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**Submission date:** 13-Mar-2023 07:25PM (UTC+0700)

**Submission ID:** 2036120632

**File name:** 10a. Artikel ICoFA 2022.pdf (908.3K)

**Word count:** 2715

**Character count:** 13683

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To cite this article: P R Ratri *et al* 2022 *IOP Conf. Ser.: Earth Environ. Sci.* **980** 012040

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## Formulation of Local Food Based Snack Using Linear Program for Nutrisurvey to Prevent Stunting in Under-Five Children

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**Abstract.** The prevalence of stunting in Indonesia has decreased from 37.2% in 2013 to 30.8% in 2018. This prevalence is still far from the government target, which is 14%. Immunostimulant prebiotic food formulations in the form of snack bars made from lempeni leaves, edamame, and local herbal plants can be used to increase immunity and prevent stunting among children. However, the development of a local-based diet by considering the nutrient adequacy of the children is lacking. This study aimed to develop an optimized snack bar based on nutrient adequacy using linear programming to meet the nutrient requirement of under-five children. This study used Nutri Survey for Linear Programming 2004 software to develop an optimized snack bar. Nutrition Adequacy Rate among children 1-4 years were used to determine the composition of the snack bar. The composition of the snack bar consists of Simplicia powder of lempeni leaves, edamame, cinnamon powder, ginger powder, oats, almonds, cashew, raisins, honey, peanut butter, and chocolate. The Results show two formulas based on Linear Programming calculation and one formula for control. Snack bar formula fulfilled energy and macronutrient intake requirements within the acceptable macronutrient distribution range. Formula 1 contains 122 kcal energy; 2,9 g protein; 4,9 g fat; 13,4 g carbohydrate, 0,8 mg iron; and 0,4 mg zinc. Formula 2 contains 123 kcal energy; 3,05 g protein; 5,6 g fat; 13,5 g carbohydrate, 0,9 mg iron; and 0,4 mg zinc. Those values are describe the optimization model used in this study provides a mathematical solution for an economical snack bar that approximate the nutrient requirements for under-five children to prevent stunting.

### 1. Introduction

One of the concerns in the golden age of a child's life is a stunting. Stunting will certainly affect the child's immune system. Stunting is referred to as short stature as a manifestation of chronic malnutrition. Stunting is often not realized at the age of toddlers. Several factors that are thought to be risk factors for stunting include family factors, diet, and socioeconomic conditions [1]. Stunting is also called chronic nutrition which describes a disturbance in height growth that lasts for a long time. Stunting causes poor development in toddlers, impaired cognitive function, metabolism and decreased activity [2].

In addition to maintaining a healthy lifestyle, it can also be done by utilizing local plants as herbal medicines. Herbal plants have been known as local wisdom that have been used since ancient times as alternative medicines. Some of the local plants commonly used include red ginger (*Zingiber officinale*),



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turmeric (*Curcuma longa* L.), temulawak (*Curcuma xanthorrhiza* Roxb), green tea (*Camelia sinensis*), meniran (*Phyllanthus niruri* L.), salam (*Syzygium polyanthum*), guava (*Psidium guajava*), clove (*Syzygium aromaticum*), and garlic (*Allium Sativum*) [3].

Ginger and cloves are herbal plants that are widely used to be used as immune boosters. In addition to the plants above, there is one local herbal plant that is also efficacious for maintaining endurance, namely the lempeni plant. Lempeni (*Ardisia elliptica*) is one of the plants that exist in Indonesia and is spread in Java, Sumatra, Sulawesi, and Maluku. This plant is in the form of a shrub or small tree. The leaves have a rough and elastic texture. The fruit and leaves of lempeni (*Ardisia elliptica*) are edible and efficacious in treating digestive problems. These plants are certainly very beneficial for the body if they can be consumed [4].

However, for children, consuming pure medicinal plants is a difficult thing to do. Therefore, alternative foods are needed that can also be combined and matched with other plants so that they have benefits that are not only high in nutrition but also can increase the body's immune system. One food source that can be an alternative with nutritional value is edamame. Edamame as soybeans with high production potential has various types of preparations that are easily found in the market due to the high content of phytosterol compounds [5]. Edamame soybean, which is a type of white soybean, has a sweeter taste, stronger nut aroma, softer texture and nutritional content that is easily digested by the body. This soybean has a high content of isoflavones where isoflavones have properties as antioxidants [6]. Edamame has a complete protein content whose quality is equivalent to the protein content in milk, eggs and meat. Edamame is rich in protein, dietary fiber, and micronutrients, especially folate, manganese, phosphorus, and vitamin K. The balance of fatty acids in 100grams of edamame is 361 mg of omega 3 fatty acids-1794 mg of omega 6 fatty acids. In addition, edamame also contains anti-cholesterol substances so it is very good for consumption [1].

This study aims to analyze the potential of snack bars based on local food, edamame, lempeni leaves and herbal active ingredients as snacks for toddlers in order to prevent stunting and increase body immunity.

## 2. Materials and Methods

This research is an experimental study in a laboratory by applying a linear program consisting of 2 formulation factors and 1 control formulation. The linear program used is the Nutrisurvey for Linear Programming application. The snack bar formulation uses a linear program with the help of chemical analysis data from Lempeni leaf powder, edamame nuts, cinnamon powder, ginger powder, and other supporting ingredients. After obtaining several formulas that are feasible according to a linear program both in terms of quality and cost. Then the linear program result 2 formulations.

The ingredients of snack bar are Lempeni leaf simplicia powder, edamame nuts, almonds, cashews, oats, cinnamon powder, ginger powder, raisins, honey, peanut butter, and chocolate. The tools used in the snack bar manufacturing process include stirrer, scales, aluminium pan, oven, stainless steel knife, stirrer, aluminium container, pan, gas stove, and plastic container.

The snack bar are made by chopped the main raw material for nuts (cashew, almond and edamae). After that it is mixed with other ingredients and then stirred. The mixture is then formed into a rectangular box and baked in the oven in 105°C for 15 minutes. After cooking, wait a few moments for caramelization to form a good *snack bar*.

## 3. Results and Discussion

Nutrisurvey for Linear Programming is used to create a formula that is in accordance with the nutritional adequacy rate (RDA) and price (public purchasing power). This snack bar product targets children under five to prevent stunting and increase body immunity. Therefore, the RDA used is the RDA for children aged 1-3 years. The snack bar will be used as a snack for toddlers, where a daily snack contributes 20% of energy needs.

Snack bar is a new product for Indonesian people. Snack bars are solid snacks in the form of sticks and are a mixture of various dry ingredients such as cereals, nuts, dried fruits which are combined into

one with the help of a binder. Binders in bars can be in the form of syrup, nougat, caramel, chocolate, and others.[8] Therefore, snack bars have the potential to be a good and effective for children alternative food.

The Control snack bar (Control/F0) are using several food ingredients as composition, including: cashews, almonds, oats, honey, raisins, chocolate, and peanut butter. In the snack bar treatments (F1 and F2), the composition was modified by adding cashew nuts, powdered ginger, cinnamon powder, and powdered lempeni leaves. The product formulations for snack bars F1 and F2 are the results of the analysis using Nutrisurvey for Linear Programming as follows:

**Table 1.** Result of Snack bar formulation using Nutrisurvey for Linear Programming

Composition	Nutrition	Min – max	Price
<b>Formula 1 (F1)</b>			
Edamame 10 gram	Energy = 243,6 kcal	Energy = 243 – 297 kcal	Rp 5,279
Cashew 5 gram	Protein = 5,8 g	Protein = 3,6 – 4,4	
Almond 5 gram	Fat = 9,7 g	Fat = 8,1 – 9,9	
Cinnamon 1 gram	Carbohydrate = 26,8 g	Carbohydrate = 38,7 – 47,3	
Ginger powder 1 gram	Vitamin C = 1,4 mg	Vitamin C = 7,6 – 8,4	
Oats 6 gram	Zinc = 0,7 mg	Zinc = 0,57 – 0,63	
Chocolate 2 gram	Fe = 1,7 mg	Fe = 1,33 – 1,47	
Honey 13 gram	Calcium = 56,7 mg	Calcium = 123,5 – 136,5	
Raisins 6 gram			
Lempeni leaves powder 1 gram			
Peanut butter 5 gram			
<b>Formula 2 (F2)</b>			
Edamame 7 gram	Energy = 245,9 kcal	Energy = 243 – 297 kcal	Rp 5,878
Cashew 7 gram	Protein = 6,1 g	Protein = 3,6 – 4,4	
Almond 7 gram	Fat = 11,2 g	Fat = 8,1 – 9,9	
Cinnamon 1 gram	Carbohydrate = 27,1 g	Carbohydrate = 38,7 – 47,3	
Ginger powder 1 gram	Vitamin C = 1,3 mg	Vitamin C = 7,6 – 8,4	
Oats 6 gram	Zinc = 0,8 mg	Zinc = 0,57 – 0,63	
Chocolate 2 gram	Fe = 1,8 mg	Fe = 1,33 – 1,47	
Honey 13 gram	Calcium = 65,4 mg	Calcium = 123,5 – 136,5	
Raisins 6 gram			
Lempeni leaves powder 1 gram			
Peanut butter 6 gram			

Source : Primary data

Note: The weight and composition of the snack bar above is the size if it is used for snacks in 1 day (2 times a day). To get 1 time interlude, then the value above is divided into half.

The chemical composition of the raw materials (moisture content, protein content, fat content, and carbohydrate content) is used as the coefficient value of each variable in linear program modeling. In addition to the chemical composition of the raw materials, the data collected also includes the prices of the main ingredients (almond, cashew, edamame, peanut butter, honey, raisin, oats, lempeni leaves powder, ginger powder, and cinnamon powder) as well as the limiting factors that are the nutritional

requirements of snack bars. The purpose of using a linear program is to determine the snack bar formula in order to produce a snack bar that is accepted by consumers, and the price is relatively cheaper than the price of snack bars on the market. Based on the calculation results, the first formula is the formula with the lowest price, which is Rp. 5,279 for two snack bar (2,639/one snack bar).



Source: Study documentation

Figure 1. Snack bar and slice of snack bar

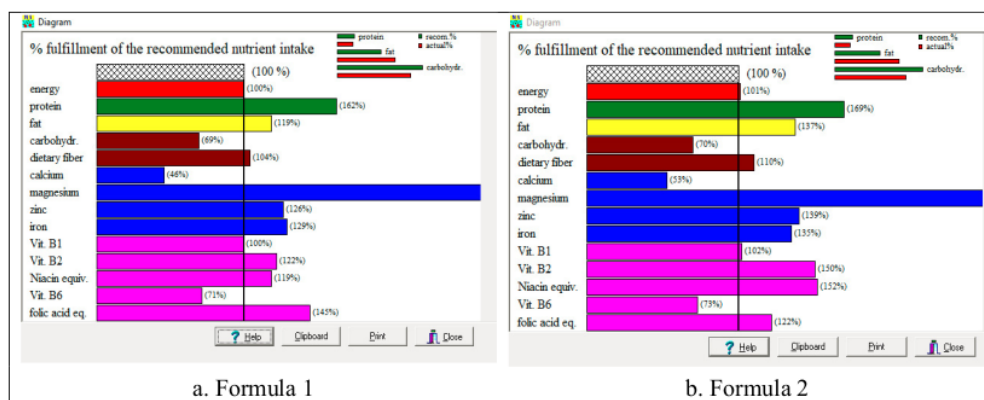


Figure 2. The fulfilment of recommended nutrient intake of herbal snack bar formula

Based on Figure 2, it can be seen that the two formulas produced by the Linear Program have met the percentage of nutritional needs in accordance with the recommended nutritional intake. In general, formula 2 shows a higher value. This may be influenced by the ratio of the main ingredients used in determining the formula. Formula 1 uses a 2:1 ratio for the main ingredients edamame (double amount) compare to others main formula such as almond, cashew, and oats. While formula 2 uses a 1:1 ratio for all main ingredients.

In addition, calorie content is an important element that must be owned by snack bars as snacks that can delay hunger. Each person's calorie needs are different according to age, height, weight, gender, and level of activity per day. The number of calories in a food product shows the amount of energy contained in an ingredient or food product. The largest source of energy is fat which produces 9 kcal of energy per g, while carbohydrates and protein produce energy of 4 kcal per g. [9] The energy value calculation for this product is 243,6 for formula 1 and 245,9 for formula 2. Based on the results of the study this amount is sufficient to meet the calorie needs for additional food or snacks for toddlers.

#### 4. Conclusion

Snack bar formula fulfilled energy and macronutrient intake requirements within the acceptable macronutrient distribution range. Formula 1 contains 122 kcal energy; 2,9 g protein; 4,9 g fat; 13,4 g carbohydrate, 0,8 mg iron; and 0,4 mg zinc. Formula 2 contains 123 kcal energy; 3,05 g protein; 5,6 g fat; 13,5 g carbohydrate, 0,9 mg iron; and 0,4 mg zinc. Those values are describe the optimization model used in this study provides a mathematical solution for an economical snack bar that approximate the nutrient requirements for under-five children to prevent stunting.

#### 5. Acknowledgment

This study was funded by the DIPA of State Polytechnic of Jember SP DIPA-023.18.2.677607 / 2021, dated 23 November 2021 budgeting year 2021, PNBPN Research Grant.

#### References

- [1] Sudiarti D. 2017. The Effectiveness Of Biofertilizer On Plant Growth Soybean Edamame (Glycin max). *SainHealth*. Oct 1;1(2):97–106.
- [2] Lestari A, Hanim D. 2020. Edukasi Kader dalam Upaya Pencegahan dan Penanggulangan Stunting di Kecamatan Mondokan Kabupaten Sragen. *AgriHealth: J of Agri-food, Nutrition and Public Health*. Apr 30;1(1):7–13.
- [3] Dewi Y K, and Riyandari B A. 2020. Potensi Tanaman Lokal sebagai Tanaman Obat dalam Menghambat Penyebaran COVID-19. *Pharmascience*. Oct 31;7(2):112–28.
- [4] Kusumastuti S A, Firdayani F, and Chaidir C. 2015. Potensi Ekstrak Etanol Daun Lampeni (*Ardisia Elliptica*) Dan Fraksinya Sebagai Agen Antiproliferatif Terhadap Sel Kanker Hati Hepg2. Prosiding SNaPP: Kesehatan (Kedokteran, Kebidanan, Keperawatan, Farmasi, Psikologi). Oct 1;1(1): 389–94.
- [5] Kurniawan N D, Setiani B E, and Dwiloka B. 2019. Kadar Lemak, Kadar Air, Kadar Protein, Dan Antioksidan Tempe Edamame (*Glycine Max* (L) Merrill) Dengan Jenis Pengemas Yang Berbeda. *J Tek Pang*. 3(2).
- [6] Nur R, Lioe H N, Palupi N S, Nurtama B. 2018. Optimasi Formula Sari Edamame dengan Proses Pasteurisasi Berdasarkan Karakteristik Kimia dan Sensori. *Jurnal Mutu Pangan : Ind J of Food Qual*. Oct 31;5(2):88–99.
- [7] Almatier S. 2009. Prinsip Dasar Ilmu Gizi. Jakarta: PT Gramedia Pustaka Utama.
- [8] Rinda, Ansharullah, and Asyik N. 2018. Pengaruh komposisi snack bar berbasis tepung tempe dan biji lamtoro (*Leucaena leucocephala* (Lam) de wit) terhadap penilaian organoleptik, proksimat dan kontribusi angka kecukupan gizi. *J Sains & Tek Pang*. 3(3): 1328-1340.
- [9] Suloi A N F, Farid J A, Fitriani S N A, and Ramadhani. 2020. Snack bars: Camilan sehat rendah indeks glikemik sebagai alternatif pencegahan penderita diabetes. *J. Abdi*. 2: 118 -125.

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