ACCEPTABILITY AND MINERAL CONTENT OF PAN-FRIED AND DEEP-FRIED FERN RAVIOLI

Sofia C. Naelga
University of Science and Technology of Southern Philippines
Ninia Marie A. Estillore
University of Science and Technology of Southern Philippines

Abstract. People nowadays are already becoming health conscious and wanted to eat foods that have grown natural way from seeds that have not been genetically modified in any way. We are looking for food which offer health and nutrition benefits, that's why many researchers nowadays continued innovating food products that can give nourishment in the body. Consequently, Fiddlehead fern with its scientific name Diplazium esculentum, locally called "pako" in the Philippines, is one of the organic vegetable which can offer a lot of health benefits. Nutritionally speaking, fiddlehead contains potassium, magnesium, phosphorous, iron, calcium and many other nutrients.

The study employed experimental method of research. The mineral content between basic ravioli and fern ravioli using pan-fry and deep fry method in terms of potassium, magnesium, phosphorous, iron and calcium was tested by F.A.S.T. Laboratories. Furthermore, the respondents evaluated the acceptability to food attributes in terms of appearance, color, aroma, flavor, texture and taste evaluation using 9-point Hedonic Scale.

The acceptability to food attributes of the fern ravioli in terms of appearance, color, aroma, flavor, texture and taste were accepted by the ravioli consumers. Moreover, the mineral contents found were potassium, magnesium, phosphorous, iron and calcium which are essential to the body. The minerals found in fern ravioli and basic ravioli can strongly supplement the Recommended Daily Allowance (RDA) of an individual through menu planning, after which, needed nutrients are properly distributed through meals and snacks preparation every day.

Keywords: fiddlehead fern, mineral content, sensory evaluation, and recommended daily allowances (RDA), ravioli.

1.   Background and rationale

People are already becoming conscious of their wellness and well-being have turned toward food that have grown natural way-from seeds that have not been genetically modified in any way. Studies show that organically grown crops tend to be higher in health-giving vitamins, minerals and antioxidants. Balanced soils with the right pH levels, not having used chemicals, produce strong, healthy plants that become nourishing food for people and animals (Philstar Global, 2011 ; Ortiz-Salgado, Rodrigo, and Alfredo García-Carmona. 2018).

As Spritzler (2016) has testified that eating <u>nutritious foods</u> can improve your health and energy levels. Surprisingly, the way people cook their food have a major effect on the amount of nutrients in it. Thus, cooking food improves digestion and increases absorption of many nutrients. Nutrient loss is a consequence of nearly every cooking process. Exposure to heat, light or oxygen will alter the nutrients found in food, and methods that involve water often reduce the amounts of nutrients as these get 'washed out' and left behind. However, Diaz (2011) claimed that cooking food also has its advantages, including a reduction of the number of possible malignant microbes, an increase in digestibility and the increased availability of certain phytonutrients. Alongside with this, fiddlehead fern with its scientific name Diplazium Esculentum, locally called pako in the Philippines, is a vegetable fern, which is characterized with fronds of young leaves found to be rich in vitamins and minerals. Canopio (2014) said that these are commonly sold in bunch at local markets just like any ordinary vegetables for a fairly cheap price. Fiddleheads are an excellent source of vitamins A and C and are rich in niacin, magnesium, iron, potassium and phosphorus. As McClellan (2014) posited that fiddleheads are also rich in antioxidants and bioflavonoids, which are plant chemicals that help protect against disease. Common cooking methods include steaming and boiling but fiddleheads are best showcased sautéed in olive oil or butter. Fiddleheads will retain their crunchiness and achieve new flavors that cannot be reached with water based cooking methods.(Lyytinen, K., & Yoo, Y. 2002).

This study aimed to create and produce a unique innovation of fern ravioli where the Pako or fiddlehead fern is an added ingredient use to enhance its nutritive value. Fern Ravioli product is nutritious especially to those person who have osteoporosis, bone structure, anemia, blindness in children and diabetes.

Apart from this, the study aimed also to determine the effect of two cooking method of Basic Ravioli and Fern Ravioli as to its Mineral Content and Acceptability using the pan frying method and the deep frying method in the study to ascertain its food innovation.

2.materials and methods

2.1.Research Design

The study will employ a experimental method of research in conducting the study including the sampling scheme, sensory evaluation and analysis of the mineral contents found in the two (2) cooking methods of Fern Ravioli and Basic Ravioli, the acceptability of the product by the consumers as well.

2.2.Research Setting

The study will be carried out in Mindanao University of Science and Technology. MUST is a higher education institution in the Philippines. It was known as Mindanao Polytechnic State College until 7 January 2009 when it has achieved its university status after a long odyssey from its humble beginnings as a tradeschool in 1927. Its main campus is located in Lapasan, Cagayan de Oro City, with satellite campuses in Jasaan, Misamis Oriental, Oroquieta city and Panaon, Misamis Occidental.

Experiments will be performed at Gusa National High School-Cugman Annex. A secondary school located at the East of the City of Golden Friendship, Cagayan de Oro. The analysis of the mineral content will be carried out in F.A.S.T Laboratories located ate Lapasan Highway, Cagayan de Oro City. The source of the fern vegetable are from Sta. Cruz, Claveria, Misamis Oriental. 47 Kilometers from PUJ Terminal situated at Agora Lapasan, Cagayan de Oro City.

2.3.Preparation of the Sample
1. Sampling preparations
a)   Fresh Fern

Traveling from Cagayan de Oro to Sta. Cruz Claveria, Misamis Oriental early in the morning takes 1 hour. Harvest young ferns early in the day while they are at their freshest. Choose fern with tightly coiled crosiers and with only approximately 1 inch of stem extending from the crosier. A fresh fern will snap off easily when bent. Examine the ferns for brown chaff on the surfaces. Gently rub as much chaff from the ferns with your bare hands. Grasp the ferns by the ends of the stems and shake them carefully outside to loosen and remove the chaff. Put it in a clean white cellophane in travel back to Cagayan de Oro.

In the Mindanao University of Science and Technology Laboratory Room, place the fern in a bowl filled with water and swish the fern around in the water to remove any remaining chaff. Pour off the cold water and dirt and repeat the soaking and swishing process at least two more times. Place the fern in a colander and run cold water over them for a final rinsee. Shake off as much excess water as possible. Weigh Twenty (20) grams of Fresh Fern.

b)   Basic Ravioli

In the first sample, Pasta dough weight will be Two Hundred (200) grams. For the filling, One Hundred (100) grams shrimp will be mixed to the Twenty (20) grams of mushroom, Thirty (30) grams of basil leaves, Twenty Five (25) grams of shallots, Thirty (30) grams of Feta Cheese, Thirty (30) grams of corn oil chicken, Thirty (30) grams of fresh egg, salt and white pepper to taste using the sauteeing method. Boil fern ravioli in chicken stock.

c)   Fern Ravioli

In the first sample, Pasta dough weight will be Two Hundred (200) grams. For the filling, One Hundred (100) grams shrimp will be mixed to the One Hundred (100) grams of fresh fern, Twenty (20) grams of mushroom, Thirty (30) grams of basil leaves, Twenty Five (25) grams of shallots, Thirty (30) grams of Feta Cheese, Thirty (30) grams of corn oil chicken, Thirty (30) grams of fresh egg, salt and white pepper to taste using the sauteeing method. Boil fern ravioli in chicken stock.

2. Cooking Method
a) Pan frying method

After poaching the ravioli, pan-fry cooked fern ravioli in (30) grams corn oil and arrange it on the plate   top with Two Hundred Fifty (250) grams of tomato sauce, sprinkle with Twenty (20) grams parmesan cheese and Twenty (20) grams fresh basil.

b) Deep fat frying method

After poaching the ravioli, deep-fry cooked fern ravioli in (1000) grams corn oil and arrange it on the plate top with Two Hundred Fifty (250) grams of tomato sauce, sprinkle with Twenty (20) grams   parmesan cheese and Twenty (20) grams fresh basil.

2.4.Analysis of Nutritional Content
The average of the mineral content during the three sampling periods conducted was the basis for comparing the percent difference of potassium, magnesium, phosphorous, iron and calcium between fern and basic ravioli.

2.5.Sensory Evaluation
The 9-point Hedonic Scale was used to evaluate the sensory quality of basic and fern ravioli products. The appearance, color, aroma and flavor, texture and taste are the sensory qualities used in determining the acceptability of the innovated ravioli product. The respondents, who evaluated the pesto product were composed of 25 teachers and 75 students, a total of 100 consumers.

1.   Iii. Results and discussions

Findings

Problem 1. What is the level of acceptability of basic ravioli and fern ravioli in terms of pan frying and deep fat frying method?

1.1 appearance;
1.2 color;
1.3 aroma & flavor;
1.4 texture; and
1.5 taste?

Table 1.1.1 Test Statistics (mean and standard deviation) on First sample of respondents' level of acceptability of Basic Ravioli in Pan

	Mean	Description	Standard Deviation
Appearance	7.98	Like moderately	1.02

Color	7.79	Like moderately	1.03
Aroma	7.92	Like moderately	1.10
Flavor	7.81	Like moderately	1.17
Texture	7.65	Like moderately	1.18
Taste	7.98	Like moderately	1.02

The data show that the level of Acceptability in the first sample in terms of Appearance of Basic Ravioli cooked in pan is Like moderately (mean=7.98). The color is Like moderately (mean=7.79). Aroma Like moderately (mean=7.92) flavor Like moderately (mean=7.81). Texture Like moderately (mean= 7.65) taste Like moderately (mean=7.98). The standard deviation ranges from 1.02 t0 1.18. This indicates that level of acceptability varies from each other.

The color of basic ravioli were golden brown due to pan frying method of cooking, which consequently appealing to eat. Its outer appearance is crunchy.

Therefore, this study pointed out that Basic Ravioli were acceptable through visual sensation with golden brown in color by the ravioli consumer.

Table 1.1.2 Test Statistics (mean and standard deviation) on First sample of respondents' level of acceptability of Basic Ravioli in deep fat fry

	Mean	Description	Standard Deviation
Appearance	8.01	Like much	1.15
Color	7.95	Like moderately	1.16
Aroma	7.60	Like moderately	1.12
Flavor	7.78	Like moderately	1.04
Texture	7.66	Like moderately	1.13
Taste	7.83	Like moderately	1.17

The data show that the level of Acceptability in the first sample in terms of Appearance of Basic Ravioli cooked in deep fat try is like much (mean=8.01). The color is Like moderately (mean=7.95). Aroma Like moderately (mean=7.60) flavor Like moderately (mean=7.78). Texture Like moderately (mean= 7.65) taste Like moderately (mean=7.98). The standard deviation ranges from 1.04 t0 1.17 This indicates that level of acceptability varies from each other.

Table 1.1.3 Test Statistics (mean and standard deviation) on First sample of respondents' level of acceptability of Fern Ravioli in Basic Pan

	Mean	Description	Standard Deviation
Appearance	7.86	Like moderately	1.11
Color	7.77	Like moderately	1.04
Aroma	7.88	Like moderately	1.15
Flavor	7.89	Like moderately	1.23
Texture	7.80	Like moderately	1.20
Taste	7.95	Like moderately	1.16

The data show that the level of Acceptability in the first sample in terms of Appearance of Fern Ravioli cooked in Basic pan is Like moderately (mean=7.86). The color is Like moderately (mean=7.77). Aroma Like moderately (mean=7.88) flavor Like moderately (mean=7.89). Texture Like moderately (mean= 7.80) taste Like moderately (mean=7.95). The standard deviation ranges from 1.04 t0 1.17. This indicates that level of acceptability varies from each other. The aroma and flavor of the fern ravioli were natural. These were enriched by the addition of fern in the fillings which enhanced the smell and aroma of the fern ravioli product as well.

For that reason, this study concluded that Fern ravioli were acceptable through odor arising, sensory impression and the neutral flavor by the ravioli consumer.

Table 1.1.4 Test Statistics (mean and standard deviation) on First sample of respondents' level of acceptability of Fern Ravioli in Deep fat fry

	Mean	Description	Standard Deviation
Appearance	7.60	Like moderately	1.45
Color	7.44	Like moderately	1.43
Aroma	8.01	Like much	1.09
Flavor	7.69	Like moderately	1.38
Texture	7.65	Like moderately	1.20
Taste	7.88	Like moderately	1.22

The data show that the level of Acceptability in the first sample in terms of Appearance of Fern Ravioli cooked in deep fat try is Like moderately (mean=7.60). The color is Like moderately (mean=7.44). Aroma Like much (mean=8.01) flavor Like moderately (mean=7.69). Texture Like moderately (mean= 7.65) taste Like moderately (mean=7.88). The standard deviation ranges from 1.09 t0 1.45 This indicates that level of acceptability varies to varies a lot from each other.

Table 1.2.1 Test Statistics (mean and standard deviation) on Second sample of respondents' level of acceptability of Basic Ravioli in Pan

	Mean	Description	Standard Deviation
Appearance	7.76	Like moderately	1.26
Color	7.66	Like moderately	1.07
Aroma	7.81	Like moderately	1.17
Flavor	7.88	Like moderately	1.16
Texture	7.78	Like moderately	1.24
Taste	8.81	Like much	1.01

The data show that the level of Acceptability in the Second sample in terms of Appearance of Basic Ravioli in Pan is Like moderately (mean=7.76). The color is Like moderately (mean=7.66). Aroma Like moderately (mean=7.81) flavor Like moderately (mean=7.88). Texture Like moderately (mean= 7.78) taste Like much (mean= 8.81). The standard deviation ranges from 1.01 t0 1.26 this indicates that level of acceptability varies to varies a lot from each other.

Table 1.2.2 Test Statistics (mean and standard deviation) on Second sample of respondents' level of acceptability of Basic Ravioli in deep fat fry

	Mean	Description	Standard Deviation
Appearance	7.70	Like moderately	1.25
Color	7.93	Like moderately	1.19
Aroma	7.82	Like moderately	0.93
Flavor	7.82	Like moderately	1.15
Texture	7.71	Like moderately	1.07
Taste	7.87	Like moderately	1.15

The data show that the level of Acceptability in the Second sample in terms of Appearance of Basic Ravioli in deep fat fry is Like moderately (mean=7.70). The color is Like moderately (mean=7.93), Aroma Like moderately (mean=7.82) flavor Like moderately (mean=7.82), Texture Like moderately (mean= 7.71) taste Like moderately (mean=7.87). The standard deviation ranges from 0.93 t0 1.25. This indicates that level of acceptability varies from each other.

Table 1.2.3 Test Statistics (mean and standard deviation) on Second sample of respondents' level of acceptability of Fern Ravioli in Basic Pan

	Mean	Description	Standard Deviation
Appearance	7.80	Like moderately	1.27

Color	7.60	Like moderately	1.34
Aroma	7.64	Like moderately	1.28
Flavor	7.91	Like moderately	1.09
Texture	7.67	Like moderately	1.31
Taste	8.03	Like much	1.05

The data show that the level of Acceptability in the Second sample in terms of Appearance of Fern Ravioli in Basic Pan is Like moderately (mean=7.80). The color is Like moderately (mean=7.60). Aroma Like moderately (mean=7.64) flavor Like moderately (mean=7.91). Texture Like moderately (mean= 7.67) taste Like much (mean=8.03). The standard deviation ranges from 1.05 t0 1.34 This indicates that level of acceptability varies to varies a lot from each other.

Table 1.2. 4 Test Statistics (mean and standard deviation) on Second sample of respondents' level of acceptability of Fern Ravioli in Deep fat fry

	Mean	Description	Standard Deviation
Appearance	7.47	Like moderately	1.59
Color	7.35	Like moderately	1.65
Aroma	7.44	Like moderately	1.43
Flavor	7.56	Like moderately	1.46
Texture	7.41	Like moderately	1.31
Taste	7.53	Like moderately	1.37

The data show that the level of Acceptability in the Second sample in terms of Appearance of Fern Ravioli cooked in deep fat fry is Like moderately (mean=7.47). The color is Like moderately (mean=7.35). Aroma Like moderately (mean=7.44) flavor Like moderately (mean=7.56). Texture Like moderately (mean= 7.41) taste Like moderately (mean=7.53). The standard deviation ranges from 1.31 t0 1.59 This indicates that level of acceptability varies a lot from each other.

The taste component of fern ravioli provides pleasurable sensation, tasting the product is one way of saying that the respondents like the fern ravioli.

For that reason, this study concluded that fern ravioli were acceptable through palate sensation by the ravioli consumer.

Table 1.3.1 Test Statistics (mean and standard deviation) on Third sample of respondents' level of acceptability of Basic Ravioli in Pan

	Mean	Description	Standard Deviation
Appearance	8.05	Like much	1.00
Color	7.88	Like moderately	1.13
Aroma	7.70	Like moderately	1.18
Flavor	7.66	Like moderately	1.14
Texture	7.81	Like moderately	1.17
Taste	7.83	Like moderately	1.25

The data show that the level of Acceptability in the third sample in terms of Appearance of Basic Ravioli in Pan is Like much (mean=8.05). The color is Like moderately (mean=7.88). Aroma Like moderately (mean=7.70) flavor Like moderately (mean=7.66). Texture Like moderately (mean= 7.81) taste Like moderately (mean=7.83). The standard deviation ranges from 1.00 t0 1.25 This indicates that level of acceptability varies from each other.

Table 1.3.2 Test Statistics (mean and standard deviation) on Third sample of respondents' level of acceptability of Basic Ravioli in deep fat fry

	Mean	Description	Standard Deviation
Appearance	7.77	Like moderately	1.09
Color	7.87	Like moderately	1.08

Aroma	7.50	Like moderately	1.16
Flavor	7.71	Like moderately	1.13
Texture	7.61	Like moderately	1.21
Taste	7.73	Like moderately	1.11

The data show that the level of Acceptability in the third sample in terms of Appearance of Basic Ravioli in deep fat fry is Like moderately (mean=7.77). The color is Like moderately (mean=7.87). Aroma Like moderately (mean=7.50) flavor Like moderately (mean=7.71). Texture Like moderately (mean= 7.61) taste Like moderately (mean=7.73). The standard deviation ranges from 1.08 t0 1.21 This indicates that level of acceptability varies from each other.

Table 1.3.3 Test Statistics   (mean and standard deviation) on Third sample of respondents' level of acceptability of Fern Ravioli in Basic Pan

	Mean	Description	Standard Deviation
Appearance	7.68	Like moderately	1.29
Color	7.67	Like moderately	1.20
Aroma	7.68	Like moderately	1.14
Flavor	7.61	Like moderately	1.29
Texture	7.68	Like moderately	1.09
Taste	7.75	Like moderately	1.23

The data show that the level of Acceptability in the third sample in terms of Appearance of Fern Ravioli in Basic Pan Like moderately (mean=7.68). The color is Like moderately (mean=7.67). Aroma Like moderately (mean=7.68) flavor Like moderately (mean=7.61). Texture Like moderately (mean= 7.68) taste Like moderately (mean=7.75). The standard deviation ranges from 1.09 t0 1.29. This indicates that level of acceptability varies to varies a lot from each other.

Table 1.3. 4 Test Statistics (mean and standard deviation) on Third sample of respondents' level of acceptability of Fern Ravioli in Deep fat fry

	Mean	Description	Standard Deviation
Appearance	7.48	Like moderately	1.38
Color	7.48	Like moderately	1.40
Aroma	7.62	Like moderately	1.35
Flavor	7.90	Like moderately	1.31
Texture	7.70	Like moderately	1.27
Taste	7.84	Like moderately	1.31

The data show that the level of Acceptability in the third sample in terms of Appearance of Fern Ravioli cooked in deep fat fry is Like moderately (mean=7.48). The color is Like moderately (mean=7.48). Aroma Like moderately (mean=7.62) flavor Like moderately (mean=7.90). Texture Like moderately (mean= 7.70) taste Like moderately (mean=7.84). The standard deviation ranges from 1.27 t0 1.40 This indicates that level of acceptability varies a lot from each other.

Table 1.4.1 Test Statistics (mean and standard deviation) on OVER-ALL of respondents' level of acceptability of Basic Ravioli in Pan

	Mean	Description	Standard Deviation
Appearance	7.93	Like moderately	0.15
Color	7.78	Like moderately	0.11
Aroma	7.81	Like moderately	0.11
Flavor	7.78	Like moderately	0.11
Texture	7.75	Like moderately	0.09

Taste	8.21	Like much	0.53

The data show that the level of Acceptability in the OVER-ALL in terms of Appearance of Basic Ravioli cooked in pan is Like moderately (mean=7.93). The color is Like moderately (mean=7.78). Aroma Like moderately (mean=7.81) flavor Like moderately (mean=7.78). Texture Like moderately (mean= 7.75) taste Like much (mean=8.21). The standard deviation ranges from 0.09 t0 0.15 This indicates that level of acceptability of the three samples are similar to each other.

The taste component of the basic ravioli has a high impact from the respondents, it has something to do with the taste buds of the students, because students like much to eat meat rather that vegetables.

Therefore, this study concluded that basic ravioli were acceptable through palate sensation by the ravioli consumer.

Table 1.4.2 Test Statistics (mean and standard deviation) on OVER-ALL of respondents' level of acceptability of Basic Ravioli in deep fat fry

	Mean	Description	Standard Deviation
Appearance	7.83	Like much	0.16
Color	7.92	Like moderately	0.04
Aroma	7.64	Like moderately	0.16
Flavor	7.77	Like moderately	0.06
Texture	7.66	Like moderately	0.05
Taste	7.81	Like moderately	0.07

The data show that the level of Acceptability in the first sample in terms of Appearance of Basic Ravioli cooked in deep fat try is like much (mean=7.83). The color is Like moderately (mean=7.92). Aroma Like moderately (mean=7.64) flavor Like moderately (mean=7.77). Texture Like moderately (mean= 7.66) taste Like moderately (mean=7.81). The standard deviation ranges from 0.04 t0 0.16 This indicates that level of acceptability of the three samples are similar to each other.

Table 1.4.3 Test Statistics (mean and standard deviation) on OVER-ALL of respondents' level of acceptability of Fern Ravioli in Basic Pan

	Mean	Description	Standard Deviation
Appearance	7.78	Like moderately	0.09
Color	7.68	Like moderately	0.09
Aroma	7.73	Like moderately	0.13
Flavor	7.80	Like moderately	0.17
Texture	7.72	Like moderately	0.07
Taste	7.91	Like moderately	0.14

The data show that the level of Acceptability in the OVER-ALL in terms of Appearance of Fern Ravioli cooked in Basic pan is Like moderately (mean=7.78). The color is Like moderately (mean=7.67). Aroma Like moderately (mean=7.73) flavor Like moderately (mean=7.80). Texture Like moderately (mean= 7.72) taste Like moderately (mean=7.91). The standard deviation ranges from 0.07 t0 0.17. This indicates that level of acceptability of the three different samples are similar to each other.

Table 1.1.4 Test Statistics (mean and standard deviation) on OVER-ALL of respondents' level of acceptability of Fern Ravioli in Deep fat fry

	Mean	Description	Standard Deviation
Appearance	7.52	Like moderately	0.07
Color	7.42	Like moderately	0.07
Aroma	7.69	Like moderately	0.29
Flavor	7.72	Like moderately	0.17

| Texture | 7.59 | Like moderately | 0.16 |
| Taste | 7.75 | Like moderately | 0.19 |

The data show that the level of Acceptability in the OVER-ALL in terms of Appearance of Fern Ravioli cooked in deep fat try is Like moderately (mean=7.52). The color is Like moderately (mean=7.42). Aroma Like moderately (mean=7.69) flavor Like moderately (mean=7.72). Texture Like moderately (mean= 7.59) taste Like moderately (mean=7.75). The standard deviation ranges from 0.07 t0 0.29 this indicates that level of acceptability of the three different samples are similar to each other.

Problem 2. Is there a significant difference in acceptability of basic and fern ravioli in terms of pan frying and deep fat frying method?

Table 2.1 Analysis of Variance in the Acceptability in first Sample when grouped according to ingredients and type of cooking method

	basi c ravioli (pa n fry)	basic Ravioli (deep fat fry)	fer n ravioli Pa n fry	fern ravioli dee p fat fry	P- Value	F- Value
Accept ability	7.8 5	7.80	7.8 5	7.71	0. 3098	1. 27NS

The Table shows the distribution of statistics (Analysis of Variance) F-Test on level of acceptability on the first sample when grouped according to ingredients and type of cooking method. There were four groups being compared: Basic Ravioli in Pan Fry, Basic Ravioli in Deep Fat Fry, Fern Ravioli in Pan Fry and Fern Ravioli in Deep Fat Fry. The null hypothesis, there is no significant difference in level of acceptability when grouped according to ingredients and type of cooking method is accepted. The result indicates that there is no significant difference (F=1.27 NS) in level of acceptability when grouped according to ingredients and type of cooking method.

The two-cooking method of Basic and Fern ravioli do not differ from the acceptability when it comes to appearance, color, aroma, flavor, texture and taste of the respondents.

Therefore, this study concluded that basic and fern ravioli were acceptable through appetite sensation by the ravioli consumer.

Table 2.2 Analysis of Variance in the Acceptability on Second Sample when grouped according to ingredients and type of cooking method

	basi c ravioli (pa n fry)	basic Ravioli (deep fat fry)	fer n ravioli Pa n fry	fern ravioli dee p fat fry	P- Value	F- Value
Accept ability	7.9 5	7.80	7.7 7	7.46	0. 0138	4. 52**

The Table shows the distribution of statistics (Analysis of Variance) F-Test on level of acceptability on the second sample when grouped according to ingredients and type of cooking method. There were four groups being compared: Basic Ravioli in Pan Fry, Basic Ravioli in Deep Fat Fry, Fern Ravioli in Pan Fry and Fern Ravioli in Deep Fat Fry. The null hypothesis, there is no significant difference in level of acceptability when grouped according to ingredients and type of cooking method is Rejected. The result indicates that there is a highly significant difference (F=4.52**HS) in level of acceptability in second sample when grouped according to ingredients and type of cooking method. The two-cooking method of Basic and Fern ravioli in the second sampling process differ from the acceptability when it comes to appearance, color, aroma, flavor, texture and taste of the respondents. It has something to do with the cooking process which the basic ravioli has smaller time of serving period from the preparation.

Therefore, this study concluded that basic ravioli in the second sample were acceptable through appetite sensation by the ravioli consumer.

Table 2.3 Analysis of Variance in the Acceptability on Third Sample when grouped according to ingredients and type of cooking method

	basi c ravioli (pa n fry)	basic Ravioli (deep fat fry)	fer n ravioli Pa n fry	fern ravioli dee p fat fry	P- Value	F- Value
Accept ability	7.8 2	7.70	7.7 0	7.67	0. 1929	1. 73NS

The Table shows the distribution of statistics (Analysis of Variance) F-Test on level of acceptability on the third sample when grouped according to ingredients and type of cooking method. There were four groups being compared: Basic Ravioli in Pan Fry, Basic Ravioli in Deep Fat Fry, Fern Ravioli in Pan Fry and Fern Ravioli in Deep Fat Fry. The null hypothesis, there is no significant difference in level of acceptability when grouped according to ingredients and type of cooking method is accepted. The result indicates that there is no significant difference (F=1.73) in level of acceptability on the third sample when grouped according to ingredients and type of cooking method.

The two-cooking method of Basic and Fern ravioli do not differ from the acceptability when it comes to appearance, color, aroma, flavor, texture and taste of the respondents. Therefore, this study concluded that basic and fern ravioli were acceptable through appetite sensation by the ravioli consumer.

Problem 3. What is the mineral content of basic ravioli and fern ravioli according to pan-frying method and deep fat frying in terms of:

Table 3.1. Nutrient Content
SAMPLE 1

Sample	basic ravioli (pan fry)	basic Ravioli (deep fat fry)	fern ravioli Pan fry	fern ravioli deep fat fry
Potassium	0.14	0.15	0.16	0.16
Iron	56.5	50.9	43.5	55
Magnesium	227	406	365	218
Calcium	142	145	135	131
Phosphorous	321	246	334	232

Table 3.2 Nutrient Content
SAMPLE 2

Sample	basic ravioli (pan fry)	basic Ravioli (deep fat fry)	fern ravioli Pan fry	fern ravioli deep fat fry
Potassium	0.12	0.13	0.13	0.16
Iron	42.4	61.3	45.5	49.2
Magnesium	370	401	304	211
Calcium	136	164	150	155
Phosphorous	385	288	262	313

Table 3.3 Nutrient Content SAMPLE 3

Sample	basic ravioli (pan fry)	basic Ravioli (deep fat fry)	fern ravioli Pan fry	fern ravioli deep fat fry
Potassium	0.13	0.12	0.14	0.14
Iron	28.3	31.4	31.7	30.4
Magnesium	172	159	173	181
Calcium	165	138	122	138
Phosphorous	334	336	308	366

Problem 4. Is there a significant difference in nutrient content when grouped according to ingredients and cooking method.

Table 4 Analysis of Variance in the nutrient content when grouped according to ingredients and type of cooking method

	basic ravioli (pan fry) Mean of 3	basic Ravioli (deep fat fry) Mean of 3	fern ravioli Pan fry Mean of 3	fern ravioli deep fat fry Mean of 3	P-Value	F-Value
Potassium	0.13	0.13	0.14	0.15	0.2073	1.90 NS
Iron	42.4	47.86	40.23	44.86	0.8941	0.19 NS
Magnesium	256.33	322.00	280.67	203.33	0.5624	0.73 NS
Calcium	147.67	149	135.67	141.33	0.6358	0.59 NS
Phosphorous	346.67	290.00	301.33	303.33	0.5178	0.82 NS

The Table shows the distribution of statistics (Analysis of Variance) F-Test on level on nutrient content when grouped according to ingredients and type of cooking method. There were four groups being compared: Basic Ravioli in Pan Fry, Basic Ravioli in Deep Fat Fry, Fern Ravioli in Pan Fry and Fern Ravioli in Deep Fat Fry. The null hypothesis, there is no significant difference in nutrient content when grouped according to ingredients and type of cooking method is accepted. The result indicates that there is no significant difference in: Potassium (F=1.90 NS, Iron (F=0.19 NS), Magnesium (F=0.73 NS), Calcium (F=0.59 NS), Phosphorus (F=0.82 NS) when grouped according to ingredients and type of cooking method.

The results indicate that there is no significant difference in the nutritional content when grouped according to ingredients and type of cooking method of basic and fern ravioli.

During the production process, the mixing of ingredients like salt has something to do with the increase of magnesium in the basic ravioli. Probably in the testing of basic ravioli has a saturated granule of salt. The decrease of mineral content result in the fern ravioli in ingredients is due to the additional ingredient which is the fiddle head fern proper proportioning of ingredients is one of the factor. Base also on the laboratory results from Department of Science and Technology it has a small quantity of mineral content like calcium which affect the decreasing result of the fern ravioli. Mineral content varies also from one sample to another, the sample has an inconsistent result due to the following factors like the preparation process, mixing of ingredients, proper proportioning of ingredients and the mineral content of fresh fern ravioli itself. In this study, it is not an assurance that if you add fern vegetable in the basic ravioli the mineral content will increase. It has a neither possibility that the mineral content will increase nor decrease because of the factors affecting in the test method.

Table 4.1 T-Test Basic Ravioli VS Fern Ravioli in Pan Fry

	basic ravioli (pan fry) Mean of 3	fern ravioli Pan fry Mean of 3	P-value	T-value
Potassium	0.13	0.14	0.2745	1.26 NS
Iron	42.4	40.23	0.8255	0.23 NS
Magnesium	256.33	289.67	0.7808	0.29 NS
Calcium	147.67	135.67	0.3732	1.00 NS
Phosphorous	346.67	301.33	0.1895	1.57 NS

The Table shows the distribution of statistics (two tailed T-Test) on level on nutrient content when grouped according to ingredients and type of cooking method (Pan Fry). There were two groups being compared: Basic Ravioli in Pan Fry and Fern Ravioli in Pan Fry. The null hypothesis, there is no significant difference in nutrient content when

grouped according to ingredients and type of cooking method is accepted. The result indicates that there is no significant difference in: Potassium (T=1.36 NS), Iron (T=0.23 NS), Magnesium (T=0.29 NS), Calcium (T=1.00 NS), Phosphorus (T=1.57 NS) when grouped according to ingredients and type of cooking method (Pan Fry).

Table 4.2 T-Test Basic Ravioli VS Fern Ravioli in Deep Fat Fry

	basic ravioli (deep fry) Mean of 3	fern ravioli deep fry Mean of 3	P-value	T-value
Potassium	0.13	0.15	0.1447	1.81NS
Iron	47.87	44.87	0.8068	0.26NS
Magnesium	322.00	203.33	0.2228	1.44NS
Calcium	149.00	141.00	0.5073	0.72NS
Phosphorous	290	303.67	0.7849	0.29NS

The Table shows the distribution of statistics (two tailed T-Test) on level on nutrient content when grouped according to ingredients and type of cooking method (Deep Fat Fry). There were two groups being compared: Basic Ravioli in Deep Fat Fry and Fern Ravioli in Deep Fat Fry. The null hypothesis, there is no significant difference in nutrient content when grouped according to ingredients and type of cooking method (Deep Fat Fry) is accepted. The result indicates that there is no significant difference in: Potassium (T=1.86 NS), Iron (T=0.26 NS), Magnesium (T=1.44 NS), Calcium (T=0.72 NS), Phosphorus (T=1.57 NS) when grouped according to ingredients and type of cooking method (Deep Fat Fry).

2.   Conclusion

Based on the results, the following conclusions were drawn:

The acceptability of the fern ravioli in terms of appearance, color, aroma, flavor, texture and taste were extremely accepted by the ravioli consumers. Moreover, the mineral contents found were potassium, magnesium, phosphorous, iron and calcium which are essential to the body.

Consequently, large percentage of calcium supports structure of teeth, bones and skeletal structure of the body. Iron is found in the red blood cells of your blood called hemoglobin, phosphorus found to help filtering out the waste in the kidneys and plays an essential role in how the body stores and uses energy.

In the light of the study, the nutrients found in fern ravioli and basic ravioli can strongly supplement the Recommended Daily Allowances (RDA) of an individual through menu planning, afterwhich, needed nutrients are properly distributed through meals and snacks preparation every day.

3.   Recommendations:

In view of the findings and conclusions, the following recommendations were recommended:

1.   Food Business Management and Food Production Management Teachers as menu planners, may consider the use of fern ravioli as one of the recipes found out to have calcium, iron, phosphorus, magnesium and potassium needed for body nourishments and for instructional purposes.

2.   Cagayan de Oro Hotel and Restaurant Association (COHARA) adopt and develop this kind of product line as part of their pasta preparations to increase ravioli consumers' choices, entrepreneurs' revenues.

3.   Future Researchers continue to produce another ravioli product utilizing an indigenous fern vegetable.

4.   Barangay Officials promote Fiddlehead Fern ravioli products to the Department of Education and Local Government Units (LGU's) as part of their menu in the feeding program implementation, because of its high mineral contents which are very vital for body nourishment.

5.   Canteens/Cafeteria Managers consider this fiddlehead fern ravioli as one product in doing entrepreneurial activities.

6.   Businessman Develop fern ravioli products for meals and snacks which contain fern vegetables as one of parameter of good nutrition.

References

1. Aroma. (n.d.). Collins English Dictionary - Complete & Unabridged 10th Edition. Retrieve January 20, 2016 from Dictionary.com websitehttp://dictionary.reference.com/browse/aroma

2. Benefits of Pako Leaves. (2013) Retrieved March 13, 2013 from: www.allaboutdiabetes.net-fern-paco-nutritional-value.

3. B.G Mane (2015). Effect of Incorporation of Lungru (Diplazium esculentum) on Physico-chemical, Microbiological and Sensory Quality of Chicken Patties Retrieved. May 23, 2015 from https://www.researchgate.net/publication/299508706_Effect_of_Incorporatio _of_Lungru_Diplazium_esculentum_on_Physicochemical_Microbiological_a d_Sensory_Quality_of_Chicken_Patties

4. Camille Conopio (2014, February) Pako: the edible fern. Retrieved February 12,   2014   from http://asianjournal.com/lifestyle/pako-the-edible-fern/

5. Data from USDA National Nutrient Database for Standard Reference, Release 28. Retrieved February 12, 2016

6. Del Giudice, Luisa (2003). Encyclopedia of Food and Culture. The Gale Group Inc.   from http://www.encyclopedia.com/topic/pasta.aspx

7. Dictionary.cambridge.org. (2016) Retrieved January 30, 2016 from http://dictionary.cambridge. org/us/dictionary/english/enhancer

8. Franziska Spritzler, RD, CDE, (2016). How Cooking Affects the Nutrient Content of Foods.

9. Retrieved February 2016 from https://authoritynutrition.com/cooking-nutrient-content/

10. Grant. (March 19, 2015) What Is A Vegetable Fern: Information About The   Vegetable   Fern   Plant. Retrieved January 16, 2016

11. from http://www.gardeningknowhow.com/ornamental/foliage/vegetable-   ferns/vegetable-fern-information.htm

12. Hastin E.N.C. Chotimah, Susi Kresnatita, Yula Miranda (2013) Ethnobotanical study

13. and nutrient content of local vegetables consumed in Central Kalimantan,

14. Indonesia. Retrieved May 15, 2013 from

15. http://biodiversitas.mipa.uns.ac.id/D/D1402/D140209.pdf

16. Hsi-Mei Lai. (2001). Effects of rice properties and emulsifiers on the quality of rice   pasta. Journal of the Science   of   Food   and   Agriculture   from http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.472.9272&rep=rep1&=pdf

17. Jean A. T. Pennington, Ph.D., R. D., Division of Nutrition Research Coordination, NIDDK, NIH, Bethesda, MD 20892-6600. Variability of Minerals in Foods from   http://www.nutrientdataconf.org/PastConf/NDBC21/p6-2.pdf

18. Johannes Kahl, Geert Jan van der Burgt, Daniel Kusche, Susanne Bügel, Nicolaas Busscher, Ewelina Hallmann, Ursula Kretzschmar, Angelika Ploeger, Ewa Rembialkowska, and Machteld Huber, (2010) Organic Food Claims in Europe from   http://orgprints.org/16968/1/kahl-etal-2010 foodtechnology_0310feat_organic.pdf

19. JVV Tongco; RM Aguda; RA Razal; Ronald Villaber. (2014) Journal of Chemical and Pharmaceutical Research, 6(8): 238-242. Retrieved December 30, 2015 from http://www.researchgate.net/publication/264782587

20. Livestrong.com. (August 15, 2015) Fiddlehead Ferns Nutrition. From National   Academies' Institute of Medicine. Retrieved February 13, 2016 from http://www.livestrong.com/article/330838-fiddlehead-ferns-nutrition/

21. Lyytinen, K., & Yoo, Y. (2002). Ubiquitous computing. Communications of the ACM, 45(12), 63-96.

22. Man Li, Ke-Xue Zhu ,Xiao-Na Guo, Kristof Brijs and Hui-Ming Zhou. (2014). Natural   Additives in Wheat-Based Pasta and Noodle Products: Opportunities for Enhanced   Nutritional and Functional Properties. Retrieved June 21, 2014   from   http://onlinelibrary.wiley.com/doi/10.1111/1541-4337.12066/full

23. McClellan. (2014, March 1) Fiddlehead ferns Retrieved Decemeber 15, 201 fromhttp://www.specialtyproduce.com/produce/Fiddlehead_Ferns_551.php#st hash.Y1AAMKIP.dpuf

24. Melissa Sokulski (2011, April) Nutrient-rich wild fiddleheads are a spring delicacy. Retrieved   April   28, 2011 from   http://www.naturalnews.com/032204_fiddleheads_wild_foods.html

25. National Pasta Association (2016). From http://pastafits.org/pasta-facts/

26. Nourishing organic food for health-conscious people. (2011) Updated November 24, 2011from:http://www.philstar.com/science-and-technology/750960/nourishing-organic-food-health-conscious-people

27. Ortiz-Salgado, Rodrigo, and Alfredo García-Carmona. "Enfoque decolonial y producción de conocimientos en dos universidades estatales chilenas." Opción 34.86 (2018): 481-516.

28. Rave Uno (2011, August) Is Ravioli Healthy Food?. Retrieved August 20, 2011 from\ http://www.buzzle.com/articles/is-ravioli-a-healthy-food.html

29. Ron Leyba (2014, September 12). Healthy Benefits from eating fern. RetrieveJanuary 21, 2016 fromhttp://foodipino.com/2012/09/24/5-healthy-benefits-from-eating-fern-paco/

30. Sara Garduno Diaz, (2011). The effects of cooking on nutrition. Fromhttp://www.leeds.ac.uk/yawya/science-and-nutrition/The%20effects%20of%20cooking%20 on%20nutrition.html

31. Shalini Misra; RK Maikhuri; CP Kala, KS Rao and KG Saxena. (2008) Journal of Ethnobiology and Ethnomedicine May 30, 2008. Retrieved fr https://ethnobiomed.biomedcentral.com/articles/10.1186/1746-4269-4-15

32. V.K. Rao; S.J. Mulvaney; J.E. Dexter; N.M. Edwards; D. Peressini, (2002). Stress-Relaxation   Properties of Mixograph Semolina-Water Doughs from Durum Wheat   Cultivars of Variable   Strength   in   Relation   to Mixing Characteristic,   Bread-and   Pasta-making Performance. Retrieved   May   25,   2002   from http://www.sciencedirect.com/science/article/pii/S0733521001903844