Vol. 24 · March 2016
Print ISSN 2012-3981 • Online ISSN 2244-0445
doi: http://dx.doi.org/10.7719/jpair.v24i1.379
Journal Impact: H Index = 2 from Publish or Perish

JPAIR Multidisciplinary Research is produced
by PAIR, an ISO 9001:2008 QMS certified
by AJA Registrars, Inc.

Quality Characteristics of Nutri-fried Noodles Made from Sweet Potato Tubers and Tops *Ipomea batatas*

GERALDINE F. DE JESUS
geraldinefdejesus95@gmail.com
Sorsogon State College
Sorsogon, Philippines

SHIRLEY G. DICEN
shirleygdicen21@gmail.com
Sorsogon State College
Sorsogon, Philippines

MARIA CRISANTA M. JARQUE
crisantamj@gmail.com
Sorsogon State College
Sorsogon, Philippines

ABSTRACT

Noodles made from sweet potato can be a healthier alternative to commercially produced ones since it is rich in vitamins and minerals. The product has no artificial preservatives, and the sweetness of its taste comes naturally from the sugar content of the Camote tubers. The project is the second phase of a study on the development of nutri-noodles made from the tubers and tops of sweet potato. The study determined the physicochemical and microbial analysis and shelf-life of the product and verify its acceptability through quantitative testing. The sample was submitted to Department of Science and Technology Region V for analysis and the results were: 6.53% moisture, 0.13% free fatty acids and <150 CFU/g of yeast and mold count. Moreover, nutrition facts were also computed, Calories is 231, Total Fat= 4%, Cholesterol= 0%, Sodium= 4%, Total Carbohydrate= 6%,

Dietary Fiber= 28%, Magnesium =13% and Vitamin B6= 12%. The shelf-life of the product is six months stored at room temperature. The Nutri-fried noodles were served with vegetable toppings, and as rated by the panelists the result was liked very much. After analyzing the quality characteristics of the product, it is recommended that the sample is ready for production and marketing.

Keywords **—** Marketing, Quality, fried noodles, sweet potato, shelf-life, consumer testing, sorsogon, Philippines

INTRODUCTION

Food Safety is an urgent concern in the development and production of food products. It is defined as the assurance that the food will not cause harm to the consumer once it is prepared or eaten according to its intended use (Codex Alimentarius, 1999). Its importance is clearly reflected in the Food Safety Act of 2013 also known as RA 10611 (Congress of the Philippines). The act ensures that consumer health is protected by strengthening food safety regulatory system in the country. Integral to food safety is the determination of shelf-life and physicochemical and microbial analysis. Consumer testing, on the other hand, supports the acceptability of the food product.

The study is the second phase of a study on the development of Nutri-fried camote noodles. Noodles made from Camote is significantly rich in vitamins, potassium and electrolytes, thus, it is a healthy alternative to other noodles found in the market. Nonetheless, food safety must be taken into account before producing the noodles and making them commercially available. The safety of the product, Nutri-fried Camote Noodles can be determined through verification of its quality characteristics which comprises its physical, chemical, biological and microbiological components (USDA National Nutrient database).

Through these processes, presence of microorganisms such as *Listeria Monocytogenes* and other toxins is known. Furthermore, the shelf-life determination is essential during the development of food to assure both its safety and quality. The Codex Alimentarius 1999 defines shelf-life as the period during which a food product maintains its microbiological safety. Furthermore, it determines the suitability of food at a specified storage temperature and handling conditions.

Physico-chemical and microbial analysis and shelf-life determination are used in conducting researches related to food safety and product development. In the study of Agu and Okoli (2014), the physico-chemical, sensory and

microbiological assessment were used as the basis for product development in the biscuit industry. In another related research on sweet potato noodles, the effect of composite flours consisting of wheat and sweet potato flour on physicochemical and sensory properties of instant noodles was also studied. Shelf-life testing was further conducted to the dried instant noodles to determine its mold growth, texture, flavor and moisture content, (Taneya, Biswas, & Ud-Din, 2014).

To find out the desirable qualities of eight varieties of Sri Lankan rice and the quality characteristics of noodles made from these rice, their physicochemical properties were also investigated (Fari, Rajapaksa, & Ranaweera, 2011). In a study related to wheat noodles and unripe banana flour, the physiochemical, textural, cooking and sensory qualities of dried noodles were investigated (Ritthiruangdej, Parnbankled, Donchedee & Wongsagonsup, 2011). Through these processes, the dietary fiber content of unripe banana flour was also found.

On one hand, consumer testing is often used to determine the acceptability of the product. Singh-Ackbarali and Maharaja (2014) clearly pointed out that consumer testing is an approach which is participated by untrained individuals representing the population of end-product users. It is used to measure liking, preference, purchase intent, and consumption patterns that help in understanding product acceptance and consumer behavior. Furthermore, sensory evaluation is a process of passing a considered opinion with the use of the human senses on the object of the study. As a tool, it is of vast use in research and product development, consumer acceptance and even surveys. It is also important in grading and standardization storage studies and product attribute analysis.

Although, there are technological advances that made it possible for test procedures to determine product quality, there is still desired information which cannot be measured other than by human senses (Gatchalian & De Leon, 1992). Correlation studies between human judgments and objective test have been continuously evaluated to guarantee that there will be no shift in human perception with time. While chemical and physical measures are available for routine tests of product quality, some attributes are still measurable only by the use of Sensory Evaluation.

OBJECTIVES OF THE STUDY

The development of Nutri-fried Camote noodles was completed in the first phase of the study. The second phase aimed to evaluate the quality characteristics of Nutri-fried noodles made from Sweet Potato tubers and tops. Specifically,

this study aimed to determine: 1) The physico-chemical and microbial analysis of Nutri-fried noodles; 2) Product stability through shelf-life study; and 3) Consumer's acceptability of the product.

MATERIALS AND METHODS

For physico-chemical and microbial analysis, the Nutri-fried camote noodles were packed in a 500g low density polyethylene film and forwarded to Department of Science and Technology (DOST) Region V. The % moisture and %free fatty Acid FFA using TM-Ch-005 with reference to AOAC 930.04 19th Ed and Tm-Ch-020 reference to AOAC 940.28, 19th Ed respectively were analyzed. Likewise, yeast and mold count were examined. The method used was TM-M-013 with reference to AOAC 997.02 19h Ed. The basis for identifying the parameters used is the Codex Standard for Instant Noodles, (CODEX STAN 249-2006).

The nutritional value of food depends on its nutrient content and the bioavailability of these nutrients. Food Composition is determined by proximate analysis of carbohydrate, lipid and protein contents, and measurement of individual vitamins and minerals using standardized techniques. In computing for the nutrition information, the derived nutrient of each ingredient was radioed and summed up according to its weight in the formula. Furthermore, the percentage daily value was calculated by dividing the actual quantity by the appropriate recommended dietary intake or daily reference value. The reference to such computation can be found in the General Labeling requirements of the United States Food and Drug Administration (USFDA). Moreover, ingredient listing was also part of the nutrition facts panel. Raw materials used were arranged in sequence from its calculated weight in a decreasing manner.

In determining the shelf-life of the product, samples are packed in 100 gram, 4X6 low-density polyethylene film and stored inside a display cabinet under a room temperature. A total of 60 packs were prepared, and samples were evaluated every two months. Sensory Evaluation was used as a tool for measuring the product's characteristic and acceptability. This notion is accustomed to knowing the product attributes and quality levels in the degree of reference of the panelists. The statistical treatment employed in this research is 9 Point Hedonic Scale, also known as degree-of-liking scale which is used in determining product preference by consumers. This is so far the most widely used scale to measure food acceptability (Peryam & Pilgrim).

In evaluating the shelf-life, 20 persons were chosen as laboratory panelists composed of students, teaching, and non- teaching personnel of Sorsogon State College, Sorsogon City Campus. The panelists were selected considering the following factors and characteristics:

1. **Interest.** Panelists should exhibit interest to the product to be evaluated. A willing participant can effectively provide a sound judgment because attention is given to the product.
2. **Health.** Panel members should not only be interested with the evaluation, but they should be healthy. Health problems such as chronic sinusitis and allergic rhinitis can affect senses, thus, compromise the result of the sensory evaluation.
3. **Integrity.** The validity of the result strongly depends on the integrity of the panelists. It is important that answers to evaluation reflect honesty and openness of the evaluators.

On the other hand, consumer testing was conducted in three local communities in Sorsogon City, namely, Bibincahan, Balogo, and Pangpang. The researchers communicated with the heads of the three target communities to inform and ask their permission to administer consumer testing. A positive response was given, and the testing and evaluation were conducted in the Local Community Halls of Balogo and Bibincahan and Pangpang Heath Center. A total of 300 respondents (mostly household mothers and children) evaluated the product using a 9-point Hedonic Scale. The evaluation sheet was translated to the local vernacular so that it can be easily understood by the respondents. During the consumer testing, the researchers briefly introduced the product to be evaluated and explained the Hedonic Scale.

The Nutri -fried camote noodles were prepared with sautéed chicken and vegetable toppings. It was placed in shallow disposable cups with sealable plastic cover. Since the respondents were not given any training on sensory evaluation, they were only asked to taste the product according to their preferences. Identification of product characteristics or discrimination of the specified product attributes is not to be asked of to consumer panels. Hence, more often than not, a consumer panel is mainly utilized to measure product acceptability or preference (McCormick, 1978). A score sheet was distributed to each of the respondents with the following preferences:

(9) Like extremely (Gustuhununun)
(8) Like Very Much (Gustuhunon)
(7) Like Moderately (Gusto)
(6) Like Slightly (Medyo gusto lang)
(5) Neither like nor Dislike (Lain gusto, lain man habo)
(4) Dislike Slightly (Medyo habo)
(3) Dislike Moderately (Habo)
(2) Dislike very much (Habuunon)
(1) Dislike extremely (Habuununon)

After the consumer testing, the result of the evaluation was tabulated and computed. Weighted mean was used as the statistical tool in the study.

RESULTS AND DISCUSSION

Physico-chemical and Microbial Analysis

Based on the Codex Alimentarius Standard for Fried Noodles (2006), the parameters needed for the product are %moisture, % free fatty acids and yeast and mold count. As gleaned in the table, the results were still within the range of the required limit, 6.53%, 0.13% and <150 respectively.

Table 1. Result of Chemical and Microbial Analysis for Nutri-fried Noodles Utilizing Tubers and Tops of Sweet Potato

Sample	Sample Description	Parameters	Results	Method Used
Camote Noodles	Brown Camote Noodles packed in PE bag	**Moisture %**	**6.53** (*max 10%)	TM-Ch-005 with reference to AOAC 930.04, 19th Ed
		Free Fatty Acid FFA %	**0.13** (*max 2.0)	TM-Ch-020 with reference to AOAC 940.28, 19th Ed
		Yeast and Mold Count (YM Count Plate, Petrifilm 25C, 5 days)	**<150 CFU*/ g**(*max 1000)	TM-Ch-013 with reference to AOAC 997.02, 19th Ed

* Codex Alimentarius Standard for Fried Noodles (2006)

The computation (see Table 2) was based on the nutritional content of the raw materials used such as all-purpose flour, camote flour, camote tops and salt. The serving size is 100 grams. The result of the computed nutrition information provides evidence that the product is healthy and nutritious.

Table 2. Nutrition Information of Nutri Fried Noodles utilizing Tubers and Tops of Sweet Potato

Nutrition Facts	
Serving Size 100g Serving per Container	
Amount Per Serving	
Calories from Fat 0 **Calories** 231	
	% Daily Values*
Total Fat 2.44g	**4**%
Saturated Fat 0.36g	**2**%
Cholesterol 0mg	**0**%
Sodium 82mg	**4**%
Total Carbohydrate 17g	**6**%
Dietary Fiber 7g	**28**%
Sugars 0g	
Protein 4.5g	

Vitamin A 0%	Vitamin C 0%

Calcium0%
Vitamin B6 12% Magnesium 13% Iron 6% Vitamin 0%

*	Percent Daily Values are based on a 2000 calorie diet. Your daily values may be higher or lower depending on your calorie needs.

Product Stability and Shelf-life Studies

Table 3 shows the result of the shelf-life studies of the product. Freshly produced samples (four days after they were cooked) were used during the initial evaluation. Sensory Evaluation was held at the Food Microbiology Laboratory, Food Service Management Building. The chosen panelists evaluated the product in terms of its physical attributes such as taste, aroma, flavor and texture.

In the Hedonic scale method, the stimuli (actual samples or food names) are presented singly and are evaluated on a scale where the 9 categories range from "dislike extremely" to "like extremely." (Peryam & Pilgrim, 1957). Through this method, the panelists' preference and overall acceptability are determined. Since the product is freshly made, the likelihood of acceptability is higher as seen in the result.

Table 3. Sensory Evaluation Result for Nutri-fried Noodles utilizing Tubers and Tops of Sweet Potato (Initial Evaluation)

9 Hedonic Scale	Color	Aroma	Taste	Texture	Overall Acceptability
Like extremely (9)	10 (90)	8 (72)	15 (135)	10 (90)	
Like very much (8)	10 (80)	12 (96)	5 (40)	10 (80)	
Like moderately (7)					
Like slightly (6)					
Neither like nor dislike (5)					
Dislike slightly (4)					
Dislike moderately (3)					
Dislike very much (2)					
Dislike extremely (1)					
	8.5	8.4	8.75	8.5	**8.535**

It can be gleaned in the table the number of respondents who rated the sample for color and texture were just the same as the initial evaluation. However, for aroma, seven ranked the product as "like extremely" while thirteen rated it as "liked very much. Likewise, the value gained for taste is 8.70. As rated by the twenty panelists, the overall acceptability of the product is 8.5125 which is equivalent to "like very much".

Table 4. Sensory Evaluation Result for Nutri-fried Noodles utilizing Tubers and Tops of Sweet Potato (60 days)

9 Hedonic Scale	Color	Aroma	Taste	Texture	Overall Acceptability
Like extremely (9)	10 (90)	7 (63)	14 (126)	10 (90)	
Like very much (8)	10 (80)	13 (104)	6 (48)	10 (80)	
Like moderately (7)					
Like slightly (6)					
Neither like nor dislike (5)					
Dislike slightly (4)					
Dislike moderately (3)					
Dislike very much (2)					
Dislike extremely (1)					
	8.5	8.35	8.70	8.5	**8.5125**

Table 5 illustrates the outcome of the sensory evaluation of the product after 120 days. The texture has retained its rating as "like very much." However, other attributes such as the color, aroma and taste have diminished compared to the result of the previous months. The final acceptability rate of the sample was 8.4, 8.3 and 8.5 for color, aroma and taste respectively. Nonetheless, the overall acceptability of the product after four months is still "like very much." Similar to the 60 days evaluation, the result shows that the product is still acceptable.

Table 5. Sensory Evaluation Result for Nutri-fried Noodles utilizing Tubers and Tops of Sweet Potato (120 days)

9 Hedonic Scale	Color	Aroma	Taste	Texture	Overall Acceptability
Like extremely (9)	8 (72)	6 (54)	10 (90)	10 (90)	
Like very much (8)	12 (96)	14 (112)	10 (80)	10 (80)	
Like moderately (7)					
Like slightly (6)					
Neither like nor dislike (5)					
Dislike slightly (4)					
Dislike moderately (3)					
Dislike very much (2)					
Dislike extremely (1)					
	8.4	8.3	8.5	8.5	**8.425**

Table 6 shows the result of the shelf-life study of the camote noodles after 180 days. It is noted that almost all the organoleptic attributes of the product do not conform to the specifications set for the sample. Fifteen among the twenty panelists have rated the sample as like slightly, thus, the overall acceptability is 7.7 equivalent to like moderately. The result of this physical attributes gives an end to the shelf-life of the camote noodles. Aside from these comments were distinguished by the panelists such as oily taste, light in color, slightly rancid, off smell and difficult to chew.

These attributes can be explained by many causes since shelf-life is influenced by several factors. These attributes can be categorized as intrinsic or extrinsic. The noodles after 180 days have both exhibited intrinsic and extrinsic traits. Intrinsic factors are the properties of the final product which include the water activity (aw) (available water), pH value and total acidity, type of acid, Redox potential (Eh) and available oxygen (International Food Standard, 1993). On

the other hand, the extrinsic factors are the properties of the environment where the noodles were stored.

Table 6. Sensory Evaluation Result for Nutri-fried Noodles utilizing Tubers and Tops of Sweet Potato (180 days)

9 Hedonic Scale	Color	Aroma	Taste	Texture	Overall Acceptability
Like extremely (9)	6 (54)	5 (45)	5 (45)	8 (72)	
Like very much (8)	10 (80)	5 (40)	7 (56)	6 (48)	
Like moderately (7)		5 (35)	8 (56)		
Like slightly (6)	4 (24)	5 (30)		6 (36)	
Neither like nor dislike(5)					
Dislike slightly (4)					
Dislike moderately (3)					
Dislike very much (2)					
Dislike extremely (1)					
	7.9	7.5	7.85	7.7	**7.762**

Table 7. Summary of Evaluation

Evaluation Period	Overall Acceptability	Interpretation
Initial Evaluation	8.535	Like very much
After 2 months	8.5125	Like very much
After 4 months	8.425	Like very much
After 6 months	7.762	Like moderately

Table 8 illustrates the result of the chemical analysis of Camote noodles. This test was conducted at the Food Microbiology Laboratory using moisture analyzer and ph meter for moisture and ph analysis. The result of the test in the sixth month indicates that there is an increase by 0.69 for moisture and 0.7 for ph.

Noodles with high moisture content can cause deterioration during storage and can easily attract mold, bacteria and insects.

Physical deteriorative changes are primarily caused by moisture migration. As explained by Kilcast and Subramaniam (2000), the physical changes in packaging materials along with chemical reactions can affect a food shelf-life. In the long run, storage can cause changes in permeability influencing the in-pack equilibrium which may result to microbiological and chemical effects. These changes may lead to migration of external volatiles into the food giving rise to the development of taint.

Table 8. Result of Chemical Analysis for Nutri-fried Noodles utilizing Tubers and Tops of Sweet Potato

Analysis	Two months	Four months	Six months
% moisture	6.50	6.51	7.2
Ph	5.5	5.5	6.2

Consumer Testing

Table 9 demonstrates the sensory evaluation for consumer acceptance testing of Nutri-Fried Noodles using 9-point Hedonic scale to determine the degree of likeness and dislikeness of the product. It was done in three local communities of Sorsogon, namely, Bibincahan, Pangpang and Balogo with one hundred (100) respondents each.

Table 9. Sensory Evaluation for Nutri-fried Noodles utilizing Tubers and Tops of Sweet Potato

9 Hedonic Scale	Value	Brgy. Bibincahan	Brgy. Pang pang	Brgy. Balogo	Overall Acceptability
Like extremely (Gustuhununun)	9	29(261)	35(315)	40(360)	
Like very much (Gustuhunun)	8	32(256)	35(280)	34(272)	
Like moderately (Gusto)	7	35(245)	28(196)	26(182)	
Like slightly (Medyo Gusto lang)	6	4(24)	2(12)		

Neither like nor dislike (Lain Gusto Lain Man Habo)	5				
Dislike slightly (Medyo Habo)	4				
Dislike moderately (Habo)	3				
Dislike very much (Habuunun)	2				
Dislike extremely (Habuunonon)	1				
		7.86	8.03	8.4	**8.01**

Consumer testing is one of the most important activities in product development to determine the response of consumers. Resurreccion (1998) states that the most important purpose of consumer affective tests is to assess personal response by current and potential customers of a product, product ideas or specific product characteristics. The 9-point Hedonic Scale is a technique that will verify if the Nutri-fried noodles is acceptable to the consumers.

CONCLUSION

The research revealed that sweet potato tubers and tops can be made into a Nutri-fried noodles. Based on the different tests conducted, the sample submitted to Department of Science and Technology Region V shows that the Nutri-fried Camote Noodles has 6.53% moisture, 0.12 Free Fatty Acid,150 CFU/g Yeast and Mold Count. The computed Nutrition Information of the product also showed that it is healthier than the commonly consumed noodles in the market. It has no sugar content, zero cholesterol and rich in fiber content. The result of the sensory evaluation also implies that the maximum shelf-life of camote noodles is up to six (6) months.

Furthermore, it was found out that the product is “like very much,” by the consumers after conducting consumer testing to 300 respondents in three

communities in Sorsogon City, Philippines. The Nutri-fried Camote Noodles is highly marketable as evidenced by the "like very much" evaluation made by respondents. Production can be started immediately and initial commercialization shall be in the three local communities where testing was made.

LITERATURE CITED

Agu, H. O., & Okoli, N. A. (2014). Physico-chemical, sensory, and microbiological assessments of wheat-based biscuit improved with beniseed and unripe plantain. *Food Science & Nutrition*, *2*(5), 464–469. http://doi.org/10.1002/fsn3.135

Codex Alimentarius (1999). http://www.codexalimentarius.org

Congress of the Philippines (2012). Republic Act 10611 (Food Safety Act 2013).

Fari, M.J.M, D. Rajapaksa and K.K.D.S. Ranaweera (2011). Quality characteristics of noodles made from selected varieties of Sri Lankan rice with different physicochemical characteristics. *Journal of the National Science Foundation of Sri Lanka, Volume 39, Issue 1.*

Gatchalian M.M. and Sonia De Leon (1992). Introduction to Food Technology. Manila: Merriam & Webster Bookstore, Inc.

International Food Standard, 1993.

Kilcast, David and Persis Subramaniam (eds.) (2000). The Stability and Shelf-Life of Food. Cambridge: Woodhead Publishing Limited. Retrieved from http://store.elsevier.com/The-Stability-and-Shelf-Life-of-Food/isbn-9781855735002/

McCormick and Co. (1978). General Guide to Sensory Evaluation. USA: Hunt Valley.

Peryam, D. R., & Pilgrim, F. J. (1957). Hedonic scale method of measuring food preferences. *Food technology*.

Resurreccion, A. V. (1998). *Consumer sensory testing for product development*. Aspen Publishers.

Ritthiruangdej, P., Parnbankled, S., Donchedee, S., & Wongsagonsup, R. (2011). Physical, Chemical, Textural and Sensory Properties of Dried Wheat Noodles Supplemented with Unripe Banana Flour.

Singh-Ackbarali, D., & Maharaj, R. (2014). Sensory Evaluation as a Tool in Determining Acceptability of Innovative Products Developed by Undergraduate Students in Food Science and Technology at The University of Trinidad and Tobago. *Journal of Curriculum and Teaching*, *3*(1), p10.

Taneya M. L. J. , M. M. H. Biswas and M. Shams-Ud-Din (2014). The studies on the preparation of instant noodles from wheat flour supplementing with sweet potato flour. *J. Bangladesh Agril. Univ. 12(1): 135–142.*

United States Department of Agriculture (USDA). National Nutrient database. Retrieved from https://ndb.nal.usda.gov/