

Food and Nutrition Security Situation in Indonesia and Its Implication for the Development of Food, Agriculture and Nutrition Education and Research at Bogor Agricultural University

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Indonesia is currently facing nutrition security and food safety problems. Although production of major food commodities has grown, Indonesia is still strongly dependent on imports for some commodities. Approximately 25.28 million Indonesians consume less than 70 percent of the recommended dietary allowance of 2000 kcal/capita/day. The diet of Indonesians is also unbalanced, with a high contribution of rice and wheat to total energy intake but few tubers, vegetables, fruits, soybean, and animal foods. In addition, more than 100 million Indonesians currently face micronutrient deficiencies, including iron, vitamin A, and iodine deficiency. Most who are severely energy deficient and consume an unbalanced diet are rural farmers of small plots, and agricultural productivity is being affected negatively. Food safety of both fresh and processed products is another major issue. Textile coloring and other dangerous substances such as formalin are widely used, particularly by small-scale food industries. Solving the problems of food and nutrition security in Indonesia will require various strategic efforts, including improvement of higher education curricula and research in related fields.

Bogor Agricultural University provides a wide range of education services in fields related to food and nutrition security. Courses related to food production are taught by the Faculties of Agriculture, Animal Husbandry, and Fisheries, and food safety courses are taught by the Faculties of Agricultural Technology, Animal Husbandry, and Fisheries. Nutrition security courses are offered by Faculty of Human Ecology. Content analysis indicates that the food safety courses are more suitable for medium to large food industries than small-scale operations that actually have serious food safety problems. However, many student and faculty research projects are less relevant to current food safety problems and few investigate new food alternatives and improvement of distribution and food accessibility, particularly among the poor. Improvement of curricula, course content, research, and community services are recommended.

Key words: food security, nutrition security, food safety, nutrition education, curricula

Introduction

The concept of food security was first introduced in early 1980s, after the striking global food crisis that occurred during 1972–1974 (Maxwell and Slater, 2004). According to the FAO (1996) definition, food security is achieved when “all people, at all times, have physical and economical access to sufficient, safe and nutritious food for a healthy and active life.” This definition was also adopted by the

government of Indonesia, as reflected in the Indonesian Food Law No. 7, 1996, which defines food security as “the fulfillment of dietary needs at the household level as indicated by adequate food availability in terms of quantity, quality, safety, equality, and affordability” (Republik Indonesia, 1996). Food security in Indonesia is a complex system involving cross-sectors and multidisciplinary management. Therefore, food security can only be achieved through the combined efforts of all stake-

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holders, namely all levels of government (central, provincial, districts), private enterprises, and the community—especially farmers (Suryana, 2008).

In practice, the definition of *food security* depends on who is using the term (Soekirman, 2008). For agriculture and economic planning, food security is more concerned with food production, supply, and availability, and sometimes includes consumption at the aggregative or macro level. The safety and nutritional aspects are often neglected or even ignored. Nutrition information is often expressed as per capita calorie and protein availability, based on a food balance sheet. Such aggregate data may be necessary for broad-scale planning but are insufficient to reflect nutritional status. To make food safety and nutrition more explicit, the FAO definition has gone through several stages of redefinition. In the 1970s food security was aimed at achieving adequate food production. In the 1980s food security focused on the accessibility and availability of food at the household level. In the 1990s, especially after the World Food Conference in Rome in 1995, the importance of nutrition was also recognized and some publications and international agencies combined the concept of food security with nutrition security. In the 2000s, publications are increasingly using the term *food and nutrition security*, including coping with vulnerability to risk and risk management aspects (IFPRI, 2004).

Soekirman (2008) proposed that the concept of food and nutrition security should comprise both aspects of commodity (food) and people (nutrition), as has been adopted by IFPRI (2004), India (Nutrition Security in IXth Five-Year Development Plan, 2002–2007), Brazil (Zero Hunger, 2005), and several countries in Africa (IFPRI, 2004). With the redefinition of food security as food and nutrition security, there must be a paradigm shift from a commodity (food) approach to a people (nutrition) approach, which would focus on food at the household and individual consumption levels (micro) as well as its nutritional status. When investigating food and nutrition security, the following indicators are important: the proportion of households with an insecure food supply, hunger, and underweight and stunted children suffering from malnutrition and vitamin and mineral deficiencies. Nutrition security implies that all households in the community have secure access to

adequate food for a balanced diet, adequate clean water and a sanitary environment, and adequate primary health services; have knowledge and skills to manage and utilize all accessible resources above; and are free from malnutrition.

In this paper I describe the situation of food and nutrition security in Indonesia and its implication for the curricula of Bogor Agricultural University (IPB). Next, I discuss the courses offered at IPB (particularly in the undergraduate program) and student final projects and faculty research, as well as the need to improve the curricula at IPB to strengthen the education and research on food and nutrition security. The paper does not elaborate on issues of food security and sustainable agriculture in Indonesia specifically, which were discussed comprehensively by Murtilaksono and Hidayat (2009).

Approach of the Study

The food and nutrition security situation in Indonesia in the last 5 years was analyzed using secondary data collected from the related institutions, mainly from the Central Bureau of Statistics (BPS), Ministry of Agriculture (Departemen Pertanian), Ministry of Health (Departemen Kesehatan), and Food and Drug Control Agency (BPOM). The data gathered include the National Food Balance Sheet that represents food production and availability, national survey on socioeconomic (SUSENAS) data that represent food intake from 2004 to 2008, nutritional status data from RISKESDAS (Primary Health Survey) 2007 (Departemen Kesehatan, 2008), and various food safety data (BPOM, 2008). The curricula related to food and nutrition security were obtained from The Undergraduate Student Guide Book 2005–2008 (IPB, 2008b). Lists of students' final projects during the period of 2004–2008 were obtained from the university library information system, and lists of faculty research and community service were obtained from University Bureau of Research and Community Services (LPPM). Data were analyzed descriptively and are presented in tables and figures.

Food and Nutrition Security Situation

Food Production and Availability

In the last 5 years, Indonesia's food security has been characterized by increased per capita availa-

Table 1. Production Trends of Plant Source Foods in Indonesia 2004–2008 ($\times 1000$ tonnes)

Year	Rice	Corn	Soy bean	Peanut	Cassava	Sweet Potato	Vegetables	Fruits	Crude Palm Oil	Re fined Sugar
2004	54,088	11,225	723	837	19,425	1902	9060	14,348	12,380	2052
2005	54,151	12,524	808	836	19,321	1857	9102	14,787	13,970	2393
2006	54,455	11,603	748	838	19,987	1854	9564	16,171	16,050	2267
2007	57,157	13,288	593	789	19,988	1887	9941	17,352	16,700	2402
2008	60,250	16,320	776	774	21,590	1880	10,234	19,279	18,600	2542
Growth Rate (%/year)	2.76	10.39	3.62	-1.91	2.73	-0.28	3.11	7.71	10.79	5.78

Source: Dewan Ketahanan Pangan (2009).

Table 2. Production Trends of Animal Foods in Indonesia 2004–2008 ($\times 1000$ tonnes)

Year	Beef	Chicken	Eggs	Fresh Milk	Fish
2004	448	1191	1107	550	6120
2005	359	1126	1052	536	6870
2006	396	1266	1204	617	7395
2007	340	1296	1382	568	7608
2008	352	1448	1485	574	8107
Growth Rate (%/year)	-4.99	5.27	7.92	1.44	7.34

Source: Dewan Ketahanan Pangan (2009).

bility resulting from the increasing production of important plant and animal food commodities. Production of rice, the most important staple food, has increased, with an average annual growth of 2.76%. Production of corn, fruits, Crude Palm Oil, and refined sugar increased sharply, while that of soybeans, cassava, and vegetables increased moderately. On the other hand, production of peanuts and sweet potatoes tended to decreased (Table 1). Similarly, the production of animal food, except beef, also tended to increase (Table 2). The increased production of animal foods, particularly chicken, eggs, and fish, is expected to have a positive impact on the improvement of diet quality among Indonesians. Those commodities have become more accessible, both physically and economically, to the needy lower income group due to their lower prices than other animal food sources.

The increased food production has improved food availability, particularly in the last 3 years

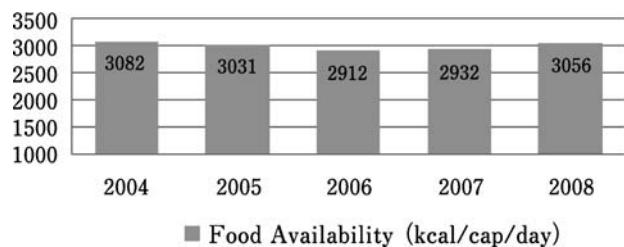


Fig. 1. Trends of Food Availability in Indonesia 2004–2008.

Source: Food Balance Sheet 2004–2008.

(Fig. 1). Average food (equivalent to energy) availability at the national level in the last 5 years was approximately 3000 kcal/capita/day, which exceeded the minimum availability at the macro level as recommended by the 1994 National Workshop on Food Nutrition of 2200 kcal/capita/day. However, according to Martianto and Baliwati (2008), this greater availability of food does not represent an improvement in the quality, because most of the

energy sources come from high calorie food, particularly rice and palm oil. The ratio of starchy staple foods is higher than 65%. In addition to being a source of energy, plant foods—particularly rice—contribute significantly as protein sources in the Indonesian diet.

Despite good improvements in food production and availability of some major food commodities, the nation's dependency on imports of wheat, soybeans, dairy products, and sugar is very high. Wheat, which is the second staple food after rice, is all imported and accounts for more than 4 million tonnes per year at an approximate cost of more than US\$20 billion a year (Suryana, 2008). Supplies of dairy products (particularly milk) and soybeans are highly dependent on imports (Table 3). Similarly, sugar, peanut, and meat imports are also high. In general, the cutoff used nationally to

express critical importation dependency is 10%.

Food Intake

According to the 2004 National Workshop on Food and Nutrition, the average Recommended Dietary Allowance (RDA) of energy for Indonesian people is 2000 kcal/capita/day. In the last 5 years (except for 2006, for which data are not available), there was a trend of improvement in the average energy intake of the community. Based on SUSENAS 2007 and 2008 data, the RDA of 2000 kcal/capita/day has been achieved but with relatively poor quality food, as indicated by the low desirable dietary pattern (DDP), as presented in Table 4. The DDP score is a quantitative measure of diet quality that is a combination of adequacy level (achievement of RDA) and the composition of a balance diet. The highest score of 100 indicates

Table 3. Food Import Dependency 2004–2007 (% of total domestic requirement)

Year	Rice	Corn	Soy bean	Peanut	Vegetable	Fruits	Sugar	Meat	Chicken	Eggs	Milk	Fish
2004	0.76	9.14	60.98	7.87	5.87	0.27	21.31	3.96	0.16	0	92.37	2.56
2005	0.58	1.47	57.33	8.94	5.49	0	36.56	7.81	0.67	0	96.04	2.02
2006	1.35	13.3	60.27	7.10	7.14	0	29.94	8.39	0.45	0	89.58	2.96
2007	4.12	5.52	70.60	11.6	7.01	0.01	16.50	14.80	0.66	0.11	66.70	2.06

Source: Dewan Ketahanan Pangan (2009).

Table 4. Trends of Food Intake in Comparison with the Desirable Dietary Pattern and RDA for Energy, 2004–2008

Group of Food	RDA (kcal/cap/day)	Food Intake (kcal/cap/day)*			
		2004	2005	2007	2008
Cereals	1000	1248	1241	1246	1281
Tubers	120	77	73	46	62
Animal source food	240	134	139	158	157
Oil and fat	200	195	199	206	204
Oily fruit/seed	60	47	51	50	44
Soybean/nut	100	64	67	74	62
Sugar	100	101	99	98	95
Vegetables and fruits	120	87	93	100	99
Others	60	33	35	36	35
TOTAL	2000	1986	1997	2015	2038
DDP Score	100	76.9	79.1	83.1	81.6

*Calculated from SUSENAS data 2004–2008; data for 2006 not available.

that the diet is fulfilling both quantity and quality requirements: it is adequate and balanced. Table 4 shows that the contribution of cereals far exceeds the recommendation of 1000 kcal, while tubers, animal food, soybeans/nuts, and vegetables and fruits are still lower than the recommendation. This unbalanced composition represents a low-quality diet due to inadequate protein and micronutrients from animal food, soybeans/nuts, and vegetables and fruits.

According to Martianto (2009), there is also a great disparity between the diets of low-, moderate-, and high-income citizens, as well as among regions in Indonesia. The low-income population faces a serious problem due to inadequate energy intake combined with very poor food quality, as indicated by a low DDP score. Similarly, the diets of people living in poor and remote areas are inadequate and unbalanced. Based on an analysis of SUSENAS data, the prevalence of Indonesians who consumed food (equivalent to energy) equaling less than 70% of RDA in 2005, 2007, and 2008 was 13.2%, 10.0 %, and 11.1%, representing 28.94 million, 22.49 million, and 25.28 million people, respectively. This 70% cutoff is commonly used to estimate the prevalence of food insecurity. The prevalence was more or less stable in the period of 2005–2008. According to Suryana (2008) this malnourishment problem is related to poverty, and the poverty level in Indonesia was 15.4% (approximately 34.96 million people) in 2008.

Nutritional Status

The prevalence of malnutrition in terms of underweight, wasted, and stunted children among those under age 5 is a general indicator of community nutrition (Fig. 2). The data are based on the latest RISKESDAS (Primary Health Survey) conducted in 2007 and reported in 2008. According to Budihardjo (2009), the cutoff points for malnutrition to be categorized as a public health problem are 10%, 5%, and 20% for underweight, wasted, and stunted children, respectively. Although the prevalence of underweight children was reduced from 25.8% in 2004 to 18.4% in 2007, its prevalence is still very high and considered to be a public health problem.

The malnutrition problem is due to macronutrient deficiencies. At present Indonesia is also

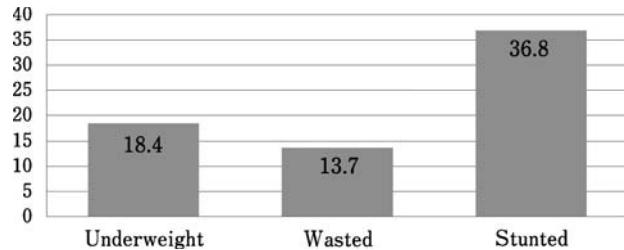


Fig. 2. Prevalence of Underweight, Wasted, and Stunted Children under Age 5 Based on Primary Health Survey 2007.

Source: Departemen Kesehatan (2008).

facing the so-called “hidden hunger” of micronutrient deficiencies. The major problems include vitamin A deficiency, iodine deficiency disorders, and iron deficiency anemia. More than 100 million Indonesians are affected by these problems (Departemen Kesehatan, 2008). According to the World Bank (2006), a cost-effective strategy of food fortification is now available to control micronutrient deficiencies. Indonesia has implemented a food fortification strategy, particularly to control iodine deficiency disorders through a mandatory salt iodization program and iron deficiency anemia through mandatory wheat flour fortification with iron and folic acid (Soekirman, 2008). A pilot project of fortifying cooking oil with vitamin A has been undertaken as well (Martianto *et al.*, 2008).

Food Safety

The main parameter commonly used to indicate the level of food safety in a country is the number of food poisoning cases, consisting of the number of outbreaks, number of people exposed, number of people sickened, deaths, case fatality rate, and incidence rate. In the period of 2003–2007, the number of outbreaks ranged from 34 to 184, with the number of deaths ranging from 12 to 54 (Table 5).

In addition to the high number of cases of food poisoning, another serious problem is the use of substances and articles that are not allowed or are explicitly prohibited to be added to food products. According to BPOM (2008), in 2006 approximately 26.5% of the sample products contained prohibited sweeteners; 14.1% contained poor-quality preservatives; 7.3% used formalin as preservative for fish, tofu, and meatballs; 6.8% used borax; and 12.9% used textile coloring for food. Similarly,

Table 5. Number of Food Poisoning Cases in 2003–2007

Year	No. of Outbreaks	No. Exposed	No. Sickened	No. of Deaths	Case Fatality Rate	Incidence Rate
2003	34	8,651	1843	12	0.65	0.84
2004	164	22,297	7366	51	0.69	3.37
2005	184	23,864	8949	49	0.55	4.11
2006	159	21,145	8733	40	0.46	3.99
2007	179	19,120	7471	54	0.72	3.42

Source: BPOM (2008).

data from the U.S. Food and Drug Administration's Import Refusal Reports collected from 2002 to 2007 suggest that the main reason for rejection was filth, meaning that the article appears to consist in whole or in part of any filthy, putrid, or decomposed substance.

In Indonesia anyone may produce and sell food for public consumption. Thus, it is not surprising that the food industry is dominated by micro, small, and medium-sized enterprises (MSMEs). According to Rahayu (2008), 99.9% of the enterprises can be categorized MSMEs; only about 0.1% of the total are large enterprises, which usually implement good manufacturing practices. Most of these MSMEs are still struggling with problems associated with basic good manufacturing practices (Hariyadi and Dewanti-Hariyadi, 2003).

Summary of Food and Nutrition Security and Food Safety in Indonesia and Their Implication for the Development of Education and Research at Bogor Agricultural University

Indonesia has significantly improved its food availability at the macro level but is still facing problems with the accessibility of food, particularly for the poor and those living in relatively remote areas. The stability of food distribution to all regions at all times at a rational price is becoming a major issue. Poverty is among the main causes of the lack of food accessibility. The diet of Indonesians is considered to be unbalanced, and inadequate and unbalanced diets are prevalent among the poor. Food safety is another important issue. The various problems indicate that this is a complex situation that requires a multidisciplinary approach. Education may play a significant role in developing the science and technology needed to

help people improve food security and safety.

IPB is working to develop curricula, research projects, and community services that will improve Indonesia's problems with food and nutrition security and food safety. IPB aims to strengthen the knowledge and technology of food production, particularly for the improvement of food productivity (mainly rice) and exploration of carbohydrate food sources (roots and tubers, sago, maize, others) as complements to rice to reduce the importation of wheat. It is also necessary to strengthen the knowledge and technology to improve food distribution efficiency, considering that Indonesia consists of thousands of islands and has some large islands with limited transportation facilities in certain areas. The university plans to improve the understanding of food and nutrition security and its relationship to socioeconomic and cultural situations (Kinseng, 2008), as well as the potential of social capital to strengthen the community's food and nutrition security through community empowerment, nutrition education, and other programs. It is also important to strengthen the knowledge and technology for the improvement of food safety and nutrition quality of food products, particularly simple technology that can be applied by MSMEs, including exploration of safe and affordable sweeteners, food coloring, and preservatives from local resources. Finally, food fortification technology that has been proven as a cost-effective measure to control micronutrient deficiencies should be strengthened.

Current Food and Nutrition Security Education and Research at Bogor Agricultural University and Recommendations for Improvement

Education

IPB is the leading higher education institution to offer courses in the agricultural sciences in Indonesia. The university has recently renewed its strategic planning with an emphasis on tropical agriculture and the accelerated engagement of bioscience for nature conservation and sustainable development. IPB's mandate is to educate students regarding the use of bioscience in the entire process of agribusiness activities, not only on farms but also the upstream and downstream processes with other supporting subsystems.

As an agricultural based university, food and nutrition security and food safety receive much attention from the faculty members at IPB. In 2008 the university launched recommendations to strengthen the emphasis on food and energy security in a plan entitled "New Development Perspective to Control the Food and Energy Crisis." In addition, a 2009–2012 research agenda for food security has been launched as well.

At present, food and nutrition security and food safety courses and research are conducted by almost all related faculties, including the Faculty of Agriculture (food/plant production), Faculty of Fisheries and Marine Sciences (fish and other marine products, including fish product processing and food safety for fisheries products), Faculty of Animal Husbandry (animal production and processing, food safety of animal products), Faculty of Agricultural Technology (food processing and food safety of various food commodities), Faculty of Economics and Management (food distribution, agricultural economics and agribusiness), and Faculty of Human Ecology (nutrition security, particularly assessment of nutritional status, child growth, and ecology of food and nutrition). No courses related to food production are given by the Faculty of Forestry. Considering that forests can function as sources of food (cultivated or not cultivated), a course on forests as food sources should be developed. This course could highlight the potential of forests to contribute to food production or provide foodstuffs when a lack of produc-

tion might occur due to drought, flood, and other calamities. Details of the IPB's undergraduate curricula on food security and food safety are presented in Appendix 1.

Various courses that help undergraduate students understand food and nutrition security as a system are available in the present curricula. Most of the basic courses required for such an understanding are being taught by all of the related faculties and departments. Under the implementation of a major-minor system at IPB, students may select food and nutrition system courses from across faculties or departments based on their own interests. This system opens the opportunity for those who are majoring in food technology or agronomy, for example, to minor in nutrition. Elective courses also can be selected by students to complete their interest in the food and nutrition security system, ranging from 144 to 160 units including seminars and a final project (undergraduate thesis).

In connection with the current problems of food and nutrition security and food safety, content analysis shows that the following aspects should be strengthened in the course materials. First, alternative carbohydrate sources (particularly tubers, sago, etc.) have been discussed in Food Crop Science (AGH 340), but their use as alternative food sources as well as their economic potential should be incorporated in Food Agribusiness (AGB 201), Food and Nutrition Economics (GIZ 442), and Food Processing Technology (ITP 333) along with the vegetables and animal foods that are discussed in those courses. The potential of harvesting starchy foods from forests could be discussed in Forest Products as Raw Material (HHT 211) and Inventory of Forest Products (MNH 212). Second, to avoid a bias toward implementation by large food industries, food safety aspects at MSMEs should be strengthened and discussed in the following courses: Food Safety and Sanitation (ITP 322), Food Regulation (ITP 430), and Storage and Warehouse Techniques (TIN 241). The course Food Additives (ITP 410) should be enriched with current practices in MSMEs and potential safe food additives for small industries and home uses. Finally, no courses on food fortification technology are offered at IPB. As a promising measure to control Indonesia's widespread micro-

nutrient deficiencies, technology for the fortification of staple foods with iron, iodine, and vitamin A should be taught by the Department of Food Science and the Department of Community Nutrition. The economic and financial aspects of food fortification as well as its cost effectiveness could be taught in Food and Nutrition Economics (GIZ 442).

Food and nutrition security courses are also offered for the master's and doctoral degree students by the respective faculties and departments. The courses offered are usually a continuation of undergraduate courses with a deeper and more sophisticated approach. IPB also offers a Master of Professional Studies degree in Food Security Management. This program is offered to professionals who work at the institutions related to food and nutrition security. Similarly, a program on Food Technology for professionals is also offered for those who are working in the food industry, FDA/BPOM, and other institutions. This program covers technology and other aspects of food processing and food safety for implementation in food industries.

Student Final Projects and Faculty Research

Each student at IPB is mandated to conduct a final project, with the final product as a bachelor thesis (6 units), master thesis (6 units), or Ph. D. dissertation (12 units). Table 6 provides information regarding areas of food and nutrition security research by students and faculty members (under coordination of LPPM/Bureau of Research and

Community Services) in the period 2004–2008. There were 14,651 bachelor theses completed during the period, but only 192 projects (1%) were directly related to food and nutrition security, discussing the improvement of food production, availability, access, utilization, and safety. Only 3% of masters' theses, 2% of dissertations, and 6% of faculty research projects were related to food and nutrition security, including food safety.

The data show that aspects of food safety received more attention than improvement of food production and availability, access, and utilization (nutritional status). Among 192 research food and nutrition security projects of the bachelor's degree, master, doctoral students and faculty, the food safety topic reached more than 60% of the total research.. Among the commonly studied topics were uses of food additives, food contaminants, food poisoning, effectiveness of food safety regulation, and safety of street food, which are relevant to the food safety problems faced by Indonesians.

The most common topics of the bachelor's, master's, and doctoral research on food security were food diversity and food consumption patterns, food intake and nutritional status, food security institutions, coping strategies against food scarcity, food demand and importation, assessment of food security and hunger, exploration of alternative carbohydrate sources (particularly roots and tubers), rice variety resistance to dry and wet stress, macro policy to stimulate food production, and food price policy. In addition, the following food security topics were also commonly studied by the faculty

Table 6. Research Areas in Food and Nutrition Security by Numbers of Students and Faculty Members

Research Area	Faculty/LPPM		Dissertation		Master's Thesis		Bachelor's Thesis	
	N	%	N	%	N	%	N	%
Food Production	4	11.1	0	0.0	8	8.6	8	4.2
Food Availability	2	5.6	2	9.5	11	11.8	7	3.6
Food Access	0	0.0	5	23.8	14	15.1	9	4.7
Food Utilization	5	13.9	1	4.8	14	15.1	30	15.6
Food Safety	25	69.4	13	61.9	46	49.5	138	71.9
Food and Nutrition Security	36	100.0	21	100.0	93	100.0	192	100.0
Total Research Studies in 2004–2008	579		961		3134		14,651	

Source: Calculated from LPPM and Central Library data of IPB.

members: impact of food insecurity to child growth and development, development of technology to increase food production and productivity, development of technology to anticipate food insecurity, and early warning systems to prevent food insecurity.

Concluding Remarks

As the leading agricultural university in Indonesia, IPB has developed its curricula and promoted research projects that are relevant to the nation's current food and nutrition security problems. Some improvement in curricula and research is still needed to develop knowledge and technology to support food availability based on local capacity to achieve food self-sufficiency under a sustainable agricultural development approach; improve food access and quality of the diet, particularly among the poor; improve nutritional status of the community, not only for macronutrient but also micronutrient deficiencies through a cost-effective approach with more preventive programs; and improve food safety by finding cheap and safe food coloring, preservatives, and additives for MSMEs.

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Appendix 1. List of Courses Related to Food Security and Food Safety

No.	Courses	Code/Unit	Faculty	Department	Description
Food Security Related Courses					
1	Food Crop Science	AGH 340/3 (2-3)	Agriculture	Agronomy and Horticulture	Food crops from cereals, pulses, and tubers; role and function, and the development prospects of crops in Indonesia; origin and adaptation; botany and physiology; environment and growing conditions; cultivation techniques.
2	Estate Crop Science	AGH 341/3 (2-3)	Agriculture	Agronomy and Horticulture	The origins, economic value, botany and plant ecology of major crops such as coconut, palm, and rubber as well as cultivation techniques from the procurement of plant material, land preparation, planting, maintenance, harvesting, and primary processing of these three types of plants.
3	Agricultural Ecology	AGH 320/3 (2-3)	Agriculture	Agronomy and Horticulture	The notion of agricultural ecosystems and a description of their components; interaction between plants and their environment and culture manipulations to achieve higher agricultural production and sustainable and optimal use of resources.
4	Vegetables	AGH 342/3 (2-3)	Agriculture	Agronomy and Horticulture	The major vegetable commodities and exotic vegetables grown in Indonesia comprehensively and from the technological aspects associated with crop production (nursery, planting systems, fertilization, irrigation, weed control, pest and disease control, harvesting), physiology, ecology, botany, germination post-harvest, and marketing; aspects of vegetable production techniques; production planning in the commodity vegetable business.
5	Non Sugar and Seed Plant Resources	AGH 344/3 (2-3)	Agriculture	Agronomy and Horticulture	The importance of carbohydrate plants from roots, stems, and other plant parts and carbohydrate metabolism in plants; the origin, botany, and needs of growing environment; cultivation from preparing material to the processing plant results. The species covered are tuber plants (cassava and taro), palmae (palm and sago), and graminae (sugarcane).

Appendix 1. (Continuation)

No.	Courses	Code/Unit	Faculty	Department	Description
6	Fruits	AGH 442/3 (2-3)	Agriculture	Agronomy and Horticulture	The tropical fruit growing environment; structure and function of organs and growth of tropical fruit trees; process of flowering and fruiting habit; fruit development, growth, and post-harvest; nursery management; development and management of fruit gardens; fruit plant breeding; agribusiness of important fruit in Indonesia.
7	Fishery Resources	MSP 332/3 (2-3)	Fisheries and Marine Science	Living Aquatic Resources Management	The characteristics of various aquatic resources that have economic value for humans and/or an ecological value, in terms of distribution and potential; exploitation and production; alternatives of development and utilization and potential types of fisheries resources to be developed and protected in Indonesia and the world.
8	Consumer Behavior	MAN 424/3 (3-0)	Economics and Management	Management	The various approaches to consumer behavior; purchase and consumption; buying decisions in the family; relationship between consumer and the type of goods; consumer choice influence; consumer perceptions and influence of advertising; market segmentation and consumption of food; children as consumers; social class and consumer behavior.
9	Food Agribusiness	AGB 201/3 (2-3)	Economics and Management	Agribusiness	The general characteristics of food agribusiness; cereals agribusiness; horticultural agribusiness; fresh products of fisheries and animals; food products agribusiness; hotels, restaurants, and catering business; up-date issues on food agribusiness.

Appendix 1. (Continuation)

No.	Courses	Code/Unit	Faculty	Department	Description
10	Agricultural Economics	ESL 211/3 (3-0)	Economics and Management	Resources and Environmental Economics	Economic science and its relation to agricultural economics, agricultural resources, agricultural institutions, function and curve production, production costs, revenue and maximum profit, supply and demand, marketing of agricultural commodities, markets and marketing policies, international trade, agribusiness systems, and agricultural development.
11	Production Economics	ESL 312/3 (3-0)	Economics and Management	Resources and Environmental Economics	The principles of economic production and its application in general agriculture (agriculture, fisheries, animals, estate crop, and forestry).
12	Agricultural Price Theory	ESL 313/3 (3-0)	Economics and Management	Resources and Environmental Economics	The problems of determining the price of agricultural products and the impact of various government policies on agricultural product prices.
13	Food and Nutrition Ecology	GIZ 341/2 (1-3)	Human Ecology	Community Nutrition	The interaction between humans and the environment to meet food and nutritional needs while maintaining the sustainability of natural resources and environment; problems of population, food, nutrition, health, and environment; food and nutrition from the ecological perspective; a variety of food resources; agricultural systems, industry, and sustainability in food trade.
14	Food and Nutrition Economics	GIZ 442/2 (1-3)	Human Ecology	Community Nutrition	The relationship between economic variables and food consumption and nutrition variables; reciprocal relationship between economic development and improved nutrition; economic policy, agriculture and food, and their impact on food consumption and nutrition; nutritional indicators in development, the principles of cost minimization of consumption food, and feasibility analysis of food and nutrition programs.
15	Food and Nutrition Planning	GIZ 443/2 (1-3)	Human Ecology	Community Nutrition	The planning of food and nutrition programs and its relation to national and regional development, including resources and problem analysis, prioritization of interventions, as well as implementation design, monitoring, and evaluation.

Appendix 1. (Continuation)

No.	Courses	Code/Unit	Faculty	Department	Description
16	Basic Nutrition Science	GIZ 213/3 (2-3)	Human Ecology	Community Nutrition	The basic knowledge in nutritional science, including energy, carbohydrates, proteins, fats, vitamins, minerals, water and electrolytes, and other nutritional components; assessment of food consumption; anthropometric nutritional status; and principles of menu (food list) planning.
17	Nutritional Assessment	GIZ 322/3 (2-3)	Human Ecology	Community Nutrition	The theory and methods of evaluating food availability; food consumption; adequacy of nutrition (dietary reference intakes); biochemical, anthropometry, biophysical, and clinical on the individual, household, and population nutritional status; and socioeconomic circumstances as a proxy indicator of community nutrition situation.
18	Consumer Behavior	IKK 231/3 (2-3)	Human Ecology	Family and Consumer Science	Learning the process of decision-making in selecting, buying, using, and evaluating goods and services, and factors (internal and external) that influence the decision-making process.
19	Consumer Education and Protection	IKK 331/3 (2-3)	Human Ecology	Family and Consumer Science	Consumer education concepts, including decision-making, resources management, and community participation; efficient resource management to obtain satisfaction from the goods/services purchased/consumed; formation of wise consumers by the increasing awareness of rights and responsibilities; introduction of consumer problems in the community; importance of role of the consumer protection movement.

Food Safety Related Courses

1	Agricultural Products Post-Harvest	AGH 440/3 (2-3)	Agriculture	Agronomy and Horticulture	The basics of post-harvest agricultural products and post-harvest handling technology; limitation and scope of post-harvest agricultural products, cleaning, sorting and grading; drying, size reduction, quality management, packaging and storage; physico-chemical properties of materials and post-harvest handling technology for specific commodities (food crops, horticulture, and estate crops).
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Appendix 1. (Continuation)

No.	Courses	Code/Unit	Faculty	Department	Description
2	Microbiology of Living Aquatic Products	THP 322/3 (2-3)	Fisheries and Marine Science	Technology of Fisheries Products	The scope, habitat, and physiology of microorganisms; diversity and the role of aquatic microorganisms (prokaryotes and eukaryotes); microorganisms that cause damage to living aquatic products; microbial pathogen interactions in humans and its control; sanitation and hygiene of aquatic products.
3	Living Aquatic Processing Technology	THP 331/3 (2-3)	Fisheries and Marine Science	Technology of Fisheries Products	The various means of aquatic product processing technology using cold temperature, high temperature, and water activity modification; its application to maintain durable, quality products, and adding value to raw materials originating from aquatic products.
4	Milk Processing Technology	PTP 351/3 (2-3)	Animal Husbandry	Animal Production and Technology	The composition, structure, and physicochemical characteristics of milk components; post-harvest handling of milk; process of homogenization and heating of milk (pasteurization and sterilization) and its problems; milk processing with fermentation and other methods; sanitation of milk product processing.
5	Meat Processing Technology	PTP 352/3 (2-3)	Animal Husbandry	Animal Production and Technology	The development of meat processing industry; relationship between meat quality and meat processing; the material/additive in meat processing; meat processing methods; by-products of meat industry; method of packaging and storage of processed meat products; food safety of meat products.
6	Egg, Meat, and Poultry Processing Technology	PTP 353/2 (1-3)	Animal Husbandry	Animal Production and Technology	The benefits of meat, poultry, and eggs; processing techniques; physical and chemical changes during processing; factors that influence the result processed and how to test processed products.
7	Food Processing Techniques	TEP 340/3 (2-3)	Agricultural Technology	Agricultural Engineering	The basics of the application of techniques in food processing, including kinematic reactions in food, separation processes, heating and cooling processes, food freezing process thermodynamics, drying, coagulation, and extrusion.

Appendix 1. (Continuation)

No.	Courses	Code/Unit	Faculty	Department	Description
8	Post-Harvest Handling of Agricultural Products	TEP 341/2 (2-0)	Agricultural Technology	Agricultural Engineering	Application of basic principles of engineering in agricultural product processing, including milling (size reduction), cleaning, sorting, and grading; the properties of air and water vapor, biological material, and principles of heat/mass transfers applied in drying, cooling, and separation techniques; simple calculation of capacity of equipment and machines; operating cost analysis.
9	Food Chemistry	ITP 210/3 (3-0)	Agricultural Technology	Food Science and Technology	Chemical principles of food components, both macrocomponents (water, fats, carbohydrates, proteins, enzymes) and microcomponents (vitamins, minerals, pigments, flavors, food additives, compounds/toxic components); composition, structure, and chemical reactions involving food components during processing, handling, and storage.
10	Food Microbiology	ITP 220/2 (2-0)	Agricultural Technology	Food Science and Technology	Microbial growth, intrinsic and extrinsic factors affecting microbial growth in food, principles of calculations of microbes in food; principles of fermentation process and the beneficial microbes in food; role of microbes in various food materials and food products causing microbiological damage; microbial pathogens in food, diseases caused by the pathogens, and the principles for controlling these microbes.
11	Principles of Food Processing	ITP 231/3 (3-0)	Agricultural Technology	Food Science and Technology	Application of chemical principles, microbiology, and engineering in processing and preserving food by considering quality factors (physical, chemical, nutritional, sensory, and microbiological) and acceptability of the product.

Appendix 1. (Continuation)

No.	Courses	Code/Unit	Faculty	Department	Description
12	Food Safety and Sanitation	ITP 322/2 (2-0)	Agricultural Technology	Food Science and Technology	Food safety hazards in terms of microbiological, chemical, and physical in relation to cases of food poisoning in Indonesia and the world; sanitation principles of food industry, sanitizer materials and cleaning, raw materials sanitation, food processing sanitation, worker sanitation, pest sanitation (mice and insects), water sanitation, equipment and building sanitation; testing the adequacy of sanitation; microbes as indicator of sanitation; waste handling.
13	Characteristics of Food Materials	ITP 332/3 (3-0)	Agricultural Technology	Food Science and Technology	Physical properties, chemical, physiological, sensory, microbiological, and functional properties of vegetable, animal, and food ingredients by food categories.
14	Food Processing Technology	ITP 333/4 (4-0)	Agricultural Technology	Food Science and Technology	Procedures and an integrated approach (physical and engineering aspects, chemical, microbiological, sensory) used in food canning and processing based on commodities, including vegetables and animals in the commercial practice based on food categories; stages in the process of product design and development, reproduction scale, market testing, the final product, and launching products on the market.
15	Food Regulation	ITP 302/2 (2-0)	Agricultural Technology	Food Science and Technology	The role of food regulation, both in national and international levels in protecting consumers and producers of food; establishment of food regulation and its enforcement, including institutions responsible for policy-making and implementing agencies, implementation of legislation, needs, and choices of food regulations used by national and international agencies on aspects of food safety, food quality, and nutrition, and "Halal" labeling; implementation of food legislation in the public for exports, domestic consumption, and imports.

Appendix 1. (Continuation)

No.	Courses	Code/Unit	Faculty	Department	Description
16	Food Quality Assurance	ITP 430/3 (2-3)	Agricultural Technology	Food Science and Technology	Quality and technological applications for the standards and specifications, quality control and assurance of food; introduction of quality assurance system concept with emphasis on Quality Management System (TQM and ISO 22000) and the Halal Assurance System.
17	Food Additives	ITP 410/2 (2-0)	Agricultural Technology	Food Science and Technology	Types and functions of food additives; how to use; product development; overview of use of food additive regulation; development of flavor technology and its application in food industry; types and functions of food processing aids.
18	Storage and Warehousing Techniques	TIN 241/3 (2-3)	Agricultural Technology	Agroindustrial Technology	Overview of storage materials and agro-industry products, including physico-chemical properties of agricultural commodities and causes of decreased quality, technique of cold storage and frozen storage, storage techniques in a controlled atmosphere/modified (CAS/MAS), and minimally processed products, determination and estimation the age of storage, warehousing techniques of bulk and packaged commodities, and security of commodities in the warehouse.
19	Quality Control	TIN 350/3 (2-3)	Agricultural Technology	Agroindustrial Technology	The role of quality control; quality factors; quality standards; testing and physical-mechanical properties; chemical, microbiological (HACCP), and preference tests; statistical analysis, sampling, and integrated quality control.
20	Beverage Material Technology	TIN 422/3 (2-3)	Agricultural Technology	Agroindustrial Technology	The spread of estate crop commodities in Indonesia; characteristics of estate crop commodities; estate crop commodities processing technology; quality control of primary products and processed products of estate crop commodities, including tea, coffee, cocoa, and tobacco.

Appendix 1. (Continuation)

No.	Courses	Code/Unit	Faculty	Department	Description
21	Food Raw Materials Science	GIZ 231/3 (2-3)	Human Ecology	Community Nutrition	The sources and types of vegetable and animal materials; physical structure; chemical composition/nutrition and changes in chemical/biochemical post-harvest from each food group.
22	Food Service and Nutrition Management	GIZ 431/3 (2-3)	Human Ecology	Community Nutrition	The principles and applications of food service management and its operations; application of the principles of nutrition science; quality management and food security; management of food service businesses to meet community needs on healthy, safe, and nutritious food according to their preference, consumer nutrition requirement, or objective of the institution.