Environmentally friendly household food consumption behavior

M Ariani¹, A Gantina², AVR Mauludyani³* and A Suryana¹

¹Indonesian Center for Agricultural Socio Economic and Policy Studies, Jln. Tentara Pelajar No. 3B, Bogor, West Java, Indonesia
²Indonesian Agency for Food Security, Ministry of Agriculture, Jl. Harsono RM No. 3, Ragunan, Pasar Minggu, Jakarta, Indonesia
³Department of Community Nutrition, Faculty of Human Ecology, IPB University, Jl. Lingkar Akademik, Kampus IPB Dramaga, Bogor, West Java, Indonesia

*anna-vipta@apps.ipb.ac.id

Abstract. Natural resources, namely land and water, as the main input factors for food production have undergone degradation in quantity and quality. On the other hand, demand for food has been growing due to population increase, which requires to intensify the use of natural resources that may harm environment. One of the solutions to this problem is by managing household food consumption pattern. This study aimed to analyze current and eco-friendly household consumption behavior in Indonesia to overcome the above problem. A technical review was conducted to various nationally representative publications, mainly from Statistics Indonesia, Indonesian Ministry of Health and Ministry of Agriculture. Results of this study indicated that in 2020 the Indonesian average daily energy and protein intake has met the recommendation. However, based on Desirable Dietary Pattern score, food consumption pattern was not balanced, dominated by cereals as carbohydrate food sources, while consumption of tubers, legumes, animal protein sources, vegetables, and fruits were still inadequate. Among high income households, consumption of animal products exceeded the recommendation whereas production of this food requires the highest environmental resources. Meanwhile, a large proportion of food waste are produced by household, mostly in the form of vegetables and fruits. Driving factors of household food selection were mainly based on social, economic, and cultural aspects rather than environmental consideration. Therefore, to reduce environmental damage, environmentally friendly food consumption behavior should be promoted. Government together with nutritionist and agronomists should create a grand design of food system which balances productivity, sustainability, and community nutrition fulfillment.

1. Introduction

Natural sources, particularly land and water, in Indonesia has undergone degradation in term of quantity and quality. Extensive deforestation increased greenhouse gas emissions, biodiversity loss, and decrease water supply for agricultural activities [1].

Land damages are predicted to reach 48.2 million hectares or about 25% of the total land. Land degradation with severe category has risen due to expanding abandoned land and decreasing dry land productivity [2]. Agricultural land conversion, particularly productive land in Java Island, is still happening as the impact of development activities, such as housing, industries, and transportation. Agricultural land expansion cannot compensate land conversion which annually reach 10 thousand
hectares. Consequently, rice production capacity has declined and average nominal rice price increased every year [3].

On the other hand, Indonesian population increases every year. Based on the 2020 Indonesia Population Census, Indonesian population reach 270.2 million with growth rate of 1.25%. More population requires more food availability which is produced by using natural resources intensively. Therefore, one of the efforts to reduce environmental damage is by encouraging people to consume environmentally friendly food. Improving demand side is expected to promote environmentally friendly food production pattern. This paper aimed to analyze the current situation of household food consumption pattern and provide strategies toward the environmentally friendly food consumption behavior.

2. Materials and methods

2.1. Materials

Data on energy and protein intake in 2020 were obtained from Statistics Indonesia, while proportion of population with inadequate consumption of vegetables and fruits were from Indonesia Ministry of Health (Basic Health Research 2018). Data on household food waste were taken from the survey in 2019 by Indonesia Agency for Food Security (IAFS) of Indonesian Ministry of Agriculture and Ministry of National Development Planning.

2.2. Methods

Energy and protein adequacy were calculated by dividing the intake with daily Recommended Dietary Allowance (RDA), namely 2100 kcal energy and 57 gram protein per capita per day. Desirable Dietary Pattern (DDP) score was calculated by IAFS. Data were presented in quintiles of expenditure as proxy of household income.

3. Results and discussion

3.1. Current food consumption behavior

In 2020 (March data), average daily energy and protein intake per capita in Indonesia were 2112 kilocalories and 62.0 gram, respectively (Table 1). These figures met the recommended energy and protein adequacy, reaching 100.6% and 108.7%, respectively. Higher household income, higher energy and protein intake.

| Household income group | Energy intake (kcal/cap/day) | Protein intake (g/cap/day) |
|------------------------|-----------------------------|---------------------------|
| 1 (bottom 20%)         | 1685                        | 45.6                      |
| 2                      | 1954                        | 54.7                      |
| 3                      | 2115                        | 60.9                      |
| 4                      | 2302                        | 68.7                      |
| 5 (top 20%)            | 2505                        | 80.4                      |
| Average                | 2112                        | 62.0                      |

Source: Statistics Indonesia (2020).

Overall, households met energy and protein adequacy, however, the lowest 40% of income group consumed less energy and protein than recommended. On the other hand, in the highest income group, quintile 5, energy and protein intake were around 1.2 and 1.4 times than the recommended adequacy (Figure 1). High income households have opportunity to spend money to meet their food preferences and needs [4].
Current household food consumption behavior in Indonesia has not met the ideal pattern yet, measured by in DDP yet. The DDP score 100 indicates an ideal food consumption pattern taking into account energy contribution from the nine food groups, namely cereals, roots and tubers, animal products, fats and oils, nuts and oilseed, pulses, bean and soybeans, sweeteners, fruits and vegetables, and beverage and seasonings. On the average households’ food consumption was still dominated by cereals as carbohydrate food sources, particularly rice, while consumption of other food groups, such as animal products, roots and tubers, vegetables and fruits are still inadequate. Similarly with energy and protein adequacy, the higher the income, the better the household food consumption quality as indicated by the DDP score. However, animal products consumption in the quintiles 4 and 5 were already very high, 25% and 63% higher compared to the recommended adequacy (Table 2).

**Figure 1.** Energy and protein adequacy by quintile of expenditure

![Energy and protein adequacy by quintile of expenditure](image)

**Table 2.** Energy intake by food groups and household income, 2020.

| Food groups                  | Energy intake by income group (kcal/cap/day) | Ideal compositiona) |
|------------------------------|--------------------------------------------|----------------------|
|                              | 1       | 2       | 3       | 4       | 5       |                     |
| Cereals                      | 1111    | 1206    | 1251    | 1300    | 1362    | 1075                |
| Roots and Tubers             | 31      | 36      | 40      | 45      | 48      | 129                 |
| Animal products              | 152     | 214     | 266     | 323     | 420     | 258                 |
| Fat and oils                 | 189     | 229     | 254     | 281     | 302     | 215                 |
| Nuts and oilseed             | 12      | 14      | 15      | 15      | 15      | 64                  |
| Pulses, bean and soybeans   | 51      | 56      | 59      | 64      | 66      | 108                 |
| Sweeteners                   | 55      | 65      | 67      | 74      | 78      | 108                 |
| Fruits and vegetables        | 69      | 85      | 98      | 116     | 144     | 129                 |
| Beverage and seasonings      | 40      | 48      | 53      | 57      | 65      | 64                  |
| **Total**                    | 1709    | 1953    | 2103    | 2278    | 2499    | 2100                |
| **DDP score**                | 64.9    | 75.8    | 84.2    | 91.5    | 94.1    | 100.0               |

a) Based on Desirable Dietary Pattern (DDP).

Source: Modified from IAIFS (2020).
Excessive consumption of animal products damages environmental sustainability. Meat products (beef, pork, and poultry) and dairy products (milk, cheese, and butter) are known as having relatively big burden on environment [5]. The use of natural resources to produce beef are among the highest. As much as 135 hectares of land and 110 thousand cubic meters of water are needed to produce 1 ton of meat, while only 15 hectares of land and 30 cubic meters of water are needed to produce 1 ton of poultry [6]. Moreover, Chai et al. [7], mentioned that vegan food pattern is the optimal food pattern for environment, producing the lowest greenhouse gas emissions. A study also found that food pattern dominant on vegetables, fruits, pulses, bean and soybeans and limited poultry, dairy and meat products promote environmental sustainability [8].

Food consumption patterns that refer to the DDP guidelines is not only enhancing healthy, active, and productive live but also support environmental sustainability. To meet food consumption need, land, water, and other natural resources are used for production, which most of the time are used intensively. On the other hand, consuming environmentally food pattern also reduce land degradation and use of fertilizer/pesticide. Therefore, reformulation of food system balancing productivity, sustainability, and people’s nutrition is importance [9].

Nonetheless, consumption of vegetables and fruits in Indonesia are still very low. Only households in the quintile 5 of income group met the recommendation. Proportion of population more than 5 years of age with inadequate consumption of vegetables and fruits reach 95% [10]. Other study conducted by IAFS in 2019 in Jakarta Metropolitan Area showed that vegetables (raw and cooked) and fruits are the highest type of food waste came from households. This food waste is consequently affecting the household financial as well as environmental burden. Another study [11] reported that during 2000-2019, average total food loss and waste reached 115-185 kg/cap/year, increasing from 39% in 2000 to 44% in 2019. Therefore, households have important role in preserving environment through food waste reduction. Food waste from households contribute to more than 60% of greenhouse gas emissions globally and 50-80% of total land, material, and water uses [12].

This improper food consumption behavior to some extent is related with food choice. Some considerations of household heads in selecting food are preferences, nutrient content, food taboo, lifestyle, health, mood, body weight, food price, packaging, aroma, nutrition label, area, and income [4,13–16]. Thus, food choice is merely based on socio-culture, economics, and food characteristics, while environmental sustainability is not considered yet.

3.2. Strategies toward environmentally friendly food consumption behavior

Indonesia has already had guidelines for healthy food consumption behavior reflected in slogan of diverse, nutritious, balance, safe food which was quantified in DDP concept. To support the implementation, Ministry of Health formulate a Guideline of Balanced Nutrition. The guideline was visualized, among others, into Indonesian version of MyPlate concept (Figure 2). In the MyPlate, 50% of the portion is for vegetables and fruits, while the other 50% is for staple food and side dish (livestock products, beans and pulses). The ratio of vegetables and fruits is 2:1. The similar ratio is also used for staple food and side dish. Implementing the MyPlate in daily consumption of households will positively affect both health and environment.
Another strategy to achieve environmentally friendly food consumption behavior is to build awareness and strong commitment of all household members to prevent food waste. Type and quantity of food selected should consider number of household members as well as their preferences. Therefore, women play significant role in changing mindset and behavior of themselves and their families. Women are more adaptable to ecological food consumption pattern [17]. Women select and determine type and quantity of food prepared at home for their families. They have important role in various steps, including purchasing, storage, and preparation. Food choice and food consumption behavior are affected by income [18]. Therefore, nutrition education for high income households should include not only on nutrition and health issues but also on environment aspects. In the context of suggesting sustainable food consumption patterns, it is recommended to intensify socialization of the balance food and nutrition consumption patterns, promote safety food consumption, and encourage the consumption of sufficiently available food in the country such as fish, eggs, and fruits [19].

Food consumption behaviour needs years to change. Therefore, the education should be done massively and continuously through various means, such as through early childhood education, empowerment of women on the balance food and nutrition awareness, and promotion of food and nutrition consumption diversification on social media.

4. Conclusions
Food consumption behavior of households in Indonesia has not reached the ideal pattern. The consumption pattern is still dominated by carbohydrate food sources, less protein, vitamin, and minerals sources. The higher the income, the better the quantity and quality of the food consumed, and it meets the Desirable Dietary Pattern (DDP) recommendation. To some extent, among the higher income households, consumption of animal products is higher than the DDP composition. Whereas production of animal products needs more environmental resources than plant products. A large proportion of food waste are produced by household, mostly in the form of vegetables and fruits. However, about 95% of population more than 5 years of age had inadequate consumption of vegetables and fruits.
Environmentally friendly food consumption behavior can be achieved by changing behavior of household members in selecting and consuming food suitable for the environment. Government together with nutritionist and agronomists should create a grand design of food system which balances productivity, sustainability, and community’ nutrition fulfillment. Promotion of the MyPlate to the community should be done massively and continuously. Promotion can be implemented through formal and informal education as well as social media, such as Facebook, WhatsApp, and Instagram. Other strategy is to build awareness and strong commitment of all household members especially women to prevent food waste. Another issue on promoting environmentally friendly food consumption is the reduction of food waste. Specific for high income household, nutrition education should be done with a focus on reducing consumption of animal products.

References
[1] Margono B A, Potapov P V, Turubanova S, Stolle F and Hansen M C 2014 Primary forest cover loss in Indonesia over 2000–2012 Nat. Clim. Chang. 4 730–5
[2] Pasandaran E 2015 Politik Pembangunan Pertanian Inovatif Berwawasan Ekoregion (Jakarta: IAARD Press) pp 178–94
[3] Purbiyanti E, Yazid M and Januari I 2017 Konversi lahan sawah di Indonesia dan Pengaruhnya terhadap kebijakan Harga Pembelian Pemerintah (HPP) gabah/beras J. Manaj. dan Agribisnis 14 209–17
[4] Ariani M, Suryana A, Suhartini S H and Salim H P 2018 Performance of animal food consumption based on region and income at household level Anal. Keb. Pertan. 16 147–63
[5] Notarnicola B, Tassielli G, Renzulli P A, Castellani V and Sala S 2017 Environmental impacts of food consumption in Europe J. Clean. Prod. 140 753–65
[6] Ranganathan J, Vennard D, Waite R, Dumas P, Lipinski B, Searchinger T I M and Authors G M 2016 Shifting diets for a sustainable food future Janet Proc. Int. Jt. Conf. Neural Networks IV 537–IV 542
[7] Chai B C, Reidar V D V J, Grofelnik K, Gudny E H, Klöss I and Perez-Cueto F J A 2019 Sustainability Which Diet Has the Least Environmental Impact on Our Planet? A Systematic Review of Vegan Vegetarian and Omnivorous Diets Sustain. 11 4110
[8] Sáez-Almendros S, Obra A, Bach-Faix A and Serra-Majem L 2013 Environmental footprints of Mediterranean versus Western dietary patterns: Beyond the health benefits of the Mediterranean diet Environ. Heal. A Glob. Access Sci. Source 12(1) 1-8
[9] Dwivedi S L, van Bueren E T L, Ceccarelli S, Grando S, Upadhyaya H D and Ortiz R 2017 Diversifying food systems in the pursuit of sustainable food production and healthy diets Trends Plant Sci. 22 842–56
[10] Ministry of Health R I 2018 National Report of Basic Health Research 2018 (Jakarta: Ministry of Health R I)
[11] Ministry of National Development Planning 2021 Food Loss and Waste in Indonesia Dalam Rangka Mendukung Penerapan Ekonomi Sirkular dan Pembangunan Rendah Karbon (Jakarta: Ministry of National Development Planning)
[12] Abdelradi F 2018 Food waste behaviour at the household level: a conceptual framework Waste Manag. 71 485–93
[13] Santoso S O, Janeta A and Kristanti M 2018 Faktor-Faktor yang mempengaruhi pemilihan makanan pada remaja di Surabaya J. Hosp. dan Manaj. Jasa 6 19–32
[14] Sholikah Y and Muhammad E 2013 Analisa faktor yang mempengaruhi keputusan pembelian makanan cepat saji KFC Lamongan J. Chem. Inf. Model. 53 1689–99
[15] Aulia L and Yuliatu L N 2018 Faktor keluarga, media, dan teman dalam pemilihan makanan pada mahasiswa PPKU IPB J. Ilmu Kel. dan Konsum. 11 37–48
[16] Aisyah S and Hiola S K Y 2017 Analisis preferensi konsumen terhadap produk olahan ayam di Kota Makasar J. Galung Trop. 6 174–84
[17] Tobler C, Visschers V H M and Siegrist M 2011 Eating green. consumers’ willingness to adopt...
ecological food consumption behaviors. *Appetite* 57 674–82

[18] Puddephatt J A, Keenan G S, Fielden A, Reaves D L, Halford J C G and Hardman C A 2020 ‘Eating to survive’: a qualitative analysis of factors influencing food choice and eating behaviour in a food-insecure population *Appetite* 147 104547

[19] Suryana A A M 2018 Faktor yang Mempengaruhi dan Arah Perubahan Pola Konsumsi Pangan Berkelanjutan Mewujudkan Pertanian Berkelanjutan: Agenda Inovasi Teknologi dan Kebijakan (Jakarta: IAARD Press) pp 367-401