilapia in tomato sauce has a soft texture and bones that are as fragile as sardines in tomato sauce. At the same temperature of 121º Celsius, we are able to examine the use of time to soften the bones of tilapia fish. To soften the bones of tilapia fish, retort processing should take about 20 minutes. The effects of retort treatment on tilapia in tomato sauce were demonstrated using physicochemical analyses such as colour, viscosity, texture, pH, and sensory evaluation before and after processing.

## 2. Methodology

### 2.1 Materials

The ingredients utilized for the product include tilapia fish, tomato puree, oil, sugar, spices, salt, seasoning, parsley and thickener (modified corn starch) will be purchased from local store near Pagoh and Muar.

### 2.2 Formulation of Ready to Eat Tilapia in Tomato Sauces

This formulation of produce ready to eat tilapia in tomato sauce was shown on Table 1. It comprises the formulation in gram.

**Table 1** Three formulation of Ready to Eat Tilapia in Tomato Sauces

| Ingredients | Formulation 1 (g) | Formulation 2 (g) | Formulation 3 (g) |
|---|---|---|---|
| Tilapia fish | 3 pcs | 3 pcs | 3 pcs |
| Tomato puree | 90 | 90 | 90 |
| Sugar | 15 | 15 | 15 |
| Oil | 10 | 10 | 10 |
| Salts | 5 | 5 | 5 |
| Spices | - | - | 3 |
| Seasonings | - | 3 | - |
| Thickener (Modified corn starch) | - | 2 | - |
| Parsley | - | 0.2 | - |

### 2.3 Preparation of tilapia fish.

Tilapia fish, the main ingredient in ready to eat tilapia in tomato sauce recipe, was sourced from suppliers in Muar, Johor. The preparation process begins with separating the head, fins and scales of tilapia fish to ensure a

pleasant eating experience. The tilapia fish will be rinsed with lime to remove the fishy smell of the fish. After 5 minutes, the tilapia fish will be rinse with plain water, making it ready for the retort process.

## 2.4 Preparation of tomato sauce.

The preparation of tomato sauce start with heating some of oil in a large saucepan over medium heat. Next, tomato puree that have been weight was poured in the hot oil. Season the mixture with a salt and sugar to balance the acidity of the tomatoes. For other formulation, it should added other ingredient like seasoning, spice, parsley and thickener.

## 2.5 Physicochemical Properties Analysis

### 2.5.1 Texture Profile Analysis

The texture analysis using a Texture Analyzer (TA-XT2i, Stable Micro System, Surrey, England) was equipped with a HDP/3PB, three-point bend rig. The speeds were recorded during the pre-test and post-test were both 1mm/s with distance 3 mm. The TPA measured various texture parameters, including consistency and hardness. The results were triplicated and averaged, with standard deviation calculations.

### 2.5.2 Moisture Content

The moisture levels in the tilapia were measured using an MX-50 A&D rapid moisture analyser from Japan. Following the analyser's instructions, 2-gram samples of dried tilapia in tomato sauce were tested at 160ºC.

### 2.5.3 Viscosity

Viscosity, a measure of a liquid's resistance to flow, was determined using a viscometer or rheometer. The "thickness" of the liquid was measured at a specific time by calibrating an AMETEK Brookfield DV2T viscometer [5].

### 2.5.4 Colour

The colour of the tilapia cooked in tomato sauce was analysed using a Hunter LAB MiniScan EZ 4500 Spectrophotometer. Three variables were used to capture the colour: L* (lightness), a* (red and green coordinates), and b* (yellow and blue coordinates).

### 2.5.5 pH

The pH meter was calibrated with a buffer solution, and the pH of the tilapia in tomato sauce was measured using a EUTECH pH 700 digital pH meter. The electrode was rinsed with distilled water between samples.

## 2.6 Sensory Evaluation

The tilapia cooked in tomato sauce underwent a sensory assessment test using a modified 7-point hedonic rating scale. Each set contained three samples for distribution to panellists. The senses evaluated included appearance, texture, aroma, taste, and overall quality. Panellists were scored on a seven-point hedonic scale, ranging from 1 (dislike very much) to 7 (like very much). The data collected was analysed using analysis of variance (Minitab) with commercial software.

## 2.7 Nutritional Value

Analysing the nutritional value is crucial for determining the balanced proportions of essential energy, total sugars, sodium, total carbohydrates, protein, total fat content, and minerals. This information is vital for nutritional labelling on food products.

# 3. Results and Discussion

## 3.1 Physicochemical Analysis

### 3.1.1 Texture Profile Analysis

The Instrumental Texture Profile Analysis (TPA) is a significant development in the realm of sensory analysis. It is currently commonly utilized in the food business and scientific community. TPA is whose parameters can be connected with sensory textural qualities [6].

**Table 2** The hardness of ready to eat tilapia in tomato sauces

| Sample | Hardness |
|---|---|
| 1 | $4.05\pm1.14^{A}$ |
| 2 | $4.44\pm1.47^{A}$ |
| 3 | $4.91\pm0.73^{A}$ |

Tilapia fish is divided into two parts which is the top and the tail. Based on the graph, they can assume that the high peak represents the upper portion of the fish. This is because the upper half of the fish contains more meat than the tail. As a result, the fish's various parts have distinct textures.

Texture profile analysis was used in this study to provide information on texture for ready to eat tilapia in retort pouches of retort technique which were hardness as represented in Table 2. The texture profile analysis test involved compressing the tilapia fish three replicates to mimic the biting action, measuring parameters such as hardness which is resistance to initial compression. The hardness of tilapia ranged from 4.05 to 4.91 which was no significantly different as the ($p < 0.05$), thus the time of retort processed did not implicate the hardness attribute of tilapia.

### 3.1.2 Moisture Content

Moisture content for the 3 samples of ready to eat tilapia in retort pouches was determined and the result is tabulated. The value of moisture content shows the quantity of water contained in the sample hence the lowest value of moisture content is desired result.

**Table 3** The results of moisture content of ready to eat tilapia in tomato sauces

| Sample Number | Moisture Content |
|---|---|
| 1 | $57.84\pm0.02^{A}$ |
| 2 | $58.11\pm0.08^{B}$ |
| 3 | $62.65\pm0.04^{\xi}$ |

Moisture content analysis result show that sample1 has the lowest moisture which its mean is 57.84±0.02. Sample that come out with the highest moisture content is sample 3 with mean 62.65±0.04. This is because, the moisture content of spice was different hence the moisture of the end product was differed.

### 3.1.3 Viscosity

Different types of formulation of ready to eat tilapia in tomato sauce produce different viscosity. Viscosity decreases as temperature increases. Viscosity is measured to analyse the thickness of tomato sauce and its resistance to flow which it can determine a good quality of sauce. The data of viscosity results were shown in table to present the precise reading of viscosity at 23°C temperature using different spindle size. Different spindle sizes are used for samples 1, 2 and 3 because the viscosity of each impacts the material contained in each sample.

**Table 4** Results of viscosity using different spindle size at temperature 23°C

| Sample Number | Temperature | Spindle Size | Viscosity (cP) |
|---|---|---|---|
| 1 | 23°C | 05 | $2047.33\pm12.01^{A}$ |
| 2 | 23°C | 06 | $3465.00\pm5.00^{B}$ |
| 3 | 23°C | 06 | $2552.0\pm38.6^{\xi}$ |

The highest reading of viscosity is sample 2, where the mean of viscosity is 3465.00 cP at 05 spindle size. This indicate that sample 2, that consist of same ratio of tomato sauce, is the thickest texture of sauce. Meanwhile, the sample that has the lowest viscosity is sample 1 with viscosity reading 2047.33 cP using 06 spindle size. Sample 1 that consist of control formulation is the less viscous texture and is the easiest to flow. Sample 3 have a high viscosity than sample 1 because the size and distribution of spices particles can affect the sauce's rheological properties. Bigger particles might not engage with the liquid phase as efficiently as smaller particles or dissolved solids, leading to a milder effect on viscosity. Both samples were observed at the temperature remains relatively constant at around 23°C.

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Factors that affect the viscosity of tomato sauce is the addition of modified corn starch where the different temperature and concentration of modified corn starch gave the different viscosity level. The gelatinization process enhances the viscosity of the sauce by breaking down corn starch molecules through heat and water, enabling them to bond with more water. When corn starch is heated, the starch granules swell and soften, losing their rigid crystalline structure. As a result, amylopectin from the granules leaches into the surrounding water, thickening the sauce. The sauce becomes even thicker as it cools [7].

### 3.1.4 Colour

An analysis was conducted to examine the colour variations of ready to eat tilapia in tomato sauces subjected to different formulation tomato sauces. The study included a control sample and measurements were obtained using a Hunter LAB spectrophotometer. The colour of each sample ready to eat tilapia in tomato sauces was determined and subsequently reported in Table 5 as follows.

**Table 5** Result colour of ready to eat tilapia in tomato sauces

| Sample | Unit | Value |
|---|---|---|
| 1 | $L^*$ | $44.85\pm0.19^{A}$ |
| 2 | | $43.13\pm0.05^{B}$ |
| 3 | $^{c}$ | $42.25\pm0.09^{c}$ |
| 1 | $a^*$ | $4.84\pm0.28^{A}$ |
| 2 | | $6.07\pm0.03^{B}$ |
| 3 | | $8.13\pm0.06^{c}$ |
| 1 | $b^*$ | $4.41\pm0.19^{A}$ |
| 2 | | $-0.36\pm0.06^{B}$ |
| 3 | | $0.94\pm0.10^{c}$ |

The quality of lightness is a distinctive characteristic found in various food products, contributing to their identification and serving as a significant colour attribute that impacts consumer acceptability. The L* value is a measure of the lightness index of a product, which represents its surface characteristics. This value is influenced by whether the product's surface reflects or absorbs light [8]. Table 5 represents the value for lightness of each sample that has significant differences ($p$<0.05) as it ranges from 44.85 to 42.25.

### 3.1.5 pH

The analysis of pH value of ready to eat tilapia in tomato sauces was determined and results were tabulated. The pH value indicates the acidic properties of the sample where the lower the pH value, the more acidic the sample is. Acidic condition can preserve the sauce by slowing the formation of bacteria and mold [9].

**Table 6** Results of pH of ready to eat tilapia in tomato sauces

| Sample Number | pH |
|---|---|
| 1 | $3.56\pm0.10^{A}$ |
| 2 | $3.48\pm0.08^{A}$ |
| 3 | $3.47\pm0.05^{A}$ |

Data shows that sample 3 appear with the lowest pH value where its mean is 3.47±0.05. Sample 3 is the formulation with % chili which contain the capsaicin. Sample 1 shows the high reading of pH value where its mean 3.56±0.10. The absence of bacterial activity that makes alkaline chemicals and elevates the pH could justify maintaining the pH in this range [10].

## 3.2 Sensory Evaluation

Sensory evaluation of 3 samples of ready to eat tilapia in tomato sauces was evaluated by 40 panellists. The panellists were given a score sheet of 7-point hedonic scale with attributes of appearance, aroma, colour, texture, taste and overall acceptance. The results of each attribute were tabulated in Table 7.

**Table 7** Result of mean and standard deviation of each attribute in sensory evaluation

| Run | Appearance | Aroma | Colour | Texture | Taste | Overall acceptance |
|---|---|---|---|---|---|---|
| 1 | 5.80±0.91$^{A}$ | 5.65±1.12$^{A}$ | 6.03±1.03$^{A}$ | 6.00±0.78$^{A}$ | 6.03±0.92$^{A}$ | 6.08±0.94$^{A}$ |
| 2 | 6.13±0.85$^{A}$ | 5.90±1.13$^{AB}$ | 6.00±0.85$^{A}$ | 6.05±0.96$^{A}$ | 6.08±1.16$^{A}$ | 6.08±1.05$^{A}$ |
| 3 | 5.78±1.23$^{A}$ | 5.10±1.13$^{B}$ | 5.90±1.30$^{A}$ | 5.43±1.24$^{B}$ | 4.70±1.49$^{B}$ | 5.03±1.35$^{B}$ |

Appearance is evaluated by the colour of sample. The tomato sauce is in red colour but it becomes slightly bright as it mixed with thicker (modified corn starch). With a slightly different of appearance, the colour between samples could become slightly differed and sample 2 turned out to be looked more attractive to panellist's sight.

The basis of odor perception is the contact between chemical molecules, mainly in the gaseous sate, which can be detected by the olfactory epithelium. This evaluation was carried out by sniffing the samples and rate scale of likeness in the score sheet form whether they like the aroma or not. Since the samples contain tilapia that contribute to the fishy smell, this might affect the aroma of sample. Moreover, the highest rate of likeness, at average scale of 5, the aroma of sample 2 is considered like slightly where the fishy smell of tilapia fish was eliminated.

For colour attributes, the highest acceptance is sample 1, 6.03±1.03 and the lowest was sample 3, 5.90±1.30. This is due to the formulation that sample 1 is control tomato sauce that does not have adding food additive or spice. Because of the original colour from tomato paste, the panellists might just accept the sample 1 as being light. Colour preference might affect consumer's subjective perception, resulting in changes in consumer behaviour [11].

Texture of samples is evaluated once the sample felt by the tongue. As the tilapia sample come with solid food texture, mouthfeel is the parameter to measure the quality of texture. Sample 2 is the best texture over other samples because its viscosity of tomato sauce formed perfectly during cooking and retort processed with the presence of modified corn starch. All samples underwent a 40-minute retort process using various tomato sauce formulations. The type of sauce is expected to influence the texture of the fish.

Taste attributes were evaluated once the sample reached the taste bud at tongue where it can perceive the taste of salt, sweet, sour, spicy, bitter and umami. The fishy taste of tilapia fish that contain in ready to eat tilapia might affect the taste of sample however the sourness of tomato sauce that was added had overpower the fishy taste in the ready to eat tilapia and balancing the taste. Sample 2 had the highest scale of likeness which it at scale 6, averagely.

From the data of sensory evaluation, it shows that sample 2 is the most acceptable sample since the mean of its overall acceptance is the highest, 6.08±1.05. Overall acceptance is an attribute that is solely based on the overall likeness of the sample without affected by any other detailed characteristics. Sample 2 is the formulation of tomato sauce that contain 0.18% of parsley, 1.75% seasonings and 2.63% of thickener. The high percentage of thickeners probably contribute to this result because of the thickeners gives a different texture to tomato sauce compared to other formulations. Nevertheless, as stated by [12], the incorporation of starches reduced the moisture level and enhanced the viscosity of the tomato sauce.

## 3.3 Nutritional Value

The nutrient analysis of ready to eat tilapia in tomato sauces was analysed to determine the energy content, total sugars, sodium, carbohydrates, protein and total fats levels. The results were tabulated in Table 8.

**Table 8** Nutrition value of formulation 2 ready to eat tilapia in tomato sauces.

| NUTRITION INFORMATION | | |
|---|---|---|
| Serving Size : 100 g | | |
| | Per 100 g | Per Serving (100 g) |
| Energy | 447 kJ | 447 kJ |
| | 106 kcal | 106 kcal |
| Total Carbohydrates | 12 g | 12 g |
| Protein | 10.3 g | 10.3 g |
| Total Fat | 1.9 g | 1.9 g |

| | | |
|---|---|---|
| Total Sugars | 5.6 g | 5.6 g |
| Sodium | 487 mg | 487 mg |

The ready to eat tilapia in tomato sauces is a relatively moderate-calorie count, offering only 106 kcal per serving which is low than sardine in tomato sauce calorie. Nevertheless, protein and fat content were characterized with 10.3 gram of protein and 1.9 gram of fat per serving. Carbohydrates constitute the majority if its calories, contributing 12 grams per serving. Total grams of carbohydrates in tilapia in tomato sauces are higher than sardine in tomato sauce which is 1.1 grams per 100 grams.

Additionally, this sample stands out for its high sodium content, exceeding 487 mg per serving, which is quarter by recommended sodium intake per day. As stated by [13], the intake of sodium per day is recommended less than 2000 mg/day. The weight of salt added is only 15 g for 250 g of sample. This product typically includes sauces or is seasoned to improve flavour, which can additionally elevate sodium levels. Other than that, seasonings that used as a food preservative in tomato sauce of ready to eat tilapia in tomato sauces also contribute to the high level of sodium content. High levels of sodium are associates with negative health effects such as elevated blood pressure. To reduce sodium intake, the reformulation of food product to have reduced salt content and the establishment of target thresholds for salt levels in foods and dishes. In conclusion, this food appears to be a moderate-calorie, low-protein and low-fat option rich in carbohydrates and sugars, but its significant sodium content is considered high in the context of individual dietary needs and goals.

## 4. Conclusion

The aim of this study was to develop a ready to eat tilapia fish in tomato sauces using retort processing. The recorded physicochemical properties show a mean moisture content of 57% to 63% for tilapia, compared to 60% to 70% for sardines. The tilapia's mean pH is 3.56, lower than sardines' range of 4.0 to 4.6, while its viscosity varies from 2047.33 cP to 3465 cP, indicating notable differences. Sensory analysis indicated sample 2 excelled in most attributes, while sample 1 led in colour. Nutritional content for tilapia was recorded as 106 kcal, 12 g carbohydrates, 10.3 g protein, 1.9 g fat, 5.6 g sugar, and 487 mg sodium per 100 g. Formulation 2 shows high market potential and diversification of tilapia use.

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## Conflict of Interest

Authors declare that there is no conflict of interests regarding the publication of the paper.

## Author Contribution

*The authors confirm contribution to the paper as follows:* ***study conception and design:*** *Nurhaziqah Md Salleh, Faridah Kormin;* ***data collection****: Nurhaziqah Md Salleh;* ***analysis and interpretation of results:*** *Nurhaziqah Md Salleh, Faridah Kormin;* ***draft manuscript preparation:*** *Nurhaziqah Md Salleh, Faridah Kormin. All authors reviewed the results and approved the final version of the manuscript.*

## References

[1] Prabu, E., Rajagopalsamy, C. B., Ahilan, B., Jeevagan, I. J., & Renuhadevi, M. (2019). Tilapia – an excellent candidate species for World Aquaculture: A Review. Annual Research & Review in Biology, 1–14.
[2] Lucas. (2023, January 12). Red Tilapia vs black tilapia - which is the better fish? FuncFish. https://funcfish.com/red-tilapia-vs-black-tilapia/
[3] Basak, P., Ali, Md. S., Isra, L., Rahman, Md. H., & Haq, M. (2023). Effects of thermal and salt water soaking pre-treatment on the physicochemical and nutritional properties of sundried tilapia fish (Oreocromis niloticus) products. Heliyon, 9(11).
[4] Pratap Singh, A., Yen, P. P.-L., Ramaswamy, H. S., & Singh, A. (2018). Recent advances in agitation thermal processing. Current Opinion in Food Science, 23, 90–96.
[5] Garcia, J. M., Chambers, E., Matta, Z., & Clark, M. (2005). Viscosity measurements of nectar- and honey-thick liquids: Product, liquid, and time comparisons. Dysphagia, 20(4), 325–335.
[6] Rahman, M. S., Al-Attabi, Z. H., Al-Habsi, N., & Al-Khusaibi, M. (2021). Measurement of Instrumental Texture Profile Analysis (TPA) of foods. In Springer eBooks (pp. 427–465).
[7] Chin, T. (2024, September 17). A guide to cornstarch. Serious Eats. https://www.seriouseats.com/what-is-cornstarch-

5324865#:~:text=As%20you%20hydrate%20and%20heat,the%20mixture%20generally%20becomes%20thicker.
[8] Singh, B., Khamrui, K., Debnath, A., Lodh, J., Gupta, H. R., & Prasad, W. (2017). Sensory and colour profile of milk-coconut sweet as a function of ingredients. Indian Journal of Dairy Science, 70(5), 491-495.
[9] Rahman, M. S., & Rahman, M. R. T. (2020). Ph in Food Preservation. ResearchGate.
[10] Monteiro, M. L. G., Márcico, E. T., Mano, S. B., Da Silveira Alvares, T., Rosenthal, A., Lemos, M., Ferrari, E., Lázaro, C. A., & Conte-Junior, C. A. (2018). Combined effect of high hydrostatic pressure and ultraviolet radiation on quality parameters of refrigerated vacuum-packed tilapia (Oreochromis niloticus) fillets. Scientific Reports, 8(1).
[11] Luo, D., Yu, L., Westland, S., & Mahon, N. (2019), The influence of colour and image on consumer purchase intentions of convenience food. Journal of the International Colour Association, 24, 11-23.
[12] Indrianti, N., Ratnawati, L., Kumalasari, R., Sholichah, E., & Afifah, N. (2024). Physicochemical and sensory properties of pasta sauce thickened by different starches. AIP Conference Proceedings, 3055, 060018.
[13] WHO, W. H. O. (2023, September 14). Sodium reduction. https://www.who.int/news-room/fact-sheets/detail/salt-reduction