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Physicochemical and Microbiological Changes in Halal Tipas: Maguindanaon Delight

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ABSTRACT

As one of their traditional delights, Tipas has been consumed by the Maguindanao people for generations. It is a delicacy that represents the pride and identity of the Maguindanaons. In addition to being served at special occasions, it is sometimes used as a snack as well. This study was conducted to determine the physicochemical and microbiological Changes during storage. The Tipas was packed individually and stored under 30 ± 2 °C (ambient temperature). The samples were analyzed for water activity, microbiological contaminants (Total Plate Count, Yeast and Mold Count, Coliform Count, E. coli, and Salmonella), and sensory attributes (odor, appearance, and flavor/taste) over a period of 3 months, with evaluations at 7 time points: Month 0, 0.5, 1, 1.5, 2, 2.5, and 3. The results show that Tipas is relatively stable in terms of its appearance/color and odor. The microbiological and water activity tests results are all within the set standard limits and the Tipas is stable until the end of shelf-life study. Overall, the Tipas is relatively stable in terms of microbial, organoleptic, and physicochemical properties when stored at 30+2ºC. The stability of Tipas indicates that it can maintain its quality and safety over time, which makes it a reliable product for consumers. It is important to consider these findings when developing products and marketing strategies. The shelf life of Tipas is three (3) months.

Keywords: *Tipas, Physicochemical, Microbiological Changes, Sensory Evaluation, Shelf-life*

1. INTRODUCTION

Tipas is one of the traditional delights of the Maguindanaon people that has been consumed for generations. Served on special occasions, these delights contribute to Maguindanaon pride and identity. According to Guerrero et al. (2009), traditional foods have historically contributed to the sense of pride, identity, and heritage of different cultures through their roles in traditions and customs. These foods often reflect a community's cultural heritage and identity (Burlingame, 2000).

Often used as a snack, Tipas is a wheat flour product. Several new products have been developed in recent years to attract consumers in the snack food industry (Yuksel & Kayacier, 2016). It is a good source of energy for humans and contains a high carbohydrate content, which makes it an abundant cereal resource in China. To promote advanced wheat processing and the development of related products, much research has been conducted on wheat-based snacks (Kayacier, Yüksel, & Karaman, 2014; Mann, Schiedt, Baumann, Conde-Petit, & Vilgis, 2014). This will enable consumers to choose from a range of wheat products in addition to bread, noodles, and cakes.

Wheat flour is primarily composed of starch (70–75%), water (14%), and proteins (10–12%). According to Goesaert et al. (2005), starch typically contains 25–28% amylose and 72–75% amylopectin. The starch content of potato flour is approximately 77%, while its amylose ratio is lower than that of wheat flour (Jagadeesan, Govindaraju, & Mazumder, 2020). The main protein in potato flour is patatin. Potato flour dough is substantially less viscoelastic than wheat flour, despite the fact that patatin has good functional properties including solubility, gel-forming ability, foaming, and emulsifying effects (Fu, Liu, & Soladoye, 2019). After hydration and mixing, wheat protein forms a three-dimensional viscoelastic dough. Delcour et al. (2012) classify these proteins as gluten-forming (gliadins and glutenins) and non-gluten-forming proteins. As a continuous viscoelastic gluten network, gluten proteins form an essential component of wheat flour (Singh & MacRitchie, 2001). In wheat flour-based foods, such as bread and noodles, glutenin subunits and glutenin macropolymers (GMP) determine their characteristics (Goesaert et al., 2005; Hong et al., 2021).

There are several ways to prepare cereal chips, including frying, baking, and microwave cooking. A frying method was used to make Tipas in this study. Most commercial chips are fried at high temperatures (140–190 °C); thus, they contain high amounts of oil and can contribute to obesity and other chronic diseases. As a result, they may negatively influence consumers who prefer healthier foods with low-calorie content (Doan et al., 2020). In contrast to fried chips, baked chips have attracted consumers' attention as a healthier snack option. Dry air-baked chips (140–190 °C, 3–10 minutes) with lower oil content satisfy consumers' demand for non-fried foods, especially among those concerned about diet and health (Doan et al., 2020

). Another alternative to conventional production is microwaving. In addition to saving cooking time and energy, it preserves the nutritional value of the food (Ekezie, Sun, Han, & Cheng, 2017; Kutlu et al., 2021). Microwave heat cooks the food internally by absorbing microwave energy, while the surrounding cold air condenses the evaporated water from the food (Chandrasekaran, Ramanathan, & Basak, 2013). However, food products produced using this method lack crispiness and have not been widely adopted in industrial production. Other kinds of commercial chips made from fruits or vegetables are typically dehydrated and dried by osmosis (Pravitha, Manikantan, Kumar, Beegum, & Pandiselvam, 2021; Su, Zhang, Chitrakar, & Zhang, 2021).

The objective of this study was to determine the nutritional, microbial, and sensory evaluation of Tipas.

2. MATERIALS AND METHODS

2.1. Ingredients

All ingredients were purchased from a mall supermarket in Cotabato City. These ingredients were certified halal by one of the halal certification boards in the Philippines. This ensures that the ingredients meet specific dietary standards, quality, and safety. Furthermore, supporting halal-certified products promotes inclusivity and respect for diverse cultural and religious practices. The ingredients include all-purpose flour, evaporated milk, baking powder, and white sugar. Eggs were also purchased from the same store.

2.2. Preparation of Materials and Ingredients

All utensils were properly washed to eliminate harmful bacteria, prevent foodborne illness, avoid contamination, and ensure food safety. This also ensures that the ingredients' flavors and quality are not compromised.

The ingredients for the Tipas were weighed and measured before preparation. A dough was then formed by mixing and blending the ingredients. To smooth out the texture, the dough was kneaded. It was then rolled out and cut into parallelograms. Once ready, the pieces were fried until light brown, usually taking 1–2 minutes. Once cooked, the Tipas were removed from the oil and drained on paper towels. After draining, they were allowed to cool completely to ensure crispness. Once cooled, they were carefully placed into stand-up pouches with dimensions of 165 mm × 290 mm × 90 mm. Each pack of Tipas contained 25 grams.

2.3. Shelf-life Evaluation

The Tipas samples were submitted for shelf-life evaluation to SGS Philippines, Inc. Tests for bacterial load, physicochemical properties, and sensory quality were conducted. A Tipas sample analyzed for Day 0 was sent to the laboratory on August 3, 2021. The remaining samples used in the succeeding tests were stored at 30 ± 2 °C (ambient temperature), pulled out at given sampling intervals, and analyzed for defined parameters, as shown in Table 1.

Table 1. Sampling Frequency

Test Parameter	**Sampling Frequency**						
	Month 0	**Month 0.5**	**Month 1**	**Month 1.5**	**Month 2**	**Month 2.5**	**Month 3**
Sensory Evaluation (Appearance/Color, Taste/Flavor, Odor	X	X	X	X	X	X	X
Chemical/Physical Test (Water Activity)	X	X	X	X	X	X	X
Microbiological Tset (TPC, YMC, Coliform, E.coli, Samonella)	X	TPC, YMC, and Coliform only	TPC, YMC, and Coliform only	TPC, YMC, and Coliform only	TPC, YMC, and Coliform only	TPC, YMC, and Coliform only	TPC, YMC, and Coliform only

2.4 Methodologies

Microbiological testing was conducted using the standardized methodologies outlined in the FDA Bacteriological Analytical Manual (BAM). To determine the Total Plate Count (TPC), the Pour Plate Method was used (FDA BAM Ch. 3), which

involves mixing the sample with agar and pouring it into a plate. The plate is then incubated, and the resulting colonies are counted to determine the total number of viable microorganisms present.

The Yeast and Mold Count (YMC) was also determined using the Pour Plate Method (FDA BAM Ch. 18), similar to the method used for TPC. This test is used to quantify the number of yeasts and molds present in the sample.

Additionally, the Coliform Count was determined using the Most Probable Number (MPN) method (FDA BAM Ch. 5), which involves diluting the sample and inoculating it into a series of tubes containing selective media. The tubes are then incubated, and the resulting growth is observed to estimate the number of coliform bacteria present.

The Escherichia coli (E. coli) count was determined using the Spread Plate Method (FDA BAM Ch. 4), which involves spreading the sample onto a plate containing a selective medium. After incubation, colonies are counted to determine the number of E. coli bacteria present.

Finally, Salmonella detection was conducted using the Conventional Method (FDA BAM Ch. 5), which involves enriching the sample and inoculating it onto selective media. The resulting growth is confirmed through biochemical and serological tests to detect the presence of Salmonella bacteria.

Physical and chemical tests were conducted in accordance with the AOAC Official Method, 20th Edition, 2016. Water activity (aw) was measured using this method, which is widely recognized and accepted for determining the water activity of foods and other products. Studies that have used this standardized method demonstrate that the results of the water activity (aw) measurement are reliable, accurate, and comparable.

The sensory attributes of the sample—including odor, appearance, and flavor/taste—were evaluated by trained panelists using a scoring method (Mabesa, 1986). This method enabled panelists to assess changes in sensory attributes over time. The panelists were trained to detect and describe the sensory characteristics of the sample, and their scores were used to determine the overall acceptability of the product. By using this method, the study aimed to provide a comprehensive understanding of the sensory changes that occur in the product during storage.

Results and Discussion

3.1 Sensory Evaluation

The sensory evaluation findings indicate that the product maintained its quality during the 3-month storage period. While there were minor changes in appearance—from light brown to golden brown—the taste and odor remained consistent and typical of chips. This suggests that the product is stable and retains its desirable sensory attributes over time.

The average rating for appearance/color decreased from 2.73 at Month 0 to 2.40 at Month 3. The ratings fluctuated throughout the storage period but increased slightly at Month 2.5. In terms of odor (off-odor), the average rating decreased from 2.09 at Month 0 to 2.00 at Month 3, remaining relatively stable throughout storage. A similar decrease in the average rating for taste (off-taste) was observed—from 2.09 at Month 0 to 2.00 at Month 3.

Using the rating scale provided:

Appearance/Color: Changed from "Light brown" (Month 0) to "Golden brown" (Month 3).

Odor: Remained "Typical of chips (no off-odor)" throughout storage.

Taste: Remained "Typical of chips" throughout storage.

Based on the sensory evaluation results, the product's quality remained relatively stable over the 3-month storage period, with only minor changes observed in appearance/color.

Analysis	Month 0	Month 0.5	Month 1	Month 1.5	Month 2	Month 2.5	Month 3
Appearance /Color	2.73	2.45	2.27	2.45	2.36	2.36	2.40
Odor (off odor)	2.09	1.82	2.00	2.00	2.00	2.00	2.00
Taste(off taste)	2.09	1.91	1.91	2.00	2.00	2.00	2.00

Rating	Appearance/Color	Odor (off odor)	Taste (off taste)
1	Very light brown	Odorless	Bland
2	Light brown	Typical of chips (no off odor)	Typical of chips (no off odor)
3	Golden brown	With slight off odor	With slight off taste

4	Brown	With moderate off odor	with moderate off taste
5	Dark Brown	With pronounced off odor	With pronounced off odor

3.2 Microbiological Evaluation

Further, the following are the key findings: For total plate count, the Tipas has a relatively low total plate count, ranging from 10 to 120 CFU/g, which is within the acceptable range (m = 100). For Yeast and Mold Count, the results indicate that the Tipas has a yeast and mold count of 10 CFU/g, which is acceptable (m = 100). As to Coliform Count, the Tipas had 1.8 MPN/g, which is within the acceptable range. In terms of Escherichia coli, the results show that the Tipas has an E. coli count of 1.8 MPN/g, which is within acceptable tolerances. Then for Salmonella: The results of the tests indicate that there is no Salmonella present in 25 g of the product. Based on the microbiological analysis results, the product meets the microbiological standards set by the Philippine National Standards (PNS) and the Food and Drug Administration (FDA) for Ethnic Flour-Based Confectioneries and Ready-to-Eat Savories – Snack Foods. The Tipas is stable until the end of the shelf-life study.

Analysis	**Mon 0**	**Mon 0.5**	**Mon 1**	**Mon 1.5**	**Mon 2**	**Mon 2.5**	**Mon 3**	**Standard Limit** *PNS?FDA 32:2011:Ethnic Flour Based Confectioneries **FDA Circular No. 2013-10 ; eady to Eat Savories – Snack Foods
Total Plate Count, CFU/g	40	<10	10	<10	120	30	20	1.000**
Yeast and Mold Count	<10	<10	<10	<10	<10	<10	<10	m= 100* M= 1000*
Coliform Count,MPN/g	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	<1.8	10
Eschrechia coli Count, MPN/g	<1.8							-
Salmonella	Absent in 25g							Negative

Note: < means no colony growth was observed on tubes or plates.

m is the acceptable level of microorganism determined by a specified method; the values are generally based on levels that are achievable under GMP.

M is the level which when exceeded in one or more samples would cause the lot to be rejected as this indicates potential health hazard or imminent spoilage.

3.3. Chemical/Physical Test Result

During the 3-month storage period, the water activity (aw) of the product fluctuated between 0.4813 and 0.5268 at 25.01°C. Comparing Ethnic Flour-Based Confectioneries with Standard Limits, the standard limit for water activity (aw) in ethnic flour-based confectioneries is 0.60, as specified in PNS/FDA 32:2011. As a result of the findings, the product's water activity (aw) remains within the acceptable range of ≤0.60 throughout the storage period. It appears, however, that the product is sensitive to changes in storage conditions, such as temperature and humidity, given the fluctuations in water activity (aw) values.

Analysis	Month 0	Month 0.5	Month 1	Month 1.5	Month 2	Month 2.5	Month 3	Standard Limit PNS/FDA 32:2011 Ethic Flour-Based Confectioneries
Water activity, aw	0.4867at 25.01ºC	0.4885 at 25.01ºC	0.4813 at 25.01ºC	0.4917 at 25.01ºC	0.5268 at 25.01ºC	0.5003at 25.01ºC	0.5241 at 25.01ºC	≤0.60

3. CONCLUSION

Based on the results and discussion presented, Tipas is relatively stable in terms of microbial, organoleptic, and physicochemical properties when stored at 30 ±2ºC. The stability of Tipas indicates that it can maintain its quality and safety over time, which makes it a reliable product for consumers. It is important to consider these findings when developing products and marketing strategies. The shelf life of Tipas is three (3) months. Developing products that have a longer shelf life enables them to be distributed and stored for a longer period of time, thereby reaching more consumers without sacrificing quality. Hence, manufacturing costs can be reduced, and operational efficiency can be increased. Furthermore, a reliable shelf life increases consumer trust and satisfaction, which can result in increased brand loyalty and market share.

4. RECOMMENDATIONS

 Continuously monitor the product's sensory, microbiological, and chemical/physical attributes to detect any changes that may affect its quality and safety.

 Optimize the product's packaging, storage conditions, and formulation to maintain its quality and safety throughout its shelf life.

 Maintain GMP and quality control measures to ensure the product's quality and safety.

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