



Proximate Composition of Fortified Filipino Snacks for Picky Eaters

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Abstract

Objectives: The study aimed to determine the nutritive values of fortified Filipino snacks and to calculate the calorie value of the energy-yielding nutrients. **Methods/statistical analysis:** The Official Method of Analysis of Association of Official Analytical Chemists was used to analyze the proximate composition. The calorie content was calculated by the use of specific energy factors of 4:9:4 for proteins, fat, and carbohydrates, respectively. The majority of the food samples showed significant ($P < 0.05$) variations among the means concerning proximate composition. **Findings:** The highest protein was found in Moringa Sweet Potato Tuile, it can replace animal-based street foods. The moisture content of Saba-Potato Halaya was the highest and found lowest in Moringa Polvoron. The dry nature of Moringa Polvoron can prolong its shelf-life. It can substitute candies and gummies. The ash content was found highest in Moringa-Sweet Potato Tuile (MST). This can be associated with the mineral-dense Moringa and sweet potato. MST can be a healthier alternative for commercial pastries. The crude fiber content was again observed rich in MST. The Moringa and sweet potato are good fiber sources. MST is a healthier option than any fiber-rich junk food. Crude fat content was highest in Banana Blossom Bar. This snack can better substitute chocolate-flavored bars. The Jute-Spinach PastiYema was found richest with carbohydrates. It can be a healthier alternative for chocolate or marshmallow. All fortified snack samples are healthy calorie-containing foods suitable for picky-eating children. **Application/improvements:** If sufficiently consumed, these healthy snacks may contribute to the nutritional requirement of picky-eating children. This knowledge can be used to produce greener foods for school canteens in the Northern Philippines.

Keywords: Calorie Content, Fortified Filipino Snacks, Picky Eaters, Proximate Analysis, Proximate Composition

1. Introduction

One beneficial strategy in ensuring and improving dietary intake other than with nutritional supplements is to increase nutrients and energy through dietary fortification [1]. Food fortification as the addition of one or more essential nutrients to food whether or not it is normally contained in the food to prevent or correct a demonstrated deficiency of one or more nutrients in the population or specific population groups. One of the several types of fortification programs around the world is the Targeted Fortification. This is performed when a particular group within a population, like the elementary or middle school learners, has a distinct risk for a nutrient deficiency which is maybe due to picky eating syndrome [2]. The addition of nutrient-rich vegetables to common snacks is one of the practices of Targeted Fortification.

Picky eating habit is usually associated with low fruit and vegetable intake [3]. The high amount of fatty and carbohydrate-rich foods in their diet may make them at risk of malnutrition [4]. The picky eating syndrome may also affect the child's personality, behavior, well-being and the relationship between the parent and the child [5]. The 8th National Nutrition Survey presented that for children 5–10 years old, 29.1% were underweight, 29.9% were stunted, 8.6% were wasted, and 9.1% were overweight. The cause of malnutrition of some school children in the Philippines is due to inadequate total food intake. It is still commonly observed that children particularly in Northern Cagayan, Philippines prefer fast foods and junk foods [6].

Parents should be encouraged to include more nutrient-rich foods in the diet of their children especially fruits and vegetables [7]. Parents who role model the fruit consumption at snack would more likely to have children who could meet the recommended daily fruit and vegetable consumption [8]. It is for these reasons that at home, the parents try various practical means to combat the feeding disorder such as change of family meal style; make fun with veggie food art and garnish; engage children to meal planning; prepare colorful vegetable recipes, and some may even resort to making a meal for fun. However, these strategies oftentimes fail and may even resort to clinical treatment to ensure that children have healthy and safe food consumption. Furthermore, there were identified impediments to the intake of plant-based foods such as accessibility of fresh fruits and vegetables, the number of calories from fresh against processed foods, and availability of time and cooking knowledge and skills needed to prepare plant-based foods [9].

School-based health and nutrition initiatives may be improved by emphasizing on policies and interventions to address the unhealthy eating habits of the learners. Healthy diet defines as a balance in food consumption which obtains energy balance and normal weight; restricts energy intake from total fats and alters saturated fat consumption to unsaturated fats and toward the elimination of trans-fatty acids; increases fruits and vegetables intake, legumes, whole grains, and nuts; limits the free sugars in the diet; and limits salty foods [10]. The DepEd ensures that every school develops its healthy menu, with food and drinks that are nutritious and affordable. The DepEd order reads that the school canteen and DepEd offices shall not sell foods and beverages high in fat and/or sugar and/or table salt. The order also presented the importance of reading the Nutrition Facts of the products.

The fortification advocacy program and food analysis must also be in place particularly at home and school. In the University, the promotion of healthy snack options in the community may be done in a multi-modal scheme that may be integrated for classroom instruction, research-based programs, information drive, and socio-environmental influences. The knowledge and skill in healthy food processing may be emphasized to come up with vegetable- and fruit-enriched snacks. The nutritionists and dieticians in the University carried out targeted fortification by blending the standard food components of common Filipino snacks such as Polvoron (shortbread), Tuile (baked wafer), Cookie Bar, Halaya (Jam), Pasti Yema (candy) and Pastillas (candy) with nutrient-dense plant materials that are readily available in Northern Cagayan, Philippines. These plant materials used for the samples were Malunggay leaves (*Moringa oleifera*), Spinach leaves (*Spinacia oleracea*), Jute leaves (*Corchorus olitorius*), Sweet Potato tuber (*Ipomoea batatas*), Potato (*Solanum tuberosum*), Cacao (*Theobroma cacao*) and Rice grains (*Oryza sativa*). Furthermore, scientific food evaluation processes are introduced to address the problems of nutrient deficiencies and feeding difficulties of the target population. These processes are food preservation techniques; phytochemical screening, proximate analysis and identification of bioactive components of plant materials; organoleptic evaluation and microbial analysis of food products. However, proximate analysis to determine the nutritive values of the fortified Filipino snacks has not yet carried out. The findings of the study are used as baseline data for the sustainable health and nutrition extension program of the University. The results obtained are also used as initial data for the labeling of processed fortified snacks to comply with the mandatory labeling requirements of the Bureau of Food and Drug Administration in the Philippines. This is to ensure the food safety of the products when exhibited by the University during regional and national Science Trade Fairs. Moreover, the nutrition information is an added face-lift to increase product marketability and business integrity.

The study aimed to determine the proximate composition of the fortified Filipino snacks for picky eaters. Specifically, it sought to determine the nutritive values of the selected fortified Filipino snacks such as Moringa Polvoron (MP), Jute-Spinach Pastillas (JSP), Saba-Potato Halaya (SPH), Moringa-Sweet Potato Tuile (MST); Rice Krispie- Sweet Potato Pasti Yema (RSP), and Banana Blossom Bar (BBB) in terms of their moisture, ash, crude protein, crude fat, crude fiber and carbohydrate contents. The study also estimated the total calorie content from fats, proteins, and carbohydrates obtained from the snacks. The nutritional data obtained through proximate analyses of fortified Filipino snack samples are still uninvestigated, hence, the study was conducted.

2. Materials and Methods

2.1. Collection of Food Samples

The fresh green leafy vegetables, tubers, rice grain, and cacao beans were collected from insecticide- and fertilizer-free farm from Sta. Maria, Lal-lo, Cagayan, Philippines. The fortified Filipino snack samples were prepared at the College of Hospitality Management Food Laboratory, Cagayan State University- Andrews Campus, Tuguegarao City, Cagayan,

Philippines. These snack samples include Moringa Polvoron, Jute-Spinach Pastillas, Saba-Potato Halaya, Moringa-Sweet Potato Tuile; Rice Krispie-Sweet Potato Pasti Yema, and Banana Blossom Bar. They were kept separately in sterile labeled containers. The prepared samples were then transported immediately to the DOST Regional Standards and Testing Laboratory-Region 02, Tuguegarao City, Cagayan, Philippines 3500 for the analysis of their proximate composition.

2.2. Proximate Analysis

One hundred grams of each of the fortified Filipino snack samples were analyzed for proximate composition in terms of moisture, protein, fat, ash, and carbohydrate by the standard methods published by the Association of Official Analytical Chemists. Moisture content was computed by the Gravimetric method of weight loss after drying the samples in an oven at 105°C until a constant weight was achieved. Protein was determined by the Kjeldahl method, and thenceforth a conversion factor of 6.25 was used to calculate the total nitrogen to crude protein. The ash content was estimated by Gravimetric measurement of the samples in the furnace at 550°C until the constant weight was obtained. Crude fat was analyzed by the Soxhlet extraction method. The digestible carbohydrates were calculated by difference, i.e. 100% moisture+% protein+% fat+% ash+% crude fiber [11].

2.3. Calorie Content

The calorie content (Kcal/100 g) of the snack samples was calculated by the use of specific energy factors of 4:9:4 for proteins, fat, and carbohydrates, respectively.

2.4. Statistical Analysis

All six fortified snack samples were analyzed in triplicate. The data obtained through a proximate analysis were analyzed using SPSS version 12. Differences between means were evaluated by the standard deviation. Statistical significance at the 95% probability levels was set at $p < 0.05$.

3. Results and Discussion

The concentrations of protein, moisture, ash, fiber, fat, and carbohydrate of fortified Filipino snacks are presented in Table 1.

3.1. Proximate Composition

3.1.1. Crude Protein

The crude protein contents in MP, JSP, SPH, MST, RCP, BBB were found to contain 7.51%, 2.41%, 1.00%, 11.63%, 4.96%, and 9.84%, respectively. MST has the highest protein value. This can be associated with the Moringa leaves and the cacao bean powder

TABLE 1. Proximate composition of fortified Filipino snacks (Mean \pm SD, n = 3)

Nutrients	Proximate Analysis (g/100g) Mean \pm SD					
	MP	JSP	SPH	MST	RSP	BBB
Protein	7.51 \pm 21.81	2.41 \pm 0.19	1.00 \pm 0.07	11.63 \pm 0.16	4.96 \pm 0.06	9.84 \pm 0.16
Moisture	5.34 \pm 0.11	6.24 \pm 0.89	34 \pm 0.40	7.39 \pm 0.070	18.52 \pm 1.09	14.34 \pm 0.37
Ash	1.18 \pm 0.02 ^{ns}	2.39 \pm 0.06	0.79 \pm 0.04 ^{ns}	3.37 \pm 0.17	1.63 \pm 0.03 ^{ns}	1.91 \pm 0.13
Fiber	11.27 \pm 0.88	2.16 \pm 0.22	2.3 \pm 0.30	12.23 \pm 0.55	2.16 \pm 0.40	4.966 \pm 0.31
Fats	26.82 \pm 1.80	7.14 \pm 0.31	0.24 \pm 0.17	20.61 \pm 0.81	19.65 \pm 0.27	28.32 \pm 0.92
Carbohydrate	59.14 \pm 5.81	81.83 \pm 0.72	63.97 \pm 0.23	57.01 \pm 1.14	55.24 \pm 1.25	45.59 \pm 0.77

Legend:

MP- Moringa Polvoron

JSP- Jute Spinach Pasti Yema

SPH- Saba Potato Halaya

MST- Moringa Sweet Potato Tuile

RSP- Rice Krispie Sweet Potato Pasti Yema

BBB- Banana Blossom Bar

SD-Standard Deviation

ns-not significant

in MST, both rich in protein. Eating Moringa food products is good for those suffering from malnutrition for 100 g of its leaves contains 8.1 g [12]. The protein concentrations of roasted cocoa beans varied from different countries of origin (Dominican Republic, Ivory Coast, Ecuador, Madagascar, and Echeandia), ranging from 6.39 g to 17.26 g per 100 g [13]. The protein content of the BBB ranked second with 9.84 %. This result is in close agreement with the previous research finding that 100g of banana blossom contains 1.62%–2.07% of protein [14]. The least protein is given to SPH, this can due to its main ingredient, the carbohydrate-rich potato, and saba. However, plant-based proteins used in all these snacks can be a good replacement for animal-based and protein-rich snacks.

3.1.2. Moisture

Moisture content in the fortified products ranged from 5.34% in MP to 34.0% in SPH. The moisture content of SPH was the highest among all other snack samples, possibly because its preparation required a considerable volume of water; and can be attributed to the natural liquid content of Saba and Potato. In terms of product stability, increased moisture content tends to hasten microbial contamination and chemical degradation, as it provides a medium for many reactions to occur [15]. The minimal amount of moisture content in MST, JSP, and MP can prolong their shelf-lives, this implies that these relatively dried snacks have good storage quality and can be disposed of by school canteens over a long period. Moreover, these snacks are better options for any type of sugary candies, gummies, and chocolates.

3.1.3 Ash

All the six fortified snacks contained ash content ranging from 0.79% to 3.3%. MST obtained the highest ash content with 3.37% with Moringa as its bulk content. This indicated the presence of minerals, hence, this particular result is in agreement with the

previous research findings, that mineral Potassium in Moringa is 15 times more than bananas and 25 times more Iron than spinach [16]. MST can be a healthier alternative for sugary cupcakes and cookies. MP with 1.18% of ash may also be associated with the added Moringa powder to its high protein flour. The JSP got the second richest ash content (2.39%) since it contained Jute and Spinach leaves which both bear a considerable amount of Calcium and Iron [17]. It is also important to note that the ash contents of the tuber-containing snacks such as SPH and RSP are maybe attributed to the common minerals contained in potatoes and sweet potatoes like Calcium, Magnesium, Potassium, Phosphorus, and Sodium. Tubers and roots are a potential functional food, they provide several desirable nutritional and health benefits to ensure general wellness [18]. Saba fruit also contains calcium, phosphorus, and iron [19]. High-protein flour is used as a standard ingredient of the fortified tuile, cookie bar, and polvoron samples. High protein flour is associated with high ash count especially from wheat grown in mineral-rich soil [20].

3.1.4. Fat

Fat content in all the snack samples reflected the highest mean score as compared to the other nutrients, this is maybe due to the main ingredients common in all the snack samples such the fatty dairy products- butter and milk. The BBB contained the highest fat content with 28.32%. This finding could be attributed to the added fat-rich chocolate chips and egg. However, this snack can better substitute chocolate-flavored bread, cookies, and cupcakes with artificial additives. The snack with the lowest fat content was the SPH. As regards to food stability, relatively high-fat content could be undesirable in baked food products like the BBB because it can promote rancidity in foods [21].

It is important to note that diet providing 1–2% of its caloric energy as fat is said to be sufficient because of too much fat in the diet of kids and carry excess weight into adulthood have a greater risk of heart disease, high blood pressure, and diabetes [22]. With this current study, it is suggested that healthy fats with plant-based fortified snacks may be taken in proper amounts since they supply energy suitable for the active lifestyle of school children and teenagers. Most of the fortified snack samples contain healthy monounsaturated fats from soya oil.

3.1.5. Carbohydrate

The carbohydrate content was relatively high with values ranging from 45.59% BBB to 81.83% JSP. The highest percentage of carbohydrates was recorded for JSP with 81.83%, while the lowest was observed for 45.59% in BBB. JSP can be a healthier alternative for chocolates, lollipop or marshmallow. The whole wheat from the flour, the brown rice for rice-crispies, tubers, and non-starchy vegetables like Moringa, spinach, and jute contained in the snack samples are good sources of complex carbohydrates. These food materials can provide long-lasting energy necessary for the active brains and moving muscles of the children. The unfortified forms of these snacks with high sugar, starch, and fat components may contribute to hyperactivity, mood disorders, and increase the risk of obesity, and type 2 diabetes [23].

3.1.6. Fiber

The snack samples were analyzed to contain crude fiber from 2.16% to 12.23%. This means that 10–20 g per serving of these snack samples is sufficient to provide the 14–31 g fiber requirement of children between ages 1 to 18. The crude fiber content was found highest in MST. Higher fiber intakes, seen in countries around the world, may significantly reduce chronic disease risk [24]. MST is a healthier option than any fiber-rich junk foods like the salty cereal and grain chips, and cheesy potato fries.

3.2. Caloric Content

The calorie contents of the fortified Filipino snacks are indicated in Table 2. The results show that MP has the highest calorie with 507.98, followed by BBB with 476.61. The SPH obtained the lowest calorie value. It is reflected that all the calorie values fairly exceeded the recommended caloric snack intake per day. Nutrition experts estimate that the snack consumption of the children should not exceed 200 calories, however, each has a distinct caloric requirement based on personal health goals and/or nutritional or medical needs. However, all these fortified snacks are healthy calorie-containing foods suitable for picky-eating children.

TABLE 2. Caloric content of fortified food snacks using the available nutrient parameters (Kcal/100 g)

Calorie	MP	JSP	SPH	MST	RSP	BBB
Kcal/100 g	507.98	401.22	262.04	460.05	417.65	476.61

4. Conclusion

These fortified Filipino snacks which contain an appreciable amount of nutrients can be a good food supplement for picky eaters needed to maintain a healthier diet. The snack samples can be kid-friendly junk food alternatives. The minimal amount of moisture content observed in all the snack samples may prolong their shelf-lives. The ash content is also an important component in health and nutrition, quality and, like moisture, microbial viability. It is suggested that picky eaters, active learners, athletes and those who intentionally skip meals may consume such healthy snacks with reasonably high calories. However, in the absence of any of these conditions, consuming these high-calorie snacks may only add extra calories in the diet resulting in the accumulation of body fat. Whether fussy eaters or not, children do not always eat what is healthy for them. Hence, it is suggested that starchy, sugary and fatty Filipino snacks should be made healthier and more enticing with the locally available fruits and vegetables through fortification. The results obtained in this study are used as a sustainable health and nutrition extension program of the University and indispensable to comply with the mandatory labeling requirements for the fortified snacks produced by the Cagayan State University-Andrews Campus.

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