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PREPARATION OF VIETNAMESE "TRA" FISH AND MORINGA LEAF FOR HEALTHY FISH VEGETABLES SOUP MIX PROCESSING

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ABSTRACT

Soup mix powder is ready food to eat that contains full nutrient-dense and adequacy with required the energy of the body. This study was carried out to formulate seven formulas from "Tra" fish and locally vegetables in Viet Nam, espeacily moringa leaves. The "Tra" fish and moringa leaf were prepared by oven-drying in temperatures (60, 70 and 80ºC) or freeze-drying (especially for "Tra" fish) with varying time (from 12 to 60 hours). The results showed that moringa leaves and fish were dried at 70ºC are the highest nutritional contents. The best time for freeze-drying of fish was 48 hours (the condenser temperature of -80ºC and a pressure of 0.001 mBar). The soup mix containing 30% freeze-dried fish, 5% moringa leaf powder and other ingredients (2.4% full cream powder, 12% non-dairy creamer, 21% potato starch, 22.7% of vegetables powder, 5.1% seasoning and 1.8% sugar) was the best sensory quality among the seven formulas evaluated. The water activity, protein, carbohydrate, lipid and ash content of this formula were 0.245, 22.34%, 47.89%, 6.36%, 5.35%, respectively. The final moisture content of product was less than 7% that were convenient for the preservation.

KEYWORDS: "Tra" fish, dehydrated powder, formulation, healthy soup mix, moringa leaf.

1. INTRODUCTION

The healthy soup mix is in the group of dehydration foods (Fang *et al.*, 2018), that designed for fast and simple preparation comfort to eat, delicious which contains full nutrient-dense and adequacy with required energy and nutrient of the body. It was prepared from vegetables, cereal, grind fish or meat, it is invention relates to an instant food product and more particularly a dry soup product will be instantly converted to the ready-to-eat soup by the addition with boiling temperature water mixing with water and take time a few minutes can be consumed.

Fish (*Pangasianodon hypophthlmus*) has the native to the river of southeast Asia, common in the Mekong delta, especially in Vietnam (Range, 2018), this fish has low price and desirable quality attributes, including its white flesh, delicate texture, clean taste and lack of horizontal bones, low fat content, high protein level, abundant essential amino acids (Wang and Hsieh, 2016).

Moringa trees are widely distributed in the tropical and subtropical regions of the world, it is considered the kind of most useful trees as almost every part of the plant can be used as food and medicine. Now drawing great attention throughout the world for its nutritional and medicinal value. The moringa leaf can be consumed either raw or cooked, dried, ground into powder. Moringa leaves are the excellent source of proteins (essential sulfur containing amino acid which are rarely found in daily dried), vitamins, beta-carotene, minerals, and tocopherols. Moreover, moringa leaf is a good source of antioxidants and also has anti-inflammatory properties as well, it can effectively reduce serum cholesterol may protect from arsenic toxicity quercetin, help in lowering blood pressure (Farzana *et al.*, 2016)

Food drying is a traditional method of food preservation, which is used for the production of special foods and food ingredients. In recently, drying technology was applies for food preservation, especially oven-drying and freeze-drying to deduce the moisture content and avoid food spoilage but maintaining the value nutrition of food (Özbek and Dadali, 2007).

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2. MATERIALS AND METHODS

Materials

Fish (*Pangasianodonhypophthalmus*), Moringa *oleifera* leaves, potatoes, soybeans, corn starch, pumpkins, tomatoes, carrots, garlics, purple onion, garlic, sugar, seasoning, coriander leaf, black peppers, on-dairy creamer, and full cream milk powder were purchased in the supermarket in Can Tho city**.**

Preparation of raw material

Processing of vegetable and cereal were dried by oven-drying (pumpkin, potato, tomato, garlic, purple onion, coriander, carrot) were cleaned, sliced and soaked in water with sodium metabisulfite ($Na_2S_2O_5$) 300 ppm for 10-30 minutes before steaming by microwave 800W for 5 minutes (excepted for garlic, purple onion, coriander), soybeans were soaked in normal water 2 hours before boiling 30 minutes, seed black pepper was dried before breaking to small size, the ingredients were dried in oven-drying at 60℃ (Chen *et al*, 2013; Karimi, 2015) for 3-8 hours depend on the types of raw material, then milled and kept them at PA package at ambient temperature 28±2ºC (Fang *et al.*, 2018).

Preparation of fish (Pangasianodon hypophthalamusm): The size of fish muscle are 0.5x0.5 cm, after finishing preparation, the samples were dried in freeze-dryer, the condenser temperature of -80℃, the pressure of 0.01 mBar, in vary time 12, 24, 36, 48, and 60 hours. Or was dried in oven-dryer after steaming by microwave 800W of different temperature (60,70, and 80℃), the final moisture content of samples after drying was less than 6% (Elavarasan and Shamasundar, 2016).

Preparation of moringa leaf powder: The fresh and fully grown moringa *oleifera* leaves, after were washed and soak in water with sodium metabisulfite ($Na_2S_2O_5$) 100 ppm for 10 minutes, then spread thinly out on racks for 10-15 min to drain out water (Farzana *et al*., 2016), the samples was dried by hot air oven (Yusof *et al.*, 2014) in different temperature (60, 70, and 80℃), then milled, sieved, package and stored at ambient temperature (28±2ºC), the moisture content should be less than 6% (Olabode *et al*., 2015)

Formulation of instant soup mix

The formulas showed in the **Table 1**: 5 formulas (F1, F2, F3, F4, and F5) were used oven-dried fish and 2 formulas (F6 and F7) were used freeze-dried fish.

Table 1. The seven formulas of instant soup mix

No	Ingredients (g)	F1	F2	F3	F4	F5	F6	F7
1	Fish	30	27	24	21	18	30	24
2	Moringa leaf	5	7.5	10	12.5	15	5	10
3	Potato	21	20	19	18	17	21	19
4	Soy bean	4	5.5	7	8.5	10	4	7
5	Corn flour	5	5	5	5	5	5	5
6	Pumpkin	3	3	3	3	3	3	3
7	Tomato	4	4	4	4	4	4	4
8	Carrot	3.8	3.8	3.8	3.8	3.8	3.8	3.8
9	Garlic	0.5	0.5	0.5	0.5	0.5	0.5	0.5
10	Onion (Purple)	1	1	1	1	1	1	1
11	Sugar	1.8	1.8	1.8	1.8	1.8	1.8	1.8
12	Seasoning	5.1	5.1	5.1	5.1	5.1	5.1	5.1
13	Coriander	0.2	0.2	0.2	0.2	0.2	0.2	0.2
14	Black pepper	1.2	1.2	1.2	1.2	1.2	1.2	1.2
15	Non-dairy creamer	12	12	12	12	12	12	12
16	Full cream milk powder	2.4	2.4	2.4	2.4	2.4	2.4	2.4
TOTAL		100	100	100	100	100	100	100

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Physical-chemical analysis.
The chemical composition of samples such as basic nutrients protein, moisture, fat, ash determined by using standard methods (AOAC 2000). The total carbohydrate content was determined according to the method of MsCseady (1970) and Dubois *et al*. (1956). The water activity (a_w) was measured using Rotronic Hygro Palm HP23-AW-A-SET (USA).

Sensory characteristics of soup
Sensory properties (flavor, taste, and appearance) were used Quantitative Descriptive Analysis (QDA) and analyzed by Principal Component Analysis (PCA).

Statistical analysis
Data analyses were carried out using STATGAPHICS Centurion XV (USA). Values were expressed as percentage and mean ± SD. The significance/non-significance of result was determined using one-way ANOVA and Duncan test.

3. RESULTS AND DISCUSSION

The effect of drying time on the quality of freeze-dried fish.

Physical characteristics (water activity, moisture content)
The higher moisture content could make the product susceptible to microbial and enzymatic spoilage. *Pangasius* having a moisture content of 78% is susceptible to spoilage if it is not preserved properly. The moisture content and water activity (a_w) of freeze-dried fish decreased during the drying process (12 to 60 hours) (**Table 2**) from 36.40±0.17 to 3.55±0.09% and from 0.75±0.03 to 0.19±0.01, respectively.

Table 2. Effect of drying time on water activity, moisture content of freeze-dried fish

Time (hours)	Moisture (%)	Water activity
12	36.40 ± 0.17^{a}	0.75 ± 0.03^{d}
24	35.33 ± 0.49^{b}	0.68 ± 0.03^{c}
36	28.27 ± 0.38^{c}	0.62 ± 0.02^{b}
48	5.13 ± 0.09^{d}	0.21 ± 0.01^{a}
60	3.55 ± 0.09^{e}	0.19 ± 0.01^{a}

Values are expressed as mean±SD. Values with different superscripts are significantly different (P<0.05).

According to Genin *et al.* (1996), to prolong the preservation time of freeze-dried products, the moisture content of the product must meet the requirement (approximately 5%). This result also agreement with Govidan (1975) and Sablani *et al.* (2007) moisture content of fish in their study was less than 5%. Pathogens *et al.* (2013) stated that low water activity able confirm the safety of food for long storage. The time of freeze-dried for fish was selected at 48 hours.

Chemical characteristics (crude protein, lipid, and ash content)
The proximate composition of freeze-dried "Tra" fish by using freeze-drying at different time (12, 24, 36, 48, and 60 hours) had been shown in **Table 3**. The protein content of freeze-dried fish increased when drying time increased from 12 hrs (protein content was 25.88±0.34%) to 60 hrs (protein content was 66.77±0.96%). Similarly, the lipid and ash content of the product also increased markedly with respect to increased drying time from 12 (7.04±0.16%, 1.86±0.1%) to 60 hrs (19.81±0.47%, 3.15±0.19%). During drying, heat and moisture transfers are coupled. It is a simultaneous heat and moisture transfer process where moisture leaves the food in the form of vapor, while oil and protein content are not significantly changed, it means that proportion of lipid in fish is stability in the fish, the freeze-dried fish kept fat at higher levels, this findings agree with the observation of freeze-dried of other fish keep fat at high level (Sablani *et al.*, 2007). An increase in protein content was due to aggregation of proteins after the removal of water molecules present between proteins during drying (Ninawe and Ratnakumar, 2008). The increase in drying time and loss of moisture leads to denaturation of the protein (Begum *et al.*, 2013). Protein was not lost during kiln and electric oven drying of cat fish (*Clarias gariepinus*)

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(Chukwu and Shaba, 2009). Normally, the stability of ash content in raw material was observed, it means that percent of ash is no change in the fish. In addition, these results are quite similar with Kordon *et al.* (2018) in the study on *Pangasianodon hypophthlmus*.

Table 3 Effect of drying time on the content of protein, lipid, and ash of the freeze-dried fish

Drying time (hrs)	Nutrients (%)		
	Protein	**Lipid**	**Ash**
12	25.88±0.34^{a}	7.04±0.16^{a}	1.86±0.1^{a}
24	32.27±0.48^{b}	8.20±0.36^{b}	2.39±0.22^{b}
36	39.77±0.6^{c}	10.81±0.6^{c}	2.75±0.28^{bc}
48	59.66±0.4^{d}	17.87±0.34^{d}	3.01±0.13^{cd}
60	66.77±0.96^{e}	19.81±0.47^{e}	3.15±0.19^{d}

Values are expressed as mean±SD. Values with different superscripts are significantly different (P<0.05).

Effect of oven-drying process on the quality of fish (*Pangasianodon hypophthlmus*)

The moisture ratio

The moisture ratios of oven-dried "Tra" fish in different temperature (60, 70, and 80℃) are shown in the **Figure 1.** It could be seen that the moisture ratio was decreased following the time of drying.

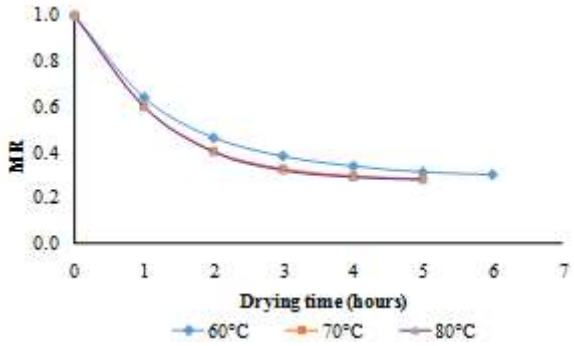

Figure 1. Moisture ratio on drying time (hours) of three temperatures (60, 70, and 80 ℃

In order for the final material to reach a moisture content of 6-8%C, the drying times of the sample at different time are selected (6 hrs, 5 hrs, and 5 hrs for drying temperature of 60, 70, and 80℃, respectively).The initial drying rate was very high at all drying temperatures due to high heat supplied at high temperatures and evaporation took place. According to the drying process of Chinenye (2009), the drying rate decreased continuously at all any temperature. The drying time for oven 70℃ and 80℃ up to could be shortened than 1 hour when compared to the oven at 60℃ (Bharda et al., 2017). This result strongly agree with other research, it takes time around 5 hours for drying fish (Das and Rohit, 2015).

Physical charateristics (water activity and moisture content)

Table 4 shows the effects of drying temperatures on the moisture content and water activity of oven-dried fish. The initial moisture content of fish after harvest was 78.28% (fresh weight basis). As drying temperatures increased moisture percentage decreased and water activity decreased as well. Moisture percentage decreased faster at higher temperature than at low temperature. The moisture content and water activity of dried-fish were 2.63-5.57% and 0.35-0.43, respectively. The high temperature can remove water from the raw material, due to the water in the fish evaporated and the moisture from drying food released from the oven. The reduction in moisture level reduced the water activity of the dehydrated sample. The correlation between moisture content and water activity, the value of moisture content low, the water activity also low, low water activity can safety food a long storage (Pathogens *et al.*, 2013). A relatively low value of water activity of dehydrated sample that is, less than 0.6 is the recommended level for safe and long-term storage. The lower value of water activity

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prohibits the microbial activity and thereby prevents the oxidative and enzymatic degradation of the sample (Kaur and Singh, 2014).

Table 4. Effect of drying temperature on moisture content and water activity of oven-dried fish

Temperature (℃)	Moisture content (%)	Water activity
60	5.57±0.41[b]	0.43±0.02[b]
70	3.10±0.08[b]	0.40±0.03[b]
80	2.90±0.53[a]	0.35±0.02[a]

Values are expressed as mean ± SD. Values with different superscripts are significantly different (P<0.05).

Chemical characteristics (Crude protein, lipid, and ash)

The proximate composition of oven dried "Tra" fish samples is presented in **Table 5**. The results showed that all the parameters significantly (P<0.05) changed when the leaves were dried in oven dryer. As the drying temperature increased from oven drying 60 to 80ºC, crude protein decreased significantly, sample dried at 60ºC had 57.45% and that dried at 80ºC had 56.73%. Men *et al.* (2003) reported that, the protein content of fish (*Pangasianodon hypophthlmus)* was 58.6% by air-drying. The lipid content of samples were reduced as incresead drying temperature, at high temperature, the lipid is removement from the fish mass (Begum *et al.*, 2012). As drying temperature increased there was corresponding increase in protein denaturalization resulting to significant decrease in both protein and fat. These results are in agreement with the report of Gernah and Sengev (2011) and Sengev *et al.* (2013). When comparing between freeze-dried and hot air dried samples, the oven dried samples had higher protein and lipid content than freeze-dried samples and the color was also brighter.

Table 5. The chemical composition of dried fish by oven-drying

Drying temperature (℃)	Protein (%)	Lipid (%)	Ash (%)
60	57.45±0.65[b]	17.22 ±0.98[b]	2.82±0.12[a]
70	57.44±0.36[b]	17.08±0.62[b]	2.92±0.09[a]
80	56.73±0.59[a]	15.24±0.85[a]	2.90±0.12[a]

Values are expressed as mean ± SD. Values with different superscripts are significantly different (P<0.05).

Effect of oven-drying process on the quality of moringa leaf powder

Moisture ratio

The initial moisture content of fresh moringa leaf was recorded as 81.58±0.61% (wet basis) and was reduced to a final moisture content of 6-8% to preserve the quality and safety during storage.

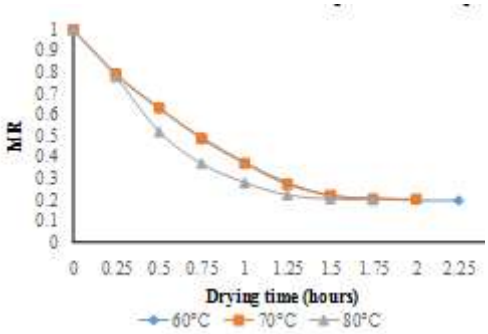

Figure 2. Moisture ratio on drying time (hours) of three temperatures (60. 70, and 80 ℃

The drying profile of moringa leaf was analyzed by the curves of experimental moisture ratio at different drying temperatures (60-80ºC) as shown in **Figure 2.** It was apparent that the experimental moisture ratio continuously decreased with an increase in drying temperatures (60-80ºC). A similar decreasing trend in moisture ratio was evaluated as a function of time until it reached the final moisture content. These results further confirmed that at the temperature of 60ºC, morginga leaf reached the final moisture content within 2.25 hours of drying time and the same sample reached the final moisture content within 1.75 hours at the temperature of 80ºC, which led to

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the formation of a steeper-shaped drying curve. Drying times ranged from 1.75 hours (80ºC) to 2.25 hours (60ºC) to reach the final moisture content.

The physical characteristics (moisture content and water activity)

The moisture content and water activity of samples were dried at different temperatures from 60 to 80℃ decreasing significantly (**Table 6**). The evaporation of moringa leaf were heated diffusivity of oven drying at high temperature until to the end point of moisture content. The relative of moisture content and water activity, when the value of moisture content low, the water activity also low, the low water activity is safety food a long storage a voice food spoilage (Pathogens *et al.*, 2013). Water activity less than 0.6 is the recommended level for safe and long term storage (Kaur and Singh, 2014). The results further indicated that all three oven temperature able to reduce moisture content leaves temperature less around 6% is favorable for further processing (Division, 1995).

Table 3.5 Effect of drying temperature on moisture content and water activity of oven-dried moringa leaf

Temperature (℃)	Moisture content (%)	Water activity
60	5.52 ± 0.12^{c}	0.44 ± 0.01^{b}
70	4.20 ± 0.11^{b}	0.42 ± 0.02^{ab}
80	3.74 ± 0.18^{a}	0.40 ± 0.01^{a}

Values are expressed as mean ± SD. Values with different superscripts are significantly different (P<0.05).

Chemical properties (protein, lipid, carbohydrate and ash content) of moringa leaf powder

As the drying temperature increased from oven drying 60 to 80°C, crude protein decreased non-significantly (**Table 7)**. Samples dried at 60°C had 31.04% and that dried at 80°C had the value of 29.94%. Similar trends were observed for fat content which had values of 2.27% at 60°C, 2.45% at 70°C and 2.52% at 80ºC. As drying temperature increased there was corresponding increase in protein denaturalization resulting to significant decrease in both protein and fat. These results are in agreement with the report of Gernah and Sengev (2011) and Sengev *et al.* (2013). These results are similar with the research of Farzana *et al.* (2017) and El-Gammal *at el.* (2016b). **Table 7** also shows that the ash content increased significantly ($p<0.05$) with drying temperature of moringa leaf. This is in agreement with what was reported by Olabode *et al.* (2015) and (Yusof *et al.*, 2014), reported that mild drying conditions with lower temperature may improve the product quality but decrease the drying rate.

Table 7. The nutrition of moringa powder

Temperature (℃)	Nutrition compound (%)			
	Protein	Lipid	Carbohydrate	Ash
60	31.04 ± 1.41^{a}	2.27 ± 0.15^{a}	45.63 ± 1.41^{a}	4.69 ± 0.43^{a}
70	30.63 ± 1.12^{a}	2.45 ± 0.15^{a}	44.30 ± 1.12^{a}	6.68 ± 0.19^{b}
80	29.94 ± 1.22^{a}	2.52 ± 0.11^{a}	43.53 ± 1.22^{a}	7.76 ± 0.08^{c}

Values are expressed as mean±SD. Values with different superscripts are significantly different (P<0.05)

Formulation of soup mix powder

A healthy diet is a diet that helps to maintain or improve overall health. A healthy diet provides the body with essential nutrition: fluid, macronutrients, micronutrients and adequate calories.

Moisture content and water activity

The moisture content and water activity (a_w) of the products produced by seven formulas showed no significant difference, ranging from 5.17±0.34 to 6.56±0.36% and 0.243±0.05 to 0.249±0.04, respectively (**Table 8**). The minimum a_w at which microorganisms can grow is 0.60. The minimum a_w for growth of most bacteria is approximately 0.87, although halophilic bacteria can grow at a_w as low as 0.75 (Beuchat *et al.*, 2013). According to the International Commission on Microbiological Specifications for Foods (1996), under optimal conditions, S. *aureus* can grow at a_w as low as 0.83. Moreover, the moisture content of the newly developed soup was lower than the reports of other studies (Rekha *et al.*, 2010; Rubilar *et al.*, 2012; Singh & Chaudhary, 2015). The lower moisture content may be due to the incorporation of potato flour and moringa leaf powder in the preparation of soup which is supported by our previous studies that increase in potato flour percentages decreases moisture

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content in biscuit (Farzana & Mohajan, 2015) and the study of Sengev *et al.* (2013) that increase in moringa leaf powder decrease moisture content of bread. This may be explained as potato flour contained a greater amount of total dry solid with high emulsifying properties compared to other flours. Furthermore, low moisture content of *Moringa* leaf powder used in the blends may also substantiate this study and might have implications in terms of the texture and microbiological quality of soup processed with added *Moringa* leaf powder (Sengev *et al.*, 2013). Moisture content is an important factor in maintaining food quality because increase moisture facilitates the growth of microbes and ultimately destroy quality. According to Luh and Woodroof (1975), moisture content is an important factor of microorganism's growth. Microorganisms cannot grow when moisture content is below 8%. On the other hand, when moisture is above 18%, some microorganisms may be reproduced gradually. In addition, El Wakeel (2007) claims that in case of dried materials, moisture content less than 10% is considered as more proper for keeping quality of soup ingredients.

Table 8. Moisture content and water activity of fish soup powder

Formula	Moisture content (%)	Water activity
F1	5.54±0.17	0.246±0.05
F2	6.10±0.69	0.249±0.04
F3	6.52±0.45	0.248±0.04
F4	6.35±0.26	0.243±0.05
F5	6.56±0.36	0.243±0.03
F6	5.17±0.34	0.245±0.02
F7	5.37±0.03	0.245±0.04

Values are expressed as mean±SD.

Carbohydrate, protein and fat content

In this study, the protein content of the five soup powders varied significantly. It ranged from 15.67% to 22.34%. The soup powder showed significantly highest protein content (22.34%) among all other locally available soups, F1 (20.14±1.06%), F6 (22.34±0.73%) and F7 (20.14±1.78%), whereas F5 soup (15.67%) showed the least protein content (**Table 9**).

Table 9. Proximate analysis of seven fish soup powder

Formula	Protein (%)	Lipid (%)	Carbohydrate (%)	Ash (%)	Energy provided (kcal)
F1	20.14±1.06	6.04±0.02	44.82±2.99	5.88±0.10	314.20
F2	19.58±0.06	6.14±0.06	45.82±3.07	6.09±0.02	316.86
F3	19.09±0.34	6.37±0.43	49.45±1.31	6.19±0.03	331.49
F4	17.20±0.28	6.55±0.12	55.22±2.34	6.22±0.14	339.03
F5	15.67±0.22	7.46±0.24	56.08±7.88	6.28±0.20	354.14
F6	22.34±0.73	6.36±0.41	47.89±7.66	5.35±0.02	338.16
F7	20.14±1.78	6.80±0.05	46.77±4.56	5.56±0.02	328.84

Values are expressed as mean±SD.

The protein content of the presently developed fish soup powder was higher than that of the results of other studies (Rahman *et al.*, 2012; Rekha *et al.*, 2010; Rubilar *et al.*, 2012; Singh *et al.*, 2003; Thuy *et al.*, 2019). The highest protein content of soup powder maybe was owing to potato flour, fish, and Moringa leaves supplementation in the soup. These results are supported by the finding of other studies where incorporation of soybean, moringa leaves increases the protein content (Ayo *et al.*, 2014; Farzana & Mohajan, 2015; Sengev *et al.*, 2013). Soybean is a good source of protein (40%–45%) and an excellent complement to lysine-limited cereal protein (Garg *et al.*, 2014). Hence, this is the basis for the use of soy flour as an economical protein supplement in soup, biscuit, bread, pasta, and other cereal products (Hegstad, 2008). Moringa leaf is also a good source of protein (26.2%) (Dachana *et al.*, 2010). Owing to higher protein content of these three plant sources, it could be assumed that addition of soy flour, and moringa leaf powder in soup have a greater potential in overcoming protein–calorie malnutrition of the people.

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The fat content of the seven soup powders ranged from 6.04% to 7.46%. The highest fat content was found in locally available F3 soup powder (7.46%), whereas least amount was found in F1 soup powder (6.04%). Soy flour contains 18% of fat (Kundu *et al.*, 2011). The two polyunsaturated fats that are found in soy flour, including the two essential fatty acids, linoleic and linolenic, assist in the absorption of vital nutrients that are required for human health (Hegstad, 2008). The lower fat of this soup will make it an appropriate choice as a food for everybody. Moreover, a low-fat diet can help us ward off serious medical conditions, including heart disease, high cholesterol, diabetes.

In this study, the carbohydrate content of the seven soups varied significantly. It ranged from 44.82% to 56.08%. The lower carbohydrate content of the presently developed soup powder possibly as a result of lower carbohydrate content of soy flour, mushroom, and moringa leaf powder that are used in the preparation of soup. The energy provided value of the five soups ranged from 314.2 to 354.14 (kcal/100 g).

The ash content of the seven soup formulations ranged from 5.35% to 6.28%. The ash content of the presently soup powder was found same with the results of other studies (Igwenyi & Azoro, 2014; Rekha *et al.*, 2010; Rubilar et al., 2012). The high mineral content of the soup powder may be due to the supplementation of soy flour, mushroom, and moringa leaves as soy flour and moringa leaves are good source of minerals, supported by other studies (Ayo *et al.*, 2014; Dachana *et al.*, 2010; Farzana & Mohajan, 2015; Sengev *et al.*, 2013). The higher ash content of the newly developed soup powder suggests that it is a better source of minerals.

Percent of energy providing from nutrients (%)

The percentage of energy supplied from major nutrients in formula 6 (F6) is presented in **Table 10**. A diet that is balanced in its macronutrient distribution can help reduce the risk of disease and foster lasting weight loss. Acceptable macronutrient distribution ranges (AMDRs) for a particular energy source that is associated with reduced risk of chronic disease while providing intakes of essential nutrients. An intake outside of the AMDR carries the potential of increased risk of chronic diseases and/or insufficient intakes of essential nutrients. Acceptable Macronutrient Distribution Ranges for Adults (as a percentage of Calories) are as follows: protein: 10-35%, fat: 20-35%, carbohydrate: 45-65%. Food sources that provide carbohydrate, protein & fat also provide other essential nutrients. A balance of the macronutrients can help ensure adequate intakes of micronutrients as well. Our obtained results showed that the percent of Calories from macronutrients in this formula were within the AMDR (except lipid – a little low lipid levels). Calories percentages from carbohydrates, proteins and lipids are 56.64, 26.43, 16.93%, respectively. A diet that is balanced in its macronutrient distribution is recommended for lasting weight loss because unbalanced nutrient profiles may increase the risk of adverse health consequences.

Table 10. Macronutrients content, yielding-energy and percentage of energy that provided from 100 g of mixed fish vegetable soup

Nutrients	Content (g)	Energy-yielding nutrients (kcal)	Percent of energy providing from nutrients (%)
Carbohydrate	47.89	191.56	56.65
Lipid	6.36	57.24	16.92
Protein	22.34	89.36	26.43
Totat		**338.16**	**100**

Sensory characteristics

All of the formulations were significantly different in swallow ability, lightness. In the PCA result sensory map of samples, PC was carried out on CATA question. According to cluster analysis, positive value of the first dimension that comprise formula F1, F6 and F7 and was explained with terms of lightness and chalky (**Figure 3**). It was obviously found that in term of swallow ability and lightness correlated to overall liking. The trend of liking showed that formula F1, F6, F7 received excellent appreciation by the panelists.

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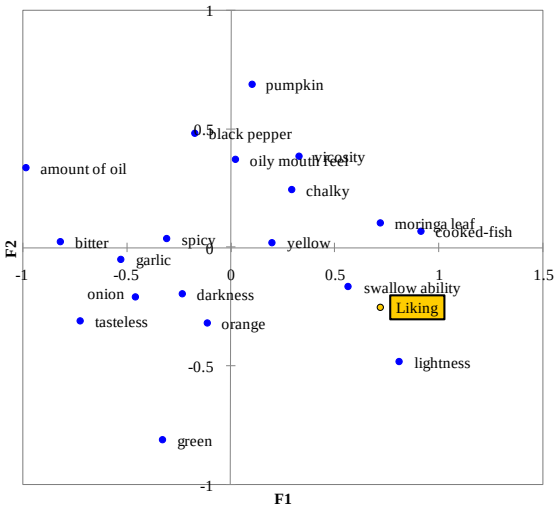

Figure 3 The plot draws by the correspondence analysis in the association between formulations and sensory attributes in instance soup mix

From the results of QDA, each formula corresponds to the mean value attribute by the panelist group. Samples are located near the descriptors that their characteristics. PCA explained 80.95% of variance (**Figure 4**). The soup powder formula F6 and F1 was characterized by descriptor overall quality rating was had the same term with CATA question. The results of this study are in agreement with Thuy *et al*. (2019) examined the sensory attributes of the soup products prepared with a combination of added vegetable and chicken. The important sensory attributes of soup powder corresponded to cooked-fish, lightness and chalky. The samples F6 and F1 shown several attributes in term of viscosity, lightness, swallow ability. Complete knowledge of sensory properties of any food powder has a decisive importance for the realization of many technological processes, especially for monitoring their quality and consumer acceptance (Kurozawa *et al.*, 2009). Regarding to results, F1 and F6 associated with the good attribute. However, F6 formula shown the higher acceptability than F1 formula. The preference mapping also shown the similar result (**Figure 5**)

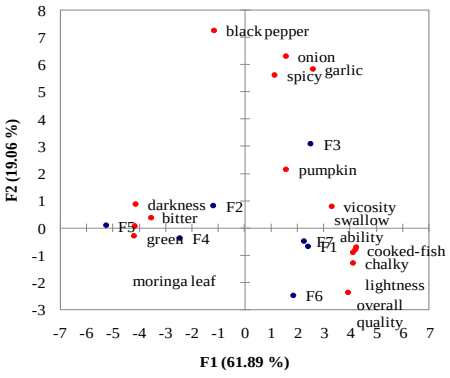

Figure 4. Principle component analyses (PCA) of sensory data of soup products

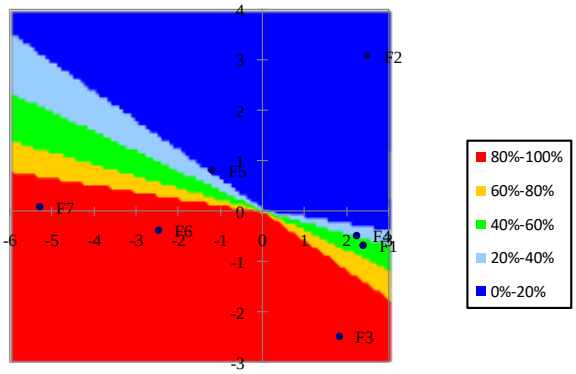

Figure 5. The Preference Mapping of soup products

4. CONCLUSION

Freeze drying is recognized as the best method to produce high-quality dried food products. For prepare fish freeze-dried, the samples were frozen at -40°C and dried in a freeze-drier at condenser temperature at -80ºC and the vacuum is 0.001 mBar during 48 hours. The final moisture content of dried products was less than 5% that were convenient for the preservation or combination with other ingredients. The quality of the ingredients was best (compared to the other samples) when dried in oven-dried at 70℃. In order to adequate and balance the nutritional in soup products, the mixing formulas were calculated. The healthy fish vegetables soup mix containing 30% freeze-dried fish, 5% moringa powder and other ingredients (2.4% full cream powder, 12%

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non-dairy creamer, 21% potato starch, 22.7% of vegetables powder, 5.1% seasoning and 1.8% sugar) was the best sensory quality among the seven formulas evaluated.

REFERENCES

[1] Akoy, E. O. M. (2014) 'Experimental characterization and modeling of thin-layer drying of mango slices', *International Food Research Journal*.
[2] Begum, M., Akter, T. and Minar, M. (2012) 'Analysis of the Proximate Composition of Domesticated Stock of Pangas (Pangasianodon hypophthalmus) in Laboratory Condition', *Journal of Environmental Science and Natural Resources*. doi: 10.3329/jesnr.v5i1.11555.
[3] Begum, M., Begum, M., uddin Ahmed, S.U., Akter, T. 2013. Studies on the effectiveness of Tejpata (Cinnamomum tamala Nee) leaf extract on dried kachki (Corica soborna) fish preservation in laboratory condition. Am. J. Food Sci. Technol. 1(3), 14-17
[4] Bharda, S. *et al.* (2017) 'Production of different type of dry fish and its yield measurement at Veraval, Gujarat, India', 6(7), pp. 28–32.
[5] Chinenye, N. M. (2009) 'Effect of Drying Temperature and Drying Air Velocity on the Drying Rate and Drying Constant of Cocoa Bean', XI.
[6] Chukwu, O., and Shaba, I.M. 2009. Effects of Drying Methods on Proximate Compositions of Catfish (Clarias gariepinus). World J. Agr. Sci. 5(1), 114–116
[7] Dachana K. B., Rajiv J., Dasappa I., & Prakash J. (2010). Effect of dried moringa (Moringa oleifera Lam.) leaves on rheological, microstructural, nutritional, textural and organoleptic characteristics of cookies. Journal of Food Quality, 33, 660–677.
[8] Division, P. (1995) *Fruit and vegetable processing*.
[9] Dubois, M., Gilles, K.A., Hamilton, J.K., Rebers, P.A. and Smith, F. (1956). Colorimetric method for the determination of sugars and related substances. Analytical Chemistry, 28, 350 – 356. https:// doi.org/10.1021/ac60111a017
[10] Doymaz, I. (2006). Drying kinetics of black grapes treated with different solutions. Journal of Food Engineering, 76(2), 212–217. https://doi.org/ 10.1016/j.jfoodeng.2005.05.009
[11] El-Gammal, R. E., Ghoneim, G. A. and Elshehawy, S. M. (2016a) 'Effect of Moringa Leaves Powder (Moringa oleifera) on Some Chemical and Physical Properties of Pan Bread', *J. Food and Dairy Sci. Mansoura University*.
[12] El-Gammal, R. E., Ghoneim, G. A. and Elshehawy, S. M. (2016b) 'Effect of Moringa Leaves Powder (Moringa oleifera) on Some Chemical and Physical Properties of Pan Bread', *J. Food and Dairy Sci. Mansoura Univ*, 7(7), pp. 307–314.
[13] Elavarasan, K. and Shamasundar, B. A. (2016) 'Effect of oven drying and freeze drying on the antioxidant and functional properties of protein hydrolysates derived from freshwater fish (Cirrhinus mrigala) using papain enzyme', *Journal of Food Science and Technology*. doi: 10.1007/s13197-015-2084-9.
[14] El Wakeel M. A. (2007). Ultra Structure and Functional Properties of Some Dry Mixes of Food. M.Sc. Thesis, Faculty of Agriculture, Cairo: Ain Shams University.
[15] Fang, Y. *et al.* (2018) 'Development and Quality Analysis of Protein Enriched Instant Soup Mix', *Food and Nutrition Sciences*. doi: 10.4236/fns.2018.96050.
[16] Farzana T., & Mohajan S. (2015). Effect of incorporation of soy flour to wheat flour on nutritional and sensory quality of biscuits fortified with mushroom. Food Science and Nutrition, 3(5), 363–369.
[17] Farzana, T. *et al.* (2016) 'Development of A Healthy Soup Powder Using Phytonutrient Enriched Mushroom-Moringa Leaf', *DIU Journal of Allied Health Sciences*, 3(1 & 2), pp. 33–40.
[18] Farzana, T. *et al.* (2017) 'Formulation and nutritional evaluation of a healthy vegetable soup powder supplemented with soy flour, mushroom, and moringa leaf', *Food Science and Nutrition*. doi: 10.1002/fsn3.476.
[19] Genin, N., Rene, F. and Corrieu, G. (1996) 'A method for on-line determination of residual water content and sublimation end-point during freeze-drying', *Chemical Engineering and Processing: Process Intensification*, 35(4), pp. 255–263. doi: 10.1016/0255-2701(95)04131-1.
[20] Gernah DI, Sengev IA (2011). Effect of processing on some chemical properties of the leaves of drumstick tree (moringaOleifera). Niger. Food J. 29(1):70-77.
[21] Garg S., Malik R. K., Lule V., & Awasti N. (2014). Soy and its supplements in combating malnutrition

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

and lifestyle disorders. Journal of Innovative Biology, 1(3), 126–131.
[22] Gernah DI, Sengev IA (2011). Effect of processing on some chemical properties of the leaves of drumstick tree (moringaOleifera). Niger. Food J. 29(1):70-77.
[23] Govindan (1975) 'Freeze drying of fishery products. Prt 5 Storage characteristics of ready-to-serve freeze dried foods', (1). Jay, J.M..Incidence and types of microorganisms in foods. In Modern Food Micro biology Springer Netherlands, pp.63-93, 1992
[24] Hegstad H. G. (2008). Nutritional and Health benefits of Soybean. Soy Protein Quality Evaluation Report, Food and Agriculture Organization of the United Nations, Food and Nutrition Paper No. 71, Rome, Italy
[25] Igwenyi I. O., & Azoro B. N. (2014). Proximate and phytochemical compositions of four indigenous seeds used as soup thickeners in ebonyi state Nigeria. IOSR Journal of Environmental Science, 8(6), 35–40.
[26] Karimi, M. (2015) 'Influences of drying methods processing on nutritional properties of three fish species Govazym stranded tail , Hamoor and Zeminkan', 22(6), pp. 2309–2312.
[27] Kaur, K. and A.K.Singh (2014) 'Drying kinetics and quality characteristics of beetroot slices under hot air followed by microwave finish drying', *African Journal of Agricultural Research*. doi: 10.5897/AJAR2013.Kordon, Ga. O., Karsi, A. and Pinchuk, L. (2018) 'Innate Immune Responses in Fish: Antigen Presenting Cells and Professional Phagocytes', *Turkish Journal of Fisheries and Aquatic Sciences*, 18, pp. 1123–1139. doi: 10.4194/1303-2712-v18.
[28] Kordon, Ga. O., Karsi, A. and Pinchuk, L. (2018) 'Innate Immune Responses in Fish: Antigen Presenting Cells and Professional Phagocytes', *Turkish Journal of Fisheries and Aquatic Sciences*, 18, pp. 1123–1139. doi: 10.4194/1303-2712-v18.
[29] Kundu, R., Brahmchari, K., Bera, P. S., Kundu, C. K., & Roychoudhury, S. (2011). Bioefficacy of imazethapyr on the predominant weeds in soy- bean. Journal of Crop and Weed, 7, 173–178.
[30] Kurozawa, L. E. *et al.* (2009) 'Influence of spray drying conditions on physicochemical properties of chicken meat powder', *Drying Technology*. doi: 10.1080/07373930903267187.
[31] Luh B. S., & Woodroof J. G. (1975). Commercial Vegetable Processing. Westport: The Avi Publishing Company Inc.
[32] McCseady, R.M. (1970). Determination of starch and dextrin in methods of Food Analysis, 2nd edition. A series of monographs, D.225-227. London, UK: Academic Press.
[33] Men, L. T. *et al.* (2003) 'Evaluation of the Genetic Diversities and the Nutritional Values of the Tra (Pangasius hypophthalmus) and the Basa (Pangasius bocourti) Catfish Cultivated in the Mekong River Delta of Vietnam'.
[34] Ninawe, A. S., and Rathnakumar, K. 2008. Preservation of Fish by Curing. In Fish Processing Technology and Product Development, New Delhi: Narendra Publishing House, 112–147.
[35] Olabode, Z. *et al.* (2015) 'Effects of Drying Temperature on the Nutrients of Moringa (Moringa oleifera) Leaves and Sensory Attributes of ... Effects of Drying Temperature on the Nutrients of Moringa (Moringa oleifera) Leaves and Sensory Attributes of Dried Leaves Infusion', *Direct Research Journal of Agriculture and Food Science*, 3(5), pp. 117–122.
[36] Özbek, B. and Dadali, G. (2007) 'Thin-layer drying characteristics and modelling of mint leaves undergoing microwave treatment', *Journal of Food Engineering*. doi: 10.1016/j.jfoodeng.2007.04.004.
[37] Pathogens, F. *et al.* (2013) 'Low-Water Activity Foods : Increased Concern as Vehicles of Low – Water Activity Foods : Increased Concern as Vehicles of Foodborne Pathogens', (January). doi: 10.4315/0362-028X.JFP-12-211.
[38] Rahman M. A., Saifullah M., & Islam M. N. (2012). Fish powder in instant fish soup mix. Journal of the Bangladesh Agricultural University, 10(1), 145–148.
[39] Rahman, M. A., Saifullah, M. and Islam, M. N. (2012) 'Fish powder in instant fish soup mix', *Journal of the Bangladesh Agricultural University*. doi: 10.3329/jbau.v10i1.12106.
[40] Range, N. (2018) 'Alcolapia ndalalani a fish, no common name) Ecological Risk Screening Summary 1 Native Range and Status in the United States 2 Biology and Ecology', 1999(March 2015), pp. 1–9.
[41] Rekha M. N., Yadav A. R., Dharmesh S., Chauhan A. S., & Ramteke R. S. (2010). Evaluation of antioxidant properties of dry soup mix extracts containing dill (Anethum sowa L.) leaf. Food and Bioprocess Technology, 3, 441–449.Raitio
[42] Renzo Cortez-Vega, W. *et al.* (2008) 'Effect of L-Ascorbic Acid and Sodium Metabisulfite in the

ISSN: 2277-9655
Impact Factor: 5.164
CODEN: IJESS7

Inhibition of the Enzymatic Browning of Minimally Processed Apple', *International Journal of Agricultural Research*, 3(3), pp. 196–201. doi: 10.3923/ijar.2008.196.201.

[43] Rubilar M., Morales E., Contreras K., Ceballos C., Acevedo F., Villarroel M., & Shene C. (2012). Development of a soup powder enriched with microencapsulated linseed oil as a source of omega-3 fatty acids. European Journal of Lipid Science and Technology, 114, 423–433.

[44] Sablani, S. S. *Et Al.* (2007) 'Drying Technology: An water sorption isotherms of freeze dried fish', (October 2014), Pp. 37–41. Doi: 10.1081/DRT-100103943.

[45] Sengev IA, Abu JO, Gernah DI (2013). Effect of moringa oleifera leaf powder supplementation on some quality characteristics of wheat bread. Food Nutr. Sci. 4(3):270-275

[46] Singh S., Ghosh S., & Patil G. R. (2003). Development of a mushroom-whey soup powder. International Journal of Food Science and Technology, 38, 217–224.

[47] Singh V., & Chaudhary G. (2015). Quality evaluation of dried vegetables for preperation of soups. Indian Research Journal of Genetics and Biotechnology, 7(2), 241–242

[48] Thuy*el al*., (2019) 'Formulation of instant soup powder from freezedried shrimp and locally available vegetables', (August).

[49] Vega-Gálvez, A., Miranda, M., Díaz, L. P., Lopez, L., Rodriguez, K., & Di Scala, K. (2010). Effective moisture diffusivity determination and mathematical modelling of the drying curves of the olive-waste cake. Bioresource Technology, 101(19), 7265–7270.

[50] Wang, D. and Hsieh, Y. H. P. (2016) 'The use of imported pangasius fish in local restaurants', *Food Control*. Elsevier Ltd, 65, pp. 136–142. doi: 10.1016/j.foodcont.2016.01.016.

[51] Younis, M., Abdelkarim, D., & Zein El-Abdein, A. (2018). Kinetics and mathematical modeling of infrared thin-layer drying of garlic slices. Saudi.

[52] Yusof, Y. A. *et al.* (2014) 'Drying Kinetics and Colour Analysis of Moringa Oleifera Leaves', *Agriculture and Agricultural Science Procedia*. Elsevier Srl, 2, pp. 394–400. doi: 10.1016/j.aaspro.2014.11.055.