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Effects of Egg Content on the Quality and Shelf-Life of Boiled Noodles (Miki)

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Abstract: This main objective of this study is to determine the effects of different egg concentration on the quality and shelf-life of boiled noodles or commonly called *miki*. It involves two phases: Phase 1-Establishment of acceptable concentration of fresh beaten eggs in cooked and uncooked boiled noodles and Phase 2- Shelf-life evaluation of uncooked boiled noodles with different egg concentrations stored at room and refrigeration temperature. Boiled noodles were added with different egg concentration from 20%, 40%, 60%, 80%, and 100% as the control.
Uncooked and cooked boiled noodles were analyzed based on color, texture, taste and color using Sensory Evaluation. These were also analysed based on percentage water absorption, pH, and texture. Microbial analysis, specifically the Total Plate Count (TPC), and *Salmonella* detection were likewise conducted for the shelf-life determination.

Key Words: Boiled Noodles (miki); egg content; pH, *Salmonella* detection; sensory evaluation; microbial analysis; Total plate count (TPC)

1. Introduction

Noodles are a form of alimentary paste that comes from various flour. It is produced in varieties of shape and form, like strings, ribbons, or sheets or as spaghetti, macaroni, or lasagna, depending from the origin of the cuisine (De Leon and Gatchalian, 1992). Noodles is generally made up of wheat flour, water, salt and alkaline salt solution with or without coloring matter. In the Philippines, boiled noodles or commonly known as miki is defined as flat or medium round yellowish noodles; made from flour, lye, salt, water and fat that are mixed and formed into a dough. The dough is flattened and cut into prefered thickness, the noodles are boiled, drained and oiled (Guzman, et. al., 1977). Boiled noodles is available in market as parboiled (60%-90% complete cooking or depending on the condition of the noodle strand's core) (Ranhotra,1998). Before boiled noodles is consumed it is cooked completely in boiling water for five to ten mins or until the white core of the noodle strand disappered as cited by Widjay (2010) from Kubomura (1998) and Nagao (1996).

Fresh egg serves as an optional ingredient in noodles. It provides a firmer texture and improves the flavor. However, the addition of fresh eggs leads to a faster rate darkening and spoilage of the noodles (Hou, 2001). The addition of egg proteins helps to form an insoluble network that traps starch granules and controls gelatinatizion more effectively. (Nouviaire et. al., 2008). Egg also acts as an thickening agent. The process of pregelatinization of noodles is affected when noodles is cooked and then dried such that it becomes dispersable in cold water and absorbs again the water to thicken.

Nowadays, noodle manufacturers limit the use of fresh eggs in noodles due to different reasons in such of economical nature and food safety reasons. Instead of using fresh egg as a raw material, other substitute ingredients are being used such as dehydrated whole egg powder instead

of fresh egg because it serve as same use as preventing bubbles forming in the noodles (Kubomura, 1998). Other allowable food additives and functional addition used are guar gum, locust bean gum, alginates and carboxymethyl cellulose (CMC) (Hou, 2001) for enhancing firmer texture, and increases in water absorption in pre-boiled noodles.

Improper processing and storage of boiled noodles could allow the growth of microorganisms, including *Salmonella spp.,* commonly found in raw eggs and egg products. In recent events, presence of *Salmonella* organism caused a alarm in food contamination outbreaks for our food safety and health. In 2011, Nestle Philippines Inc. voluntarily recall all Maggi Rich Mami Noodles Beef and Chicken Flavors nationwide due to the traces of Salmonella found in the noodle products (Phillipine FDA, 2011). Simmilar outbreak was reported in Australia where it was discovered that the noodles from Buono Pasta Company at Klemzig was contaminated by Salmonella spp, and traced to be the source of the outbreak due to eggs used in the noodle production (Australian Department of Health, 2006). Salmonella presence was found in the egg noodles of Real Taste Noodle Manufacture that was recalled by the US FDA for Salmonella contamination in Sep 8, 2010 in US.(US FDA, 2010).

Ingestion of foods containing the organism could lead to Salmonellosis which result in diarrhea, fever, and abdominal cramps (CDC, 2012). For this reason, the researcher comes up with a study on the effects of the addition of eggs to boiled noodles and its quality and microbiological properties, specifically Salmonella organism.

2. Materials and Methods

The ingredients of boiled noodles (flour, fresh egg, salt and lye solution) were bought in Balintawak public market, and the recipe of the boiled noodle is standard from Executive Development Academy (undated

I. Standard procedure for preparation of boiled noodles

The procedure for boiled noodles used in this study was based from the procedure for "miki" from a hand-out of the Executive Development Academy (undated). The amounts of ingredients based on 1 kg of flour are as follows: 300ml water, 30g salt, diluted 1% lye solution and 100g fresh eggs.

II. Boiled noodles with different concentration of fresh eggs

The standard procedure in the processing of boiled noodles was used with varying concentrations of fresh beaten eggs at 20%, 40%, 60%, 80% and 100% which serves as the control. Zero percent (0%) concentration was not applied because of noticeable color difference between the samples. The percentage of the fresh beaten egg was based from the total liquid used in the dough instead of weight of the flour.

III. Sensory Evaluation

The boiled noodle samples uncooked (parboiled) and cooked (fully cooked) from each formulations were arranged in paper plates uniformly, coded with a 3 digit number and randomly presented to the sensory panel for evaluation composed of 30 untrained panelist using Multi Comparison Difference Test score sheets based on color, texture, aroma, flavor and general acceptability using 1-9 point Hedonic Rating Scale (Gatchalian and Brannan, 2009).

IV. Physico-Chemical evaluation

a. pH determination

The pH value of the boiled noodle samples were determined by the AOAC (2005) method. Ten (10) grams of boiled noodles were weighed and placed in a beaker. An equal volume of distilled water was mixed with the sample and stirred for 5 minutes. The pH of the samples were measured by standardized pH meter.

b. Determination of percentage water absorption

Boiled noodle strands are weighed and cooked. The cooked noodle strands were then

placed in cold water, drained, wiped with paper towels.The gain in weight after cooking was recorded in percent (%) water absorption (Beta and Corke, 2001).

c. Texture analysis

Texture analysis was conducted at the Food Processing Division Laboratory of the ITDI-DOST. It is an estimation of the hardness or texture measured on the extent of penetration of a standard needle using penetrometer with a load of 150g for 5 seconds.

Boiled noodle samples were placed on the test shelf. The needle tip was slowly adjusted to just touch the surface of the sample by adjusting the movable assembly. The needle shaft was released and held free for five seconds. The indicator shaft was gently depressed until it is stopped by the needle shaft. The penetration was read from the indicator scale as one tenth of a millimeter. (ASTM Annual Book of Standards, 1993).

V. Shelf life evaluation

The uncooked boiled noodle samples used in this phase were packed in polyethylene bags stored at room and refrigeration temperatures. Sensory evaluation and pH determination, total plate count (TPC) and Salmonella detection were conducted with a 3 day interval until the samples become unacceptable.

d. Salmonella detection and Total plate count (TPC)

The method used for detection of Salmonella spp. and TPC is from Compendium 4th ed., APHA (2001).

VI. Statistical Treatment of Data

Statistical measure used to determine the significant differences that exist on the sensory attributes of boiled noodles was the Analysis of Variance (ANOVA) or F-Test.

3. Results and Discussions

Phase 1. Establishment of acceptable concentration of fresh beaten eggs in uncooked and cooked boiled noodles

I. Sensory Evaluation

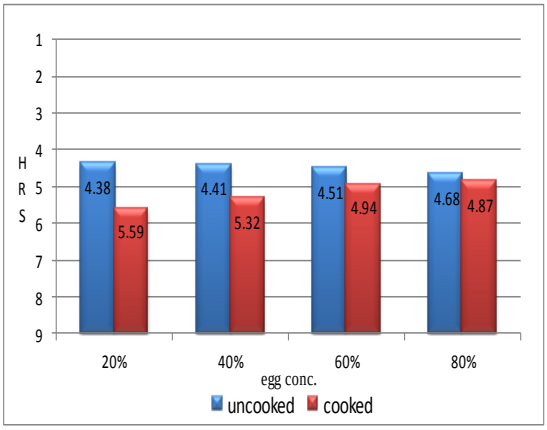


Figure 1. Mean scores for color of uncooked and cooked boiled noodles with different egg concentration.

For color. Figure 1 shows the results for the trials. The uncooked boiled noodles (UBN) with 20% added fresh beaten eggs (FBE) got the highest mean of 4.38 with descriptive rating of "slightly better than R" and 80% with the lowest mean of 4.68 corresponding to "equal to R". The cooked boiled noodles (CBN) with 80% FBE added got the highest mean of 4.87 with descriptive rating of "equal to R" and 20% with the lowest mean of 5.59 corresponding both with "slightly inferior to R" description.

Statistical treatment of the data used at five (5) percent level of significance the UBN samples have no significant difference in terms of color, although slight changes in color from off white to pale yellow were detected. This is due to the percentage of fresh beaten eggs added which indicates slight effect on color. The CBN samples have shown significant differences. DMRT reveals that: for trial 3, CBN with 20% has significant difference from that with 80% and 60%. This is an indication that additon of FBE in CBN affects its color. This associated to the egg yolk's carotenoids

property which impart a yellowish color in the BN samples (Ruxton, 2009).

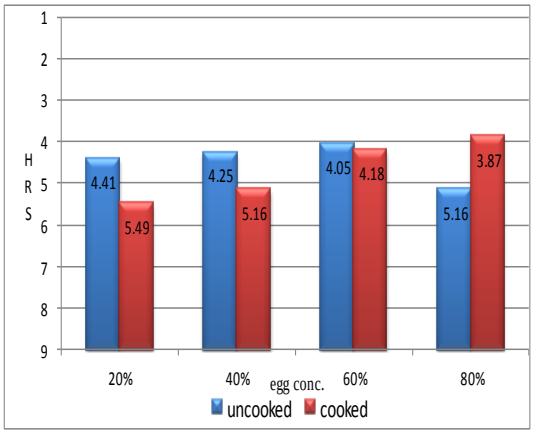


Figure 2. Mean scores for texture of uncooked and cooked boiled noodles with different egg concentration.

For texture. Figure 2 shows the results for the trials. The UBN with 60% added FBE got the highest mean of 4.05 with descriptive rating of "slightly better than R" and with 80% with the lowest mean of 5.16 corresponding to "equal to R". The CBN with 80% added FBE got the highest mean of 3.87 with equivalent rating of "Slightly better than R" and 20% got the lowest mean of 5.49 that corresponds to "Slightly Inferior than R".

Statistical treatment of the data used at five (5) percent level of significance the UBN samples have significant difference in terms of texture. This implies that addition of different concentration of fresh beaten egg affects the texture of boiled noodles. As the concentration increases from 20% to 60%, texture becomes firmer but increasing the addition of egg to 80% and 100%, texture becomes soft and soggy. The addition of eggs at a very high concentration affects texture due syneresis wherein the liquid from the fresh beaten egg weeps out from the semi-swollen boiled noodles.(Guzman, et. al., 1977).

The CBN samples shows significant differences among each other. DMRT results reveals that: CBN with 20% FBE is significantly different from CBN with 80% and 60%. But not with 40%. CBN with 40% FBE added is significantly different from that with 60% and 80% but not with 20%. This is an indication that egg concentrations affect the texture of the CBN, the higher the concentration the firmer the texture becomes. This affirms the role of eggs in noodles that is imparting a firm texture.

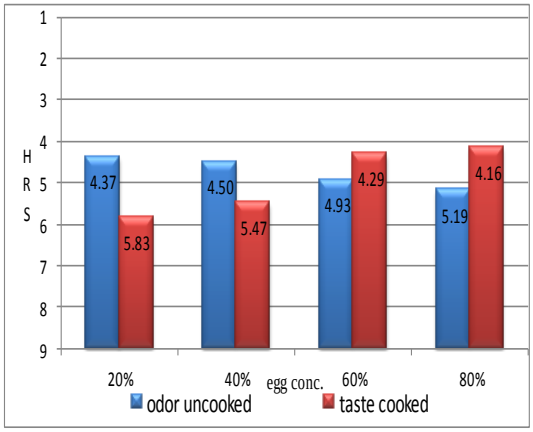


Figure 3. Mean scores for odor of uncooked and taste of cooked boiled noodles with different egg concentration

Figure 3 shows the results of the trials. For odor of UBN, the 20% added FBE get the highest mean of 4.37 with descriptive rating of "slightly better than R" and with 80% with the lowest mean of 5.19 corresponding to "equal to R". The taste of CBN with 80% added FBE get the highest mean of 4.16 with equivalent rating of "slightly better than R". and 20% got the lowest mean of 5.83 which corresponds to "slightly inferior than R".

Statistical treatment of the data used in shows that there are significant differences at five (5) percent level of significance. DMRT revealed significant differences. Results reveals that for UBN samples;, UBN with 80% is significantly different from UBN with 60%, 40% and 20%. UBN with 60% egg concentration is significantly different from that with 20% and 40%. This indicates that addition of fresh beaten eggs affects the odor of boiled noodles, as the concentration increases the odor becomes fishy which is attributed to the odor of eggs (Guzman, et. al., 1977).

II. Physico-chemical evaluation

Table 1. Results of percentage water absorption of uncooked and cooked boiled noodles with different egg concentration

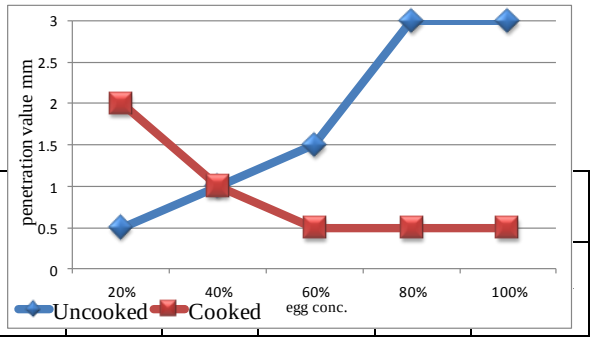
Table 1 shows the results of the percentage water absorption of the UBN and CBN samples. The percentage water absorption of the UBN samples which is based on the weight before and after parboiling. The percentage water absorption of the UBN samples increases as the concentration of added FBE increases which means that addition affects percentage absorption. This is an indication that water binding and thickening properties of egg in relationship to the percentage water absorption of uncooked boiled noodles during gelatinization in parboiling.

The percentage water absorption of the CBN reveals that as the egg concentration increases, the percentage of water absorption increases so addition is directly proportional to water absorption. This is an indication of the water binding and thickening properties of egg in relationship to the percentage water absorption of cooked boiled noodles during cooking process.

Table 2. Results of pH determination of uncooked and cooked boiled noodles with different egg concentration

Concentration (%)	Uncooked	Cooked
20%	8.0	6.80
40%	8.0	6.90
60%	8.10	7.20
80%	8.30	7.40
100%	8.50	7.50

Table 2 shows the results of the pH determination of the UBN and CBN samples with different egg concentrations. Slight increased in pH values of UBN and CBN samples are observed as the egg concentration increases which show that there is a slight effect on pH. This explains that egg white is one of the greatest source of alkaline among usual foods (Guzman, 1979) and addition to different products also affects pH values.



20%	100g	122g	22%	136g	36%
40%	100g	125g	25%	141g	41%
60%	100g	130g	30%	143g	43%
80%	100g	133g	33%	145g	45%
100%	100g	137g	37%	148g	48%

Figure 4. Results of texture analysis of UBN and CBN with different egg concentration

The measurement shows that UBN samples penetration values increases as the egg concentration increases which implied that texture is affected. This means that texture becomes softer/soggy as the addition of egg increases as shown with that of 80% and 100% with higher penetration values and that with 20% to 60% with lower penetration values. This expresses that the ability of beaten eggs, particularly the egg whites, to helps incorporate air in dough mixing that affect the textural properties and resulting to softening (Kubomura, 1998). Another factor on the softening of texture is the addition of eggs at a very high concentration causing syneresis where in the liquid from the fresh beaten egg weeps out from the semi-swollen boiled noodle (Guzman, et. al. 1977)

The result of the CBN samples with different egg concentration shows that penetration values decreases as the egg concentration increases. This means texture becomes more firmer as the addition of egg increases, this also explains the effect of heat/temperature or cooking on the coagulating

Table 8. Shelf life determination of uncooked boiled noodles

property of eggs. Coagulation is affected by temperature, time and amount of egg used. Increasing the amount or concentration of eggs lowers the gelation temperature gives a comparatively stiffer or firmer cooked noodles (Claudio, De Leon and Guzman, 1977).

Phase 2. Shelf life evaluation of uncooked boiled noodles with different egg concentration stored at room and refrigeration temperatures

Table 3 shows the results of the shelf-life determination of the UBN. The shelf-life of the UBN with 60% added FBE stored at room temperature is 3 days. Signs of spoilage like foul odor, sliminess, and changes in color from light to dark yellow are noted, total plate count almost reached the maximum limit, mold growth and positive of Salmonella were noted on the sixth day of storage. The shelf life of UBN with 60% FBE stored at refrigeration temperature is four to five days. The shelf life of UBN with 100% added FBE stored at room temperature is between one to two days. The UBN sample with 100% added FBE stored at refrigeration temperature is between 4-5 days..

The pH of all the UBN samples with 60% and 100% stored at both tempetatures decreases continuously from the 3rd to the sixth day of storage and observation. This means all the samples become acidic. The spoilage of BN samples occur when the reaction or breakdown of the chemical components of the food, including its proteins, lipids, and carbohydrates were denatured it involve reactions with protein and other ingredients brought about by enzymatic or microbiological activity.

Overall results, the shelf-life of the boiled noodles is affected by the egg concentration added. 60% addition gave a longer shelf life than the 100%.

4. Conclusions

The sensory parameters based on color, texture, aroma and flavor of the uncooked and cooked boiled noodles are affected by the concentration of the egg added. For uncooked boiled noodles, as the egg concentration increases, texture becomes soft and soggy and fishy odor were noted. For cooked boiled noodles, as the egg concentration increases texture becomes firmer and enhance egg flavor. The percentage water absorption, pH and texture are affected by the egg concentration added. For uncooked boiled noodles, percentage water absorption, pH and texture are directly proportional to egg concentration. For cooked boiled noodles, percentage water absorption and pH are directly proportional to egg concentration but texture is inversely proportional. The shelf life of UBN with 60% FBE is longer than that of with 100% FBE.

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