

VEGEEL NOODLES: A NOVEL PRIORITY FISH PROTEIN FOOD AND ITS ACCEPTABILITY

Nancy Ann P. Gonzales, Chita P. Villena, Cheryline D. Allama³
Ifugao State University, Ifugao, 3605 Philippines

Abstract

The food we take impact our health. Protein is one among the major food groups needed by our bodies and fish is a very good source. The study therefore sought to determine the acceptability of vegeel noodles as a novel priority food. Vegeel is a combination of vegetables and eels. The Complete Randomized Design (CRD) and Analysis of Variance (ANOVA) were applied in the study. The used materials were: white pepper, ginger, atsute, garlic, salt, paprika, horse radish tree leaves, spinach, kangkong leaves, taro, eggs and flour. The product prepared was vegeel noodles. Evaluation of the noodles by culinary experts based on appearance, texture, taste, aroma and general acceptability. Results showed that the desired measurement to be mixed with taro noodles is 50 g powdered eel that has a very stimulating flavor.

Keywords: Noodles, nutrition and vegeels

1. Introduction

Vegeel is a term coined by the researchers which is derived from the combination of vegetables and eels. It is specifically intended for this research only. Asian swamp eels, *Monopterus albus* are commonly known as Asian swamp, rice-paddy or yellow eels. They belong to the sybranchidae fish family that grow as large as 3-4 feet long and weigh as much as one kilo. Their body colors range from olive to brown and occasionally light orange. Some are colored yellow, black and gold spots. They breathe on air, travel on moist land and survive for weeks without food Hamilton (2006). The swamp eels prefer shallow, sluggish, standing, or even stagnant waters and dense vegetation; often burrow or submerge in mud bottoms; can live in water without oxygen because they breathe air, all mature as females, and some of these females later become males. Their populations have highly skewed sex ratio dominated by females. The oldest is believed to be about 10 years swamp eel, 33.7 inches long and 1.7 pounds. Swamp eels have good, mild tasting meat and considered as a delicacy in their native ranges Peebles (2013). By burrowing in moist ground, they can survive for long period without water Brickings (2002). As to food, they eat worms, frogs, tadpoles, shrimps, crayfish and other fishes Hamilton (2006).

Swamp eels are nocturnal predators whose eggs are laid in a free-floating nest in shallow water. Male swamp eels guard the nest and young eels ISSG (2005). As to sex identity, all young *Monopterus albus* are females but some develop into males when they are adults and can change back to females should female densities are low. Change from one sex to another takes place a year and spawning is up to 1,000 eggs per female in a spawning event. These eels are generally found in slowly moving freshwater regions.

Asian swamp eels are used as food fish Hamilton (2006). Asians, specifically Chinese immigrants are the main consumers of swamp eels ISSG (2005).

In the Philippines, rice scientists are worried about *Monopterus albus* on their potentially damaging impact on rice fields. Farmers observed that they survive long period of drought by burrowing in the moist earth such as dikes and rice fields.

The burrowed holes destroy the rice dikes affecting irrigation during the vegetative stage of rice resulting to water loss that affects nutrient management. Farmers first reported the rice paddy eel as a pest to the Bureau of Fisheries and Aquatic Resources (BFAR) in Tuguegarao, Cagayan two years ago when they complained that these swamp eels were eating fingerlings in fishponds. PhilRice declared then the rice paddy eels as “an indirect pest” during the last dry season of 2010 Icamina (2011). Rice farmers in some parts of Nueva Ecija and two other provinces reported that *Monopterus albus* appeared in their farms and damaged their irrigation dikes Roque (2011).

Ifugao local agriculturists said eels located in the rice paddies of Kiangon, Lagawe, Hingyon and Asipulo are multiplying rapidly and some even moving from one rice paddy to another raising concerns among farmers See (2010). Farmers in Kiangon, Ifugao expressed alarm over the quick spread of these eels in their upland rice fields that are contributory to the destruction of the Ifugao Rice Terraces. The emergence of *Monopterus albus* as pest in their upland rice fields worsened the threat from giant earthworms which for years have been a headache for terrace

farmers in Ifugao thus, pleaded “we are calling on our officials to please help us find means how to get rid of these swamp eels because they pose bigger problems for us”.

Protein is a critical component of proper nutrition, in general body functioning and building of muscles, skin and hair. Lower levels of protein can reduce the amount of oxygen available to the system, which may exhibit itself as feeling of tiredness, fatigue and hair loss Duvauchelle (2014). In general, it is recommended that 10-35% of daily calories come from protein. The recommended dietary allowance for protein in specific age group requires the following: children ages 1-3 years old need 13 grams each day, children ages 4-8 need 19 g/day, and children ages 9-13 years old need 34 grams of protein. For girls ages 14-18 they need 46 g/day of protein while boys of the same group require 52 grams of protein each day. For adults, women ages 19-70 and above require 46 grams of protein while men at the same age group require a total of 56 grams of protein in a day Center for Disease Prevention and Control (2012).

Side effects of low protein counts include muscle degeneration, kwashiorkor and edema. Kwashiorkor is a type of malnutrition that develops when there is no adequate protein in the diet. The National Institute of Health reports that kwashiorkor is most common in areas where there is famine, limited food supply and low levels of nutritional education. Continued protein deficiency will lead to noticeable symptoms of kwashiorkor such as changes in skin pigment, hair loss, brittle nails, protruding belly and diarrhea. It is another side effect of low protein counts. Edema is swelling caused by build up of fluid ensnared in the body's tissues Ortega (2011).

Sarcopenia refers to the gradual loss due to protein deficiency, lack of exercise, and increased frailty among the elderly US Department of Agriculture, Agriculture Research Service (2005).

New research finds that the high maternal testosterone levels associated with a low protein diet in rats are caused by reduced activity of testosterone activator, thereby allowing more testosterone to reach the fetus and increase the offspring's susceptibility to adulthood hypertension Science Daily (2012).

Protein is essential for tissue repair and muscle building. If one's protein is low, his/her muscle deteriorates which contributes to weakness. Muscle cramping is also common and usually gets worse as time goes on Styles (2014).

Lack of protein in the diet initially causes fatigue, irritability, and lethargy. If inadequate intake continues, loss of muscle mass, generalized swelling, decreased immunity, weakened cardiovascular and respiratory system and eventually death can occur McKenzie (2011).

General objective:

1. To produce a low cost exotic fish protein noodles.

Specific Objectives:

1. To identify the appropriate measurements of eels to be mixed with taro noodles.
2. To prepare noodles out of taro and eels.
3. To test the acceptability of vegeel noodles for general consumption.

2. METHODOLOGY

2.1. Method

The Complete Randomized Design (CRD) was used in the study.

2.2. *Materials*

The materials used for the eel seasoning are: powdered white pepper, powdered ginger tea, atsute powder, powdered garlic, refined salt, powdered paprika, powdered eel, powdered horse radish tree leaves, powdered spinach, and powdered kangkong. The materials for the taro noodles are: taro, egg, all-purpose flour, salt, lye solution and a noodle machine.

2.3. *Procedure*

The product prepared is vegeel noodles. The ratio of seasoning was based from McCormick Old Bay Cajun Creole seasoning.

Procedure in preparing the vegeel noodles

1. Peel the taro and slice into pieces.
 2. Dry the taro.
 3. Powder the taro to produce flour out of it.
 4. Measure all ingredients as follows:
 - 1 cup taro flour
 - ½ cup all-purpose flour
 - 1 pc egg
 - ½ tsp. salt
 - 1/8 tsp. lye solution
 - Powdered eel
 5. Mix all ingredients until dough is produced
 6. Mould the mixture and pass through a noodle Machine
 7. Fry the prepared noodles
- Ratio of powdered eel mixed with the noodles
- To = No powder eel added
- T1 = 25 g powdered eel
- T2 = 50 g powdered eel
- T3 = 75 g powdered eel

Sensory Evaluation

Culinary experts evaluated the products based on the following criteria:

- A. Factors
 1. Appearance
 2. Texture
 3. Flavor
 4. Aroma
 5. General acceptability

2.4. *Statistical Tools*

The One way Analysis of Variance was applied to test significant differences.
The scale of interpretation is as follows:

1. Appearance	Weighted mean
Natural color	2.51 - 3.0
Moderately discolored	1.51 - 2.50
Slightly Discolored	1.0 1.50
2. Texture	
Smooth	2.1 3.0
Fine	1.51 - 2.50
Rough	1.1 1.50
3. Taste	
Very stimulating flavor	2.51-3.0
Stimulating flavor	1.51 - 2.50
Plain flavor	1.0 – 1.50
4. Aroma	
Characteristics smell	2.51-3.0
Odorless	1.51-2.50
Rancid odor	1.0-1.50
5. General acceptability	
Like extremely	8.51-9.0
Like very well	7.51-8.50
Like moderately	6.51-7.50
Like slightly	5.51-6.50
Neither like or dislike	4.51-5.50
Dislike slightly	3.51-4.50
Dislike moderately	2.51-3.50
Dislike very much	1.51-2.50
Dislike extremely	1.0-1.50

3. RESULTS AND DISCUSSION

Table 1 reveals the result of the sensory evaluation on the taste of the vegeel noodles. Treatment 0 was evaluated to have a plain flavour as shown by the mean score of 1.3. Treatment 1 has stimulating flavour. Treatment 2 and Treatment 3 have very stimulating flavour. The flavour of the treatments is affected by the number of grams that were mixed with the noodles. The treatments with higher amount of powdered eels that was mixed with the noodles had very stimulating flavour.

The p-value of 0.000 reflects that there is significant difference on the taste of vegeel noodles. The evaluators prefer Treatment 2 and Treatment 3. The flavour was affected by higher weight of eels mixed with the noodles.

Table 1. *Taste of vegeel noodles*

Treatment	Trial 1	Trial 2	Trial 3	Mean	Description
T ₀ No powdered eel	1.33	1.33	1.22	1.30 ^c	Plain flavour
T ₁ 25 g powdered eel	2.00	2.44	2.78	2.41 ^b	Stimulating flavor
T ₂ 50 g powdered eel	2.56	2.67	2.78	2.67 ^a	Very stimulating flavor
T ₃ 75 g powdered eel	2.33	2.89	2.56	2.59 ^a	Very stimulating flavor
F-value = 19.874				p-value = 0.000	

Table 2 reflects the sensory evaluation on the odor of the vegeel noodles. The mean scores of all the treatments showed odorless smell.

Statistical analysis reveals a p-value of 0.766 which means that there is no significant difference on the odor of all the treatments. Treatment 0, Treatment 1, Treatment 2. Treatment 3 and Treatment 4 were all odorless.

Table 2. *Odor of the vegeel noodles*

Treatment	Trial 1	Trial 2	Trial 3	Mean	Description
T ₀ No powdered eel	2.78	1.67	2.00	2.15	Odorless
T ₁ 25 g powdered eel	1.89	2.78	2.11	2.26	Odorless
T ₂ 50 g powdered eel	2.22	2.78	2.44	2.48	Odorless
T ₃ 75 g powdered eel	2.44	2.33	2.33	2.37	Odorless
F-value = 0.368				p-value = 0.766	

Table 3 presents the result of the sensory evaluation on the texture of vegeel noodles. Treatment 0 which is pure taro noodles had fine texture. Treatment 1, Treatment 2 and Treatment 3 had rough texture. This is attributed with the mixture of powdered eels with the noodles. The particles of powdered eels caused the roughness in the noodles.

Statistical analysis shows a p-value of 0.065 indicating that there is no significant difference on the texture of all the treatments. The treatments were generally rough in texture.

Table 3. *Texture of vegeel noodles.*

Treatment	Trial 1	Trial 2	Trial 3	Mean	Description
T ₀ No powdered eel	1.44	1.89	1.89	1.74	Fine
T ₁ 25 g powdered eel	1.56	1.44	1.33	1.44	Rough
T ₂ 50 g powdered eel	1.33	1.56	1.22	1.37	Rough
T ₃ 75 g powdered eel	1.44	1.22	1.22	1.30	Rough
F-value = 3.609				p-value = 0.065	

Table 4 shows that the mean scores of Treatment 0, Treatment 1 and Treatment 3 to be moderately discolored. Treatment 2 had a mean of 1.48 indicating that the treatment was discolored.

The p-value of 0.044 indicates that there is no significant difference in the color among the treatments. The discoloration of the treatments was caused by the amount of powdered eel mixed with the noodles.

Table 4. *Appearance/color of vegeel noodles*

Treatment	Trial 1	Trial 2	Trial 3	Mean	Description
T ₀ No powdered eel	1.89	1.89	1.67	1.81 ^b	Moderately discolored
T ₁ 25 g powdered eel	1.56	1.56	1.56	1.56 ^{ab}	Moderately discolored
T ₂ 50 g powdered eel	1.44	1.44	1.56	1.48 ^a	Slightly discolored
T ₃ 75 g powdered eel	1.44	1.56	1.56	1.52 ^b	Moderately discolored
F-value = 10.758				p-value = 0.044	

Table 5 displays the result of the sensory evaluation on the general acceptability of vegeel noodles. Treatment 0 had a mean score of 5.41 which means that the evaluator neither like nor dislike the pure taro noodles as the control. According to the evaluators, they slightly like Treatment 1 and Treatment 3. They moderately like Treatment 2.

The p-value of 0.019 reveals that there is significant difference on the general acceptability of vegeel noodles. The difference lies on the preference of the evaluators. This means that among all the treatments, Treatment 2 which is the noodle that is composed of 50g powdered swamp eel and taro was preferred by the culinary evaluators.

Table 5. *General acceptability of vegeel noodles*

Treatment	Trial 1	Trial 2	Trial 3	Mean	Description
T ₀ - no powdered eel	5.56	5.00	5.67	5.41	Neither like/dislike
T ₁ -25 g powdered eel	5.33	6.00	6.11	5.81	Like slightly
T ₂ -50 g powdered eel	6.89	6.67	6.22	6.59	Like moderately
T ₃ -75 g powdered eel	6.67	6.00	6.22	6.30	Like slightly
F-value = 6.016				p-value = 0.019	

4. CONCLUSIONS AND RECOMMENDATIONS

4.1. Conclusions:

1. The desired measurement of powdered eels to be mixed with the taro noodles is 50 g. It was noted that the noodles mixed with 50 g powdered eel has a very stimulating flavour, odourless, rough, discoloured and is moderately liked by the evaluators.

4.2.Recommendations:

1. It is recommended that the powdered eel should be finely prepared to improve the texture of the noodles. This could help improve the evaluation of the noodles which may increase the rating in terms of general acceptability so that evaluation shall be strongly like.
2. Further research should be conducted in order to develop competitive vegeel noodles.

References

Bricking E. (2002). *Introduced species summary project: Asian swamp Eel*. Columbia University. 27 February 2002. Retrieved from [http://www.columbia.edu/itc/cerc/danoffburg/invasion_bio/inv_spp_summ/Monopterus albus:Swamp eel.Fishbase](http://www.columbia.edu/itc/cerc/danoffburg/invasion_bio/inv_spp_summ/Monopterus_albus:Swamp_eel.Fishbase). 18 April 2006. http://www.fishbase.org/summary/Species_Summary.php?toc_id=193 Last accessed: October 12, 2012. GSMFC (Gulf States Marine Fisheries Commission) 2003. *Monopterus albus*. 21.

Center for disease prevention and control (2012). Protein. *What do you think about when you hear the word protein?*.An article. Posted October 4, 2014. Retrieved from <http://www.cdc.gov/nutrition/everyone/basics/protein.html>.

Chang, E. (2010). *Aquatic invasive species: Swamps of Asian swamp eel*. Retrieved from <http://sites.duke.edu/aquaticinvasives/page/2/>.

Curnutt, J. (2013). *Asian swamp eels: AKA, rice eel, or “Terminator” eels*. Retrieved from <http://www.adunai.com/eels.html>.

Duvauchelle, J. (2014). *The effects of low protein intake*. An article. Updated March 13, 20014, retrieved from <http://www.livestrong.com/article/214483-the-effects-of-low-protein-intake/>

Florida Fish and Wildlife Conservation Commission, Image Credit: *Diane Peebles (2013)*. *Swamp Eel: Monopterus albus*. Retrieved from <http://myfwc.com/wildlifehabitats/profiles/fish/freshwater/nonnatives/swamp-eel/5>

Fuller, P.L., Nico, L.G., Cannister, M., & Neilson, M. (2013). *Monopterus albus* (Zuiew, 1793) article. Retrieved from <http://nas.er.usgs.gov/queries/FactSheet.aspx?SpeciesID=974>

Gascon, M. (2011). *Swamp eels delicacy but terraces’ pest*. Retrieved from <http://newsinfo.inquirer.net/1-2637/swamp-eel-delicay-but-terraces%E2%80%99-pest>.

Gao, H., Yallampalli, U., & Yallampali, C., *Gestational protein restriction reduces expression of Hsd17b2 in rat placental labyrinth*. *Biology of reproduction*, 2012 DOI: 19.1095/biolreprod.112.100479.

Ismith, Christopher (2009). *Invasive ALERT: Asian swamp eel*. Retrieved from http://www.nj.gov/dep/fgw/pdf/fwfisheries/invasive_swampeel09.pdf.

Kline, J.E. (2013). *Monopterus albus* (Zuiew, 1793). *Impact of introduction*. Revised on October 18, 2013, retrieved from <http://nass.er.usgs.gov/queries/factsheet.aspx?SpeciesID=974>.

Mckenzie, D. (2011). *How can a lack of protein affect a person?* an article. Updated on May 12, 2011. Retrieved from <http://www.livestrong.com/article/441063-how-can-a-lack-protein-affect-a-person/>.

Ortega, A. (2011). *Side Effects of Low Protein Count*. Posted on March 22, 2011. Retrieved from <http://www.livestrong.com/article/97218-side-effects-low-protein-count/>.

Schocfield, P.J. & Nico, L.G. (2009). *Salinity tolerance of non-native Asian swamp eels (Teleostei: Synbranchidae) in Florida, USA: comparison of three populations and implications for dispersal*. *Environmental Biology of Fishes* 85:51:59.

See, D. (2010) *Eels compound. Ifugao's water woes in rice fields*. Retrieved from <http://northphiltimes.com/2010/03/eels-compound-ifugao-water-woes-in.html>

Society for the Study of Reproduction, ScienceDaily, (2012). *How a low-protein diet predisposes offspring to adulthood hypertension?* Posted July 25, 2012. Retrieved from <http://www.sciencedaily.com/releases/2012/07/120725162444.htm>.

Styles, S. (2014). *What occurs if your protein is low?* Healthy eating journal. Posted 2014. Retrieved from <http://healthyeating.sfgate.com/occurs-protein-low-2266.html>.

Sylvester, S. (2008). *Asian swamp eels: Let's eat them. The Asian swamp eel is an invasive species that threatens native wildlife*.

The George Mateljan Foundation (2013). *What is Protein?* Retrieved from <http://www.whfoods.com/genpage.php?tname=nutrients&dbid=92>.

US Department of Agriculture, Agriculture Research Service (2005). *Low protein+low exercise sarcopenia*, an Article. Last modified on November 15, 2005, Retrieved from <http://ars.usda.gov/is/AR/archive/may05/sarco0505.htm>.

Zimmerman, N. (2013). *Chinese man requires emergency surgery after the swamp eel he stuck up his butt gnawz through his colon.* An article. Retrieved from <http://gawker.com/5994144/Chinese-man-requires-emergency-surgery-after-the-swamp-ee-he-stuck-u-his-butt-gnaws-through-his-colon>.