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Assessment of Poland food security in the context of agricultural production in 2010–2020

Ocena bezpieczeństwa żywnościowego Polski na tle produkcji rolniczej w latach 2010–2020

Summary: This article aims to description food security and its measurement method and analyse the agricultural production status and food self-sufficiency in 2010–2020. Currently, Poland in 2020 ranks 59th globally and fifth in the European Union in terms of utilised agricultural areas. Considering the population of agricultural workers, Poland are the first in the European Union.
Results of studies concerning the production and consumption of basic agricultural raw materials indicate that Poland is a country mostly featuring a food production surplus. From 2010 to 2020, its level of self-sufficiency to the extent of basic cereals was variable; however, grain production surplus was recorded in the analysed period. Similar observations were made for the production of potatoes and vegetables. Only in some years did fruit production show a deficit or was at the domestic consumption level. As regards milk and eggs, Poland was self-sufficient in the whole analysed period, and the dynamics of increase in the surplus of milk and eggs was proportional to the 2010 year. From 2010 to 2020, Poland recorded a high surplus of poultry meat and beef that increased every year using a dynamic approach. The level of self-sufficiency to the extent of pork supplies was highly varied. From 2010 to 2015, a deficit occurred that decreased year on year, and from 2018 to 2020, it reached a surplus of 71 000, 62 000 and 40 000 tonnes, respectively. Surveys regarding Poland's balance of foreign trade in agri-food products did not confirm food self-sufficiency in 2010; however, from 2015 to 2020, the balance was positive and was growing throughout the survey period, which means that Poland exported more agri-food products than it imported. Many households representing the part of the society with the poorest income declare they are not able to eat red meat or poultry every other day. A systematic reduction in the calorific value of food consumed in Polen is also puzzling as lower than the reference (2350 kcal), and in 2019 it reached a distressing daily intake value of 1999 kcal per capita.

Key words: agricultural production, food safety, food security, supply

INTRODUCTION

Famine and malnutrition have been present throughout human history and are now among the biggest threats to humanity. They are dangerous both in the political, economic and humanitarian dimensions. According to the United Nations Organization (UN), since the end of the 1990s, the number of starving people has been continually growing worldwide. This situation was vastly affected by the financial and economic crisis of 2006–2009, due to which food prices snowballed. As a result, in 2009, more than 1 billion people were starving and suffering from malnutrition, mainly in Asia and Africa, and more than 40 million residents of the European Union were affected by food deficiency in 2010 [Babiak 2011, Jiren et al. 2020]. Thus, food security is a key challenge to the agriculture of the European Union, considering, in particular, that according to the Food and Agriculture Organization of the UN [FAO Rome 1996, 2002, 2003, 2009], the requirement for food will be doubled by 2050, which – given an exacerbating water deficit that has already affected more than 30 world countries and climate change that are now affecting the member states of the European Union. According to Maslow's hierarchy of needs, higher-level needs appear only when a need, for example, a need for proper food, is satisfied. Currently, food security is one of the key global challenges in the present-day world, which should be considered both on a national scale and at the level of a family as a basic unit in society [Michna 1988]. Based on its surveys, Statistics Poland reports (GUS) that in 2020 children and young people under 17, depending on the number of people in the household, accounted for 1.4 to 5.9% of the population living in extreme poverty, below the subsistence minimum [GUS 2022]. Substitution of healthy products with those poor in nutrients observed in those families, or undernourishment due to restricting the amount of food consumed, has a destructive effect on human health and life and leads to serious consequences in the future not only for the young generation affected by hunger and undernourishment but also for the whole society of which these people form a part [Gulbicka et al. 2015]. Thus, ensuring food security is a fundamental constitutional obligation of every country.

Mikuła [2012] sees Poland as a country generating food production surplus. This refers to the production of basic cereal grains, potatoes and vegetables from 2006 to 2010, which covered from 104% to 112% of the national consumption. In contrast, the coverage of national consumption of fruit was negative and a production surplus amounting to 4000 t was recorded only in 2010. As regards milk, throughout the analysed period, Poland was self-sufficient in terms of food supplies and the milk production surplus was above 17% of national consumption. In addition, Poland shows a surplus in the production of poultry and beef and, recently, that of pork in 2018–2020 years. The analysis of the balance of foreign trade in agri-food products in Poland in 2015–2020 corroborated its food self-sufficiency. Despite growing prices of food, economic access to food remained stable, due to the rising wages in Poland. However, many households representing the part of the society with the lowest income declare they are not able to eat red meat, poultry or fish every other day [Mikuła 2012]. An analysis of food security in Poland from 2005 to 2013, conducted by Kwasek [2012], showed that national agriculture, having a potential sufficient to produce agricultural resources and food ensuring adequate food supplies to the population, has and will have a decisive influence on food security in Poland. By contrast, Poland continually suffers a deficiency in production of seeds and fruits of oil plants, and vegetable oil and fat, despite the increasing production of rapeseed. However, the area on which rapeseed is grown cannot be increased as, due to soil quality, this crop competes with wheat, and its yield is largely dependent on the weather. Thus, Poland has to import

the seeds and fruits of oil plants and oils from other climatic zones. A threat to Poland's food self-sufficiency is the decreasing production of pork due to low or zero profitability of pig farming [Kwasek 2012].

Świetlik [2017] reports that according to the analysis of food balance, from 2000 to 2013 the consumption of food per capita in Poland declined and, concurrently, the eating habits changed. In 2013, an average Pole consumed more fruit, vegetable oil, meat, animal fat, milk and fish, and less cereal grains, root plants and legumes, sugar, eggs and vegetables than in 2000. The negative dynamics of overall demand for food (consumption) in Poland were determined by the reduced consumption of cereal products, potatoes and other vegetables. Food production in Poland in 2015–2020 increased, which – considering the population decline – means that the country is more self-sufficient in terms of food supplies.

Poland's accession to the European Communities improved Poland's national food security. Many legislative acts set out the exact and accurate terms and conditions for maintaining safety, hygiene, product identity and composition, and care for the natural environment, plant and animal health and animal welfare [Commission of the European Communities 2000].

According to Kwasek [2012], the guarantee of food security in Poland is given in the Strategy for Sustainable Development of Rural Areas, Agriculture and Fisheries for 2012–2020, adopted by the Ministry of Agriculture and Rural Development (MRiRW). The main objective of the Strategy is improvement in the quality of life in rural areas and efficient use of their resources and potential to ensure the sustainable development of Poland, and one of the five specific objectives is food security (specific objective 3).

Food self-sufficiency is countable. Assuming a specific mean level of consumption per capita, it is possible to specify the quantity of agricultural raw materials and food for national consumption, for purposes other than satisfying the food requirements, including for export to offset the cost of import of food not produced in Poland but imported to ensure balance between the physiological needs of the society and the structure of food components in the supply of agricultural raw materials and food [Kwasek 2012].

This paper aims to description Poland's agricultural production and food security in terms of supplies of agricultural products from 2010 to 2020. It conducts an assessment of food self-sufficiency and economic access to food. The level of food self-sufficiency was based on the analysis of the volume of production and consumption of selected agricultural raw materials and products and the calculation of the balance of foreign trade in agri-food products. In addition, we described the legal framework for food security and defined food self-sufficiency. We also presented the method of measuring the Global Food Security Index. The main data source was reports issued and published by the European Statistical Office [EU-SILC 2022 and Statistics Poland [GUS 2018, 2021a, 2021b].

DESCRIPTION OF RESEARCH PROBLEM

What is food security

Food security is a complex and multifaceted problem that is current globally. This notion includes, among other things, food self-sufficiency, economic access to food and food safety [Baranowska-Skimina 2012, Grębowiec 2012]. The term "food security" was coined at the beginning of the 1970s and appeared in the food policy dictionary, and its

antonym was "food insecurity". Previously, military staff used it in the context of warfare or economic and political dependence on countries that were not capable of producing a sufficient amount of food on their own [Michna 1988]. Currently, food security references options and capacity to ensure self-sufficiency in the supply of food products.

An official definition of food security was formulated for the first time at the World Food Conference held in Rome in 1974. According to that definition, food security is "availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" [FAO 1996, 2002, 2003, 2009, Mikuła 2012]. In the 1990s, the notion of food security was extended, among other issues, by "food safety", the nutritional value of food and food preferences dependent on social and cultural factors. Ensuring food security in Poland is inscribed into the national security strategy. It is described as a situation when all households have actual access to food necessary for everyone and are not at risk of losing such access [Ministerstwo Rolnictwa i Rozwoju Wsi 2008].

The definition of food security currently in force, supplemented with the social aspect, was announced in 2009 during another World Food Summit. Then, it was agreed that food security is a situation that exists when "all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life" [FAO 2009]. This definition contains four elements – conditions to ensure food security. These are: – physical availability of food – a condition for food security is the sufficient amount of food produced in the given country, imported or procured through food aid (the origin of food matters);

– economic access to food – a condition for food security has adequate resources, and notably, financial resources, which means that food security is determined by the level of income derived by the population, its distribution and food prices;

– utilisation – a factor necessary to guarantee food security is food quality which, in order to ensure a healthy and active lifestyle, should supply the required amount of energy and contain essential nutrients and macro- and micro-elements. In addition, it should be properly stored and prepared;

– stability – a population, household or an individual must have continuous physical and economic access to healthy food and should not lose it due to sudden fortuitous events; with reference to the social aspect of food security, procured food should also comply with the food preferences of consumers, cultural restrictions and religious rules [Marzęda-Młynarska 2014].

Pawlak [2017] reports that food security can be analysed globally, at national, household, and individual levels. Global food security comprises all food system elements: production and distribution of food, food supplies, food aid, production and consumption information systems, and programmes for population nutrition. The condition of national food security is the physical and economic access of the whole population of a given country to food meeting the quality and health requirements. It is understood as the supply of food for consumption in the given country equal at least to the biological needs of the society throughout the year. The food security of households or individuals is determined by stable supplies of purchased or self-produced food, sufficient for the needs of all/individual household members. This implies that the food policy of a state ensures the maximum food security to households only if all factors and processes affecting the supply of food to household members are taken into consideration.

Reference literature enumerates three dimensions of food security: availability, access and adequacy [Leśkiewicz 2012]. Availability means having an amount of food sufficient for the whole population at any time to maintain human life. Access means not limiting food supply, and adequacy is understood as a balanced food ration, free of pathogens and toxic substances.

In legal terms, "food safety" refers to traits of a food product ensuring it will be safe for consumers' health (qualitative aspect). In contrast, "food security" is a food safety profile in the aspect of production (quantitative aspect). Lawyers can describe food security as an optimum state assumed by the legislator that should be achieved in compliance with the relevant provisions of international, European and national law [Leśkiewicz 2012].

Świetlik [2017] claims that food security has been desired, regardless of the political system and socio-economic situation. Achieving food security requires close collaboration within the international community. Such measures are undertaken by the European Union and the United Nations Organization. Numerous summits and conferences (e.g., the World Food Conference in 1974, the FAO World Food Summit in 1996 and the FAO World Summit on Food Security in 2009) dealt with that problem and set ambitious goals. The Millennium Development Goals (MDG) of 2000 assumed halving the number of people suffering from hunger worldwide by 2015. Despite many years' efforts, engagement of countries, groups of countries, as well as international organisations and institutions in designing and implementing joint solutions aimed at reducing hunger on a global scale, this problem has not been solved. Although from 1990 to 2015, the percentage of the undernourished in the world dropped from 18.6% to 10.9%, one in nine people still suffers from hunger (794.6 million people), while a considerable part of that population, that is, 779.9 million, corresponding to 98.2%, lives in developing countries. In 2015, the Millennium Development Goals were replaced with Sustainable Development Goals featuring a considerably wider horizon of projected measures with a perspective until 2030. One of the main goals of the 2030 Agenda for Sustainable Development is the complete eradication of hunger and elimination of poverty until 2030 (ONZ-UN 2015). Such a radical improvement in the global population's food supply status is one of the most difficult global problems in view of the complexity and unpredictability of its conditions. Their identification is extremely important as some of them are short-term, while others are long-term conditions.

Food security at the EU level is determined by the objectives of the Common Agricultural Policy. International food security is associated with a human right to food and an ability to supply food. Even the most developed countries of the world can experience an inability to supply food, so measures to counteract this are undertaken by the European Union and the United Nations Organization. In turn, food safety – according to the legislator – means "all the conditions that must be satisfied [...] and measures that must be undertaken at all stages of food production or turnover to ensure safety to human health and life" [Dz.U. z 2010 r. Nr 21, poz. 105]. The European Union designed its own food safety system based on a mechanism of early warning through the European Food Safety Authority with its national agencies.

In the food balance, the level of consumption does not refer to single goods but main groups of food. Surveys conducted by FAO most often analyse the following groups of food: cereals, root crops, sugar and syrups, seeds of legumes, plant oils, vegetables, fruits, meat and offal, animal fats, eggs, milk (excluding butter), and fish and seafood [Mikuła 2017]. Table 1 contains a list of products included in respective groups of food.

Table 1. List of products classified in main food groups according to FAO's food balances [Mikuła 2017]

Food groups	Products
Cereals (excluding beer)	wheat, rice (expressed as ground rice), barley, corn, rye, oats, sorghum – grains and products, other cereals, including buckwheat, quinoa, fonio, triticale, canary grass, mixed grains, cereals n.e.c. – grains and products
Root crops	cassava, potatoes, sweet potatoes, yam (Chinese potato), other root crops (including yellow-tailed, taro, roots and tubers n.e.c.) – roots, tubers, and products
Sugar and confectionery	sugar (expressed as raw sugar), honey, other (m.in. glucose, lactose, isoglucose, soft drinks
Legumes	beans, peas, other (including chickpeas, lentils, green beans, lupine) – seeds and products
Vegetable oils	soybean, sunflower, rapeseed, peanut, cottonseed, palm, coconut, sesame, olive, corn, other oil (including jojoba, hemp, linseed, castor oil and margarine)
Vegetables	tomatoes, onions, other (including cabbage, asparagus, spinach, cassava leaves, artichokes, lettuce, chicory, cauliflower, broccoli, pumpkin, gourd, cucumbers, eggplant, carrots, turnips, peppers, mushrooms, dried vegetables, canned vegetables)
Fruit (without wine)	citrus fruits, bananas, apples, pineapples, dates, grapes (without wine), other (including pears, quinces, apricots, peaches, nectarines, plums, strawberries, raspberries, gooseberries, currants, blueberries, cranberries, watermelons, melons, figs, mangoes, avocados, kiwi, papaya)
Meat and offal	beef, poultry, pork, goat, mutton, other meat (including horsemeat, the meat of donkey, silt, camel, rabbit, game, snails), edible offal
Animal fats	butter, cream, other fats (including lard, beef fat, sheep's fat, etc.), fish fat
Eggs	eggs in the shell and processed
Milk (without butter)	milk – fresh and products (whey, yoghurt, skimmed milk, condensed milk, buttermilk, cheese, ice cream, casein) from cow, buffalo, sheep, goat, camel
Fish and seafood	freshwater fish, marine fish, crustaceans, cephalopods, other molluscs, the meat of aquatic mammals, other aquatic animals, aquatic plants

Food security, as seen by international law

The right to food is a part of the human right to life, to be fed, and the right to dignity. The lack of food is also linked with humiliation and a bad mental and physical state. According to the Universal Declaration of Human Rights adopted by the United Nations Organization on 10 December 1948 (Article 3): "Everyone has the right to life, liberty and the security of person". In addition, according to article 25, paragraph 1 of the Declaration: "Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in the circumstances beyond his control" [Universal Declaration of Human Rights]. The right to food is also regulated in the International Covenant on Economic, Social and Cultural Rights (ICESCR) of 19 December 1966 [http://www.irinnews.org/Theme/FOO/Food-Security]. Article 11 of

the document recognised the right to food and its equitable distribution between food-importing and food-exporting countries and every person's right to be free from hunger. In order to implement it, the Covenant stated it was necessary to improve methods of production, conservation and distribution of food by making full use of technical and scientific knowledge, disseminating knowledge of the principles of nutrition and developing or reforming agrarian systems in such a way as to achieve the most efficient development and utilisation of natural resources. Furthermore, it also recognised a necessity to ensure an equitable distribution of world food supplies in relation to need, taking into account the problems of food-importing and food-exporting countries.

The White Paper presented by the European Commission in 2000 provides guidance on food safety in the European Union. It proposes a strategy to guarantee high-level food safety comprising about 80 measures, including food safety legislation. It sees ensuring the safety of food and animal feed throughout the food production chain, including in particular official food safety controls, as one of the key issues. It emphasises the necessity to inform consumers about the products through adequate labelling and descriptions. The White Paper sets out the rules concerning food safety, including the rule of completeness and integration, based on the from-farm-to-fork approach for all food sectors, all member states, the EU and EU's internal market, and all political decision-making levels – both within the EU and international. Another rule is risk analysis and prudence, and engagement of other entities participating in the protection of consumer health, including in relation to environmental protection, animal welfare and sustainable agriculture [Commission of the European Communities 2000].

Interest in food security is manifested by the emergence of social movements such as "fast food", in contrast "slow food" [Leśkiewicz 2012]. The latter blames the Common Agricultural Policy for following an unsustainable consumption model, which is reflected by the fact that half of the people making the 500-million population of the European Union are obese, and as many as 42 million live in poverty, while at the same time 90 million tonnes of food are wasted. According to the Global Food Security Index, in 2016, Poland ranked fifth in Europe regarding obesity levels (25.2%), while the mean level for Europe is 22.3%. The new legislative approach to food safety is expressed in Regulation (EU) No 1169/2011 of the European Parliament and of the Council of 25 October 2011 on the provision of food information to consumers. The topic is also covered by an additional provision made in the Act of 25 August 2006 on Food and Nutrition Safety – division II [Dz.U z 2006 r. Nr 171, poz. 1225].

In the European Union, food security was regulated by the Treaty of Rome [now the Treaty of Lisbon, OJ EU C 2007, No. 306, item 1, further: the Europe 2020 Strategy], which in article 39 set out the goals of the Common Agricultural Policy (CAP), including guaranteed security of supplies at a reasonable price to consumers. In 1958, the goals of the Common Agricultural Policy stemmed from the needs and the reality after World War II. It is highlighted that the Common Agricultural Policy succeeded in overcoming a food deficiency in West Europe in the 1950s [Leśkiewicz 2012].

From the point of view of "instruments" for solving the food insecurity issue, the first proposal of solutions closely linked to the distribution of food among the EU citizens in need, assumed the aid programme. In connection with the expansion of the European Union, the number of people in need is growing, which entails the necessity to increase aid. By contrast, the first of three main goals of the CAP Reform 2014– 2020 is "viable food production". There is no doubt that the EU must ensure food security with respect to the natural environment.

Food safety is a priority of the EU food safety system, including the Rapid Alert System for Food [Leśkiewicz 2012]. Specially appointed institutions and administration units will monitor the system's proper operation at the EU and national level in respective member states. In addition, relevant crisis management procedures were determined. Provisions governing the production and distribution of food and control and surveillance procedures covered nearly every area of this field. Thus, it seems that all options have been exhausted in the area of so-called regulations.

The concept and methods of measuring food security

The problem of ensuring food security has been discussed since the 1930s. Its first formal mentions date back to 1943 to the League of Nations' declaration that looked at food security only in the aspect of quantities and identified it with "freedom from want in relation to food" equivalent to ensuring "secure (that is, accessible), adequate (that is, sufficient in relation to consumer needs), and suitable (containing proper nutrients at the right amount) supply of food for every man" [Shaw 2007]. At that time, food security was seen in two ways: as an instrument for building the system of protecting producers and consumers against uncontrolled changes in the prices of agricultural products and in the context of managing the food surplus that appeared on the market [Pawlak 2017]. The Great Depression in the 1930s made people aware that food security was a global problem and after World War II the issue became a political paradigm. The term was incorporated into international socio-economic and social vocabulary only in the 1970s when a definition was formulated during the World Food Summit in Rome in 1974, which saw food security as "availability at all times of adequate world food supplies of basic foodstuffs to sustain a steady expansion of food consumption and to offset fluctuations in production and prices" [Pawlak 2017]. One of the most widely accepted definitions of food security was adopted by FAO in 1996. According to that definition, "food security, at the individual, household, national, regional and global levels [is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". In contrast to the concept of food security originally proposed by FAO, the definition from 1996 was refined by adding the aspect of healthy quality of food and specifying that food security should be assured at the global, regional, national, individual and household level.

The currently applicable definition of food security, including a social aspect, was adopted during the World Food Summit in 2009. Then, it was agreed that "food security exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" [FAO 2009]. This definition contains four elements – conditions determining food security. These are:

– (physical) availability of food – a condition for food security is a sufficient amount of food produced in the country, imported or procured under food aid programmes (irrespective of the food's origin);

– access to food – a condition for food security is having sufficient resources, in particular financial resources, which means that achieving security depends on the level and distribution of income of the population, and on food prices;

– utilisation – an essential prerequisite to ensure food security is the quality of food, which, in order to guarantee a healthy and active life style, should supply sufficient amounts of energy and contain essential nutrients and macro- and microelements. In addition, it should be properly stored and prepared;

– stability – health food should be continually available and accessible to a population, a household and an individual, which should not be affected by sudden fortuitous events; with reference to the social aspect of food security. The procured food should be consistent with the food preferences of consumers, cultural restrictions and religious rules.

The above-presented considerations imply that food security can be analysed at a global, national, household and individual level. Global food security comprises all elements of the food system, that is, production and distribution of food, food supplies, food aid, production and consumption information systems and programmes for improving food supply to people [Pawlak 2017]. The condition of national food security is physical and economic access of the whole population of a given country to food meeting the quality and health requirements. It is understood as the "supply of food for consumption in the given country equal at least to the biological needs of the society throughout the year" [Ballenger and Mabbs-Zeno 1992]. The food security of households or individuals is determined by stable supplies of purchased or self-produced food, sufficient for the needs of all/individual household members. This implies that the food policy of a state ensures the maximum food security to households only if all factors and processes affecting the supply of food to household members are taken into consideration [Pawlak 2017].

Food security is determined by three prerequisites: physical availability of food, economic access to food, and adequate utilisation of the food product. According to Leśkiewicz [2012], they should be satisfied concurrently in order to guarantee food security.

Physical availability of food signifies its sufficient supply, which can be ensured by the national food management covering at least the minimum physiological requirements of the country's population, as well as by import supplying food in excess of the minimum requirement. Economic access to food is ensured when every individual and every household has sufficient financial resources to buy sufficient amounts of nutritious food. This means that the necessary amount of food should be accessible to anyone – even to households most affected by poverty – which is handled through various forms of food aid (food coupons, programmes of free of charge distribution of food to selected groups, monetary benefits, subsidies on food prices, production subsidies etc.). The final condition is availability of food that is free from contaminants and provides sufficient levels of food free from contaminants and providing a sufficient level of energy and the right proportion of nutrients. The fourth condition of food security is stability and reliability of food supplies, dependent on the whole food chain, availability of an adequate range and quality of supplies, modernisation of commercial infrastructure, and improvement of the shops procurement system and of the customer service level [Świetlik 2017].

The Food and Agriculture Organization of the United Nations (FAO) uses the following indicators to assess economic access at the global, regional and national level: Gross Domestic Product (GDP) per capita based on purchasing power parity, disposable income per capita, national food price indices, price indices for other groups of consumer goods and services and the share of expenditure on food in total household spend. Economic access to food at a household level is estimated based on: disposable income per capita, share of expenditure on food in total household spend, price indices for consumer goods and services, including food for respective socio-economic groups, the Gini index and the percentage of population under global poverty line [Świetlik 2017].

Food security can be measured using, for example, the following ratios [Świetlik 2017]:

– the value of the balance of foreign trade in agri-food products calculated as the difference between the export and the import value of such products;

– Trade Coverage ratio (TC), calculated as the export value of the products to their import value;

– synthetic index of food self-sufficiency is calculated as the production volume of agri-food products to their domestic consumption, including consumption by people.

According to Hałasiewicz [2011], food security is most often measured using the trade balance in agri-food products. In addition, we can also talk about global food self-sufficiency. It is determined by the level of agricultural production and freedom of trade but also depends on the development of the food processing and distribution sectors. At present, the world produces enough food to feed the global population. Undernourishment occurring in many parts of the world is mainly due to imperfect distribution and wrong political and institutional solutions [Skrzypczyńska 2011].

Considering the essence of food security, in 2012, the Economist Intelligence Unit (EIU) designed the Global Food Security Index (GFSI) to the order of DuPont. The Index is used for the ongoing monitoring of affordability, availability, food quality, and safety in 113 countries, based on an analysis of 28 factors, using data provided by the United Nations Organization, the International Monetary Fund, FAO, and the World Health Organization and the World Bank. Affordability, that is, the ability of consumers to purchase foodstuffs, is a core category of GFSI. It is calculated by taking several factors into account, including the share of food cost in household expenses, the proportion of the population under the global poverty line, GDP per capita, and access to finance and financial products for farmers. Another indicator is availability, calculated on the basis of sufficiency of supply, political stability risk and volatility of agricultural production, and food loss level. The third category is quality and safety of food, designed regarding dietary diversity, nutritional standards, micronutrient availability, and protein quality [Kraciuk 2016]. According to the current Global Food Security Index, in 2019, Poland ranks 24th among the 113 monitored countries. Overall, Poland scored 75.6 out of 100 available points. This puts it among the countries with the best result in the world. Poland ranks sixth among EU countries [Global Food Security Index 2020].

Gulbicka et al. [2015] understand food (resource) self-sufficiency as (1) the ability to cover the food needs from own resources only while totally eliminating imports (autarky); (2) and satisfying the food needs of the population with domestic production, even at a high level of import, which should be offset by adequate export, and a balance between the imports and exports of food and agricultural products should be maintained.

Food self-sufficiency in a closed economy (self-procurement, self-production, autarky) is justified in extreme situations, e.g., international conflicts [Sobiecki 2007]. Food self-sufficiency in an open economy means specialisation and extensive trade relations. Sobiecki [2007] noted that the European Union should produce the minimum to cover 75% of the population's requirement for food, that is, at the level of the current intra-community exports. Most member states of the European Union feature a high level of agricultural production with a low food demand dynamics since they achieved a high level of food consumption in terms of energy and nutrition [Gulbicka et al. 2015]. In an open economy, food self-sufficiency means the balance of foreign trade in agri-food products and, at the same time, coverage of the population's food needs in line with the international nutrition standards.

The global market economy measures food self-sufficiency based on the foreign trade balance in agri-food products. Klikocka and Klikocki [2017] reported that such a balance for Poland was negative from 2010 to 2014. In addition, from 2013 to 2014, the negative

balance of trade was nearly four times lower than from 2010 to 2011, so it was advantageous for Poland. An advantage of such an approach to self-sufficiency is that it allows extending the product range to products that are not produced in Poland for various natural and economic reasons [Sobiecki 2007].

Food self-sufficiency

The assessment of food (resource) self-sufficiency can be based on the index used by the European Statistical Office [Gulbicka et al. 2015]. This is a percentage ratio of domestic production to domestic consumption of agricultural products (irrespective of their origin). Studies conducted by Klikocka and Klikocki [2017] imply that from 2010 to 2015, Poland was generally self-sufficient to the extent of plant and animal origin products, except pork.

Poland created mechanisms to achieve food self-sufficiency only at the beginning of the 1980s. At that time, it was assumed that expenditure on importing agri-food products should be covered by revenues from their export (net self-sufficiency), and domestic production was supposed to provide food at the level fostering the psychophysical human development in Poland [Gulbicka et al. 2015].

MATERIALS AND METHODS

This paper discusses the issue of food security in Poland in 2010–2020. The following research questions were formulated:

1. Does Poland satisfy national and European requirements regarding food safety procedures?
2. Is the level of plant and animal production in Poland adequate to ensure the sufficiency of food supplies for its population?
3. Is Poland self-sufficient in terms of food supplies to Poles?
4. Do Poles have economic access to food?

In order to answer these questions, the following were analysed:

– At the beginning, in the section describing the research problem, reference literature was reviewed (publications, directives and national and EU acts and international presentations on: food security, food security from the perspective of international law and measurement of food security in Poland and in the world).

– The Results section contains a dynamic analysis (2010–2020) of food security of Poland in the context of food production, food consumption, and the balance of foreign trade in agri-food products calculated as the difference between the value of exports and imports of such products, and economic access to food in Poland.

– According to the methodology adopted by FAO, the dynamic descriptive analysis (2010–2020) was applied to the production and consumption of: cereal grains, potatoes, vegetables, fruit and sugar per capita. As regards animal production, the stocks of cattle, including dairy cows, pigs and poultry, were analysed. The consumption of milk, eggs, and meat (pork, beef and poultry) was counted per capita. The overall calorie intake and the calorie intake by farmers were also determined.

– The national balance between production and consumption of cereal grains, potatoes, vegetables, fruit, milk, eggs and meat (cold weight: beef, pork and poultry) in Poland in the period from 2010 to 2020 was evaluated.

– Polish foreign trade in agri-food products from 2010 to 2020 was analysed. The balance of foreign trade in agri-food products was calculated as the difference between the value of exports and imports of such products.

– Economic access to food in Poland was analysed. Economic access to food at the national, household and individual level is measured by several indicators. This paper relies on indices applied by the Food and Agriculture Organization of the United Nations (FAO), namely: consumer goods and services price indices, individual consumption of food and non-alcoholic beverages and the percentage of expenditure on food and non-alcoholic beverage in total consumer expenses.

– The income, expenses and consumption of basic food supplies in households were analysed taking the gender and number of inhabitants into account. Economic poverty was also analysed, considering: material and social deprivation in households and the extreme poverty limit in households (%).

– Data derived mainly from databases, yearbooks and reports issued and published by the European Statistical Office (Eurostat) and by Statistics Poland (GUS). Reports and databases of Eurostat, EU-SILC and GUS contain detailed descriptions of methods of sourcing data for final statistics.

RESULTS AND DISCUSSION

Agricultural production

In terms of the overall surface area and the utilised agricultural area, Poland ranks 69th and 58th in the world and sixth in the European Union. In terms of employment, Poland ranks sixth in the EU, but it is second looking at the scale of employment in the agricultural sector. As regards the scale of agricultural production, Poland is a leader in the world and the European Union, particularly to the extent of rye, oats, potatoes, sugar beets, rape and apples. In addition, Poland is a major producer of meat and milk (Tab. 2).

Cereals, especially wheat and rye, which are strategic plants for food security, have the largest share in the plant production surface area. They are followed by vegetables, and especially fruits – including apples putting Poland in the first place among producers in the European Union. The status of animal production is also good, as the stocks of cattle and poultry are relatively numerous (Tab. 2).

When analysing the dynamics of changes from 2010 to 2020, it should be noted that the surface area covered by agricultural crops with the exception of potato growing area and vegetables and orchards is quite stable, and no special reduction in the utilised agricultural area can be observed. However, this is a positive phenomenon, as it means there is no risk to food security in the production of cereals, vegetables and fruits. As regards the stocks of animals from 2010 to 2020, the decreasing number of pigs from 2015 compared to 2010 should be mentioned, although from 2015 to 2020, the pig stocks stabilised. This can be seen as a positive thing since pork is the meat most often consumed by Poles (Tab. 3). According to Klikocka and Klikocki [2017], the existing decrease in pork production compared to the years 2010–2013 was due to the very high cost of production and very low buying prices of livestock. This phenomenon was also observed from 2015 to 2020 (Tab. 4).

Table 2. Poland's share in the global and European Union's agriculture (2010, 2015, 2019, 2020)

Description	Global agriculture						European Union's agriculture					
	Poland's share (%)			Poland's rank			Poland's share (%)			Poland's rank		
	2010	2015	2020	2010	2015	2020	2010	2015	2019	2010	2015	2019
Total area	0.2	0.2	0.2	68	69	69	7.2	7.2	7.2	5	5	5
Agricultural area	0.3	0.3	0.3	57	58	58	8.2	7.7	8.0	5	5	5
Population	0.6	0.5	0.5	33	36	38	7.8	7.6	7.4	6	6	6
of which agricultural	0.9	0.5	0.5	21	20	20	18.0	18.6	17.8	2	2	2
Production												
Wheat	1.5	1.5	1.4	16	16	16	6.9	6.8	7.1	4	4	5
Rye	23.9	15.6	18.9	2	3	2	38.7	38.8	34.6	2	2	2
Barley	2.8	2.0	2.1	11	14	15	6.6	6.4	5.4	5	5	6
Oats	7.7	6.8	7.1	3	4	5	18.1	20.0	15.1	1	1	2
Potatoes	2.6	1.7	1.7	7	10	10	15.3	14.8	14.3	2	2	3
Sugar beets	4.4	3.9	5.0	7	8	6	9.5	9.5	12.0	3	3	3
Rape	3.7	3.2	2.9	7	7	8	10.8	10.8	11.0	4	4	3
Apples	2.7	4.0	4.6	5	3	3	17.4	17.8	28.9	2	2	1
Pork	1.2	1.3	1.5	15	14	11	8.0	7.8	8.9	5	4	4
Milk	2.0	2.0	2.1	12	13	14	8.3	8.3	7.3	4	4	5
Hen eggs	1.0	0.8	0.7	18	25	28	9.3	9.2	8.2	7	7	7
Number of cattle	0.4	0.4	0.4	46	44	44	6.4	6.4	7.0	7	7	6
Number of pigs	1.6	1.2	1.3	9	15	16	9.7	9.9	7.9	3	3	6

Source: own elaboration based on GUS 2021c.

Table 3. Consumption of certain foodstuffs per capita in Poland from 2010 to 2020 (kg)

Description	Figures for the economic year				
	2010	2015	2018	2019	2020
4-grain cereals (products)	108	103	101	101	101
Potatoes	110	100	95	92	93
Vegetables	106	105	106	103	103
Fruits	44	53	54	58	58
Milk	189	213	221	225	244
Pork	42.2	41.4	42.6	40.3	61.1
Beef	2.4	1.2	3.0	4.1	
Poultry meat	24.6	27.1	29.6	28.3	28.6
Butter	4.3	4.5	4.7	4.7	5.9
Hen eggs	202	144	162	156	157
Sugar	39.9	40.5	40.2	40.1	42.7
Total kcal intake	2340	2135	2135	2082	1987
Kcal intake by farmers	2512	2070	2070	1999	1925

Source: own elaboration based on GUS 2021b.

Table 4. Sowing area and the number of animals in Poland in the years 2010–2020 (as of June)

Description	Figures for the economic year				
	2010	2015	2018	2019	2020
Area of cultivation (thousand ha)					
Total	10 366	10 753	10 829	10 898	10 742
Cereals	7597	7512	7806	7891	7411
Potato	375	292	291	302	226
Ground vegetables	159	176	176	176	144
Orchards	276	249	243	243	243
Number of livestock (thousand animals)					
Cattle	5742	5961	6201	6358	6344
Including milk cows	2646	2445	2492	2461	2468
Pigs	15 244	11 640	11 827	10 781	11 433
Poultry	142 460	153 210	201 295	201 046	205 772

Source: own elaboration based on GUS 2018, 2021a.

The consumption of (processed) cereal grains in Poland from 2010 to 2020 ranged from 108 kg to 101 kg per capita, and the value was stable. In 2015, the consumption of cereal grains dropped by 5 kg per capita, and in 2018 – by 7 kg per capita compared to 2010. It was similar in the case of the consumption of potatoes and vegetables. In contrast, an increase in the consumption of fruit by 14 kg per capita was observed in 2020 compared to the level recorded in 2010. The milk, poultry, and beef consumption was regularly growing, while pork consumption tended to decrease slightly. This is reflected by consumption expressed in kcal decreasing year on year in the analysed period. As shown in Table 4, in 2010, the daily food intake by Poles amounted to 2,340 kcal, while the energy value of food systematically decreased over the analysed years, which in 2020 amounted to 1987 kcal (Tab. 3). In particular, farmers are a group in which the nutritional value of food is low. In this group, and some age and worker groups, this value is very low and insufficiently safe for human health and life, implying that Poles are undernourished. Based on its surveys, FAO assumes that the average daily energy requirement according to the nutritional recommendations should be 2,350 kcal per capita [Kwasek 2012].

As shown in Table 5, in all the years and for all the ranges of agricultural products, Poland has generally been a country generating a food production surplus. A particularly advantageous food surplus occurred in 2018, 2019, and 2020. A notable increase in the production surplus of cereals, milk, eggs, beef, pork and poultry can be observed in those years. This can be explained by the fact that the cereal market features a high variability of supply, which depends on the weather conditions. The balance of cereals is also largely determined by changes in the requirement for animal feed, depending on the animal production status.

Only in 2018 and 2019 did a deficit occur in the requirement for fruit, amounting to 432,000 and 17,000 tonnes, respectively. Also, the production of pork in Poland in 2010 and 2015 did not cover the requirement for pork, which was associated with a reduction in the number of pigs. When considering the data from 2018, 2019 and 2020, a surplus in pork production can be already identified, so the situation should be deemed advantageous.

Table 5. Domestic production and consumption of selected agricultural products from 2010 to 2020

Description	Figures for the economic year				
	2010	2015	2018	2019	2020[a]
Basic cereals (thousand tonnes)					
Production	29 827	34 177	27 757	22 793	28 989
Domestic consumption	27 526	26 404	21 657	21 181	24 555
Surplus/deficit	2 301	7 773	6 100	1 612	4 434
Potatoes (thousand tonnes)					
Production	9 703	7 690	9 172	7 478	6 600
Domestic consumption	9 605	7 364	8 900	7 152	6 566
Surplus/deficit	98	326	272	326	34
Vegetables (thousand tonnes)					
Production	4 878	5 607	5 705	5 271	5 175
Domestic consumption	4 574	4 465	4 828	4 918	4 788
Surplus/deficit	304	1 142	877	363	387
Fruit (thousand tonnes)					
Production	2 744	4 189	3 177	5 117	4 278
Domestic consumption	2 812	3 471	3 609	5 134	4 058
Surplus/deficit	768	718	–432	–17	220
Milk (million litres)					
Production	11 921	12 859	13 758	14 090	14 822
Domestic consumption	10 133	11 045	10 665	11 033	11 802
Surplus/deficit	1 788	1 814	3 093	3 057	3 020
Eggs (thousand tonnes)					
Production	637	590	667	680	663
Domestic consumption	492	349	423	407	409
Surplus/deficit	145	241	244	273	254
Beef by cold weight (thousand tonnes)					
Production	373	441	540	530	531
Domestic consumption	91	46	115	105	97
Surplus/deficit	282	395	425	425	434
Pork by cold weight (thousand tonnes)					
Production	1 516	1 581	1 707	1 610	1 605
Domestic consumption	1 626	1 591	1 636	1 548	1 565
Surplus/deficit	–110	–10	71	62	40
Poultry meat in by cold weight (thousand tonnes)					
Production	1 386	2 021	2 621	2 727	2 837
Domestic consumption	948	1 043	1 139	1 087	1 121
Surplus/deficit	438	978	482	1 640	1 716

2020[a] – estimates. Source: own elaboration based on GUS 2021b.

Statistics Poland measures foreign trade in foodstuffs and agricultural products using four categories: processed food, live animals and products of animal origin, plant-based products and fats and oils. Data in Table 6 shows that from 2010 to 2020, both the value of export and import of agri-food products increased. Only in 2010 was the balance of foreign trade in agri-food products negative, and by contrast, it was positive in 2015 and from 2018 to 2020. The negative balance in 2010 resulted from the negative balance of fats and oils and a negative balance of trade in plant-based products [GUS 2018, 2021a]. The positive balance of trade in agri-food products in Poland after 2015 can be deemed favourable to ensuring the food self-sufficiency of Poland. The country has good natural conditions for agricultural production and is capable of producing more food and animal feed than it needs. This is also possible due to the allocation of certain products to export, which may stimulate the purchase of other food products or industrial technologies from other parts of the world, e.g., tea, coffee and feed additives. Thus, the food consumption structure becomes much more varied.

Table 6. Polish foreign trade in agri-food products from 2010 to 2020, value for the year (PLN, current prices)

Description	2010	2015	2018	2019	2020
Export	481 058.2	750 835.8	951 324.2	1 023 591.4	1 062 514.0
Import	536 220.6	740 973.3	970 830.8	1 018 479.0	1 015 360.4
Export – import balance	–55 162.4	9 862.5	19 506.6	5 112.4	47 154.0

Source: own elaboration based on GUS 2021b.

Economic access to food in Poland

Another prerequisite of food security is economic access to food. Table 7 presents consumer goods and services price ratios in Poland from 2010 to 2014 and the percentage of food and non-alcoholic beverage expenditure in total household expenses. Nearly in all the analysed years, except 2020, the consumer goods and services price index increased year on year. In addition, the share of expenditure on food and non-alcoholic beverage in total consumer expenses was higher every year. Individual consumption of food and non-alcoholic beverages compared to the previous year was lower in 2019, while in 2020, it increased by 4% compared to 2019.

Table 8 implies that a considerable part of the society (both men and women) is exposed to the risk of poverty, considering social transfers in their income. In 2020 alone, it was on average 14.8%. However, women tended to be more affected by poverty (15.7%) than men (13.9%).

Statistics Poland adopted three limits of economic poverty: (1) extreme poverty limit, (2) statutory poverty limit and (3) relative poverty limit [Gulbicka et al. 2015]. In general, poverty can be divided into three groups: (a) absolute poverty, extreme poverty, or subsistence minimum means that people lack basic necessities. For instance, they starve, have no access to clean water, adequate living quarters, and sufficient clothing and medication, and they fight for survival; (b) relative poverty is when the living standard and income of some people considerably deviates from the general standard for the country or region in

which they live. They fight for the possibility to live normally and participate in normal economic, social and cultural life; (c) risk of poverty or social exclusion – the parties at risk are individuals and families living in relative poverty or the state of severe material deprivation or characterised by very low work intensity [GUS 2022].

Table 7. Consumer goods and services price indices, consumption of individual food and non-alcoholic beverages, and percentage of expenditure on food and non-alcoholic beverages in the general consumption expenditure

Type of ratio	Figures for the year				
	2010	2015	2018	2019	2020
Consumer goods and services price index (previous year = 100)	102.6	103.8	101.6	104.0	97.0
Individual consumption of food and non-alcoholic beverages (previous year = 100)	103.3	102.1	102.6	101.8	105.8
The share of expenditure on food and non-alcoholic drinks in the general consumption expenditure (%)	24.6	24.0	25.91	26.2	28.7

Source: own elaboration based on GUS 2021b.

Table 8. The population of Poland (in millions) and the at-risk-of-poverty rate in Poland considering income after social transfers (total and by gender) from 2010 to 2020

Description	Years				
	2010	2015	2018	2019	2020
Population (thousand)					
Total	38 529.9	38 437.2	38 411.1	38 382.6	38 265.0
Men	18 653.1	18 598.0	15 581.9	18 567.1	18 502.2
Women	19 876.7	19 839.2	19 829.3	19 515.5	19 762.8
At-risk-of-poverty rate considering income after social transfers (%)					
Total	17.6	17.6	14.8	15.4	14.8
Men	17.4	18.1	14.6	15.0	13.9
Women	17.7	17.2	15.0	15.8	15.7

Source: own elaboration based on GUS 2022.

Table 9 presents the percentage of people living in households at risk below the extreme (absolute) poverty threshold. The analysis of data in Poland from 2010 to 2020 implies that the level of poverty was moderately stable and, on average, exceeded 5%. Growing food prices decrease its availability, particularly to families with the lowest income and those having three kids aged under 17. This is corroborated by surveys concerning the rate of material deprivation (unsatisfied needs) with regard to the households' possibility of having a meal of red meat, poultry or fish every other day (Tab. 9). The deprivation

rate of this need in Polish households from 2010 to 2020 ranged from 15.5% (in 2010) to 6.4% (2020). Households exposed to extreme poverty were those with three children (2020: 5.9%), households run by farmers (2020: 13.5%) and by pensioners (2020: 8.2%). As a rule, the elderly or pensioners run one-person households. Relatively the improved status of families with children could result from the fact that, in many cases, social welfare in Poland comprises financing or providing lunch at school. This is a very important measure, but it does not completely solve the problem of malnutrition among children.

Klikocka [2020] reports that according to Eurostat, the risk of poverty and social exclusion comprises three types of risk: risk of relative poverty, serious risk of material deprivation and living in a jobless household. Analysing data on the assumptions and objectives of the Lisbon Strategy and the Europe 2020 Strategy from 2004 to 2008, Klikocka [2020] found that most EU countries have experienced a decrease in the number of people at risk of poverty and social exclusion. In 2012, the risk of poverty and social exclusion clearly grew stronger in most member states of the Community, particularly in Bulgaria (49.3%). In 2016, the situation improved in some countries only since the risk of poverty and social exclusion in EU 28 decreased to 23.5% in 2016 compared to 24.7% in 2012. Generally, nearly every fifth person in Europe can have difficulty getting food, and growing food prices decrease its availability, particularly to families with the lowest income. This is supported by the results of surveys on the rate of material deprivation (unsatisfied needs) with regard to the households' possibility of having a meal of red meat, poultry or fish every other day. In 2012 and 2016, deprivation of this need affected 9.9% and 7.5% of European households [Klikocka 2020]. For the whole of the EU, the risk of poverty referred to 27% of children, 24.3% of adults (aged 18–64) and 20.5% of people aged above 64 [Gasz 2014].

Table 9. Material and social deprivation and extreme poverty line coverage indicators in households (%)

Households, number of people	Indicators (%)				
	2010	2015	2018	2019	2020
Material and social deprivation					
Total	15.5	16.0	9.5	8.3	6.4
Extreme poverty line coverage					
Total	5.8	6.5	5.4	4.2	5.2
Household without children	1.5	1.6	1.8	1.1	1.4
Household with one child aged 0–17	1.9	1.8	1.9	1.0	1.4
Household with two children aged 0–17	3.9	4.0	2.5	1.9	2.7
Household with three children aged 0–17	15.3	9.0	7.0	5.0	5.9
Household of farmers	9.0	14.7	11.0	9.8	13.5
Household of pensioners	9.7	10.7	8.4	6.3	8.2

Source: own elaboration based on EU-SILC 2022.

SUMMARY AND CONCLUSIONS

Food security is a current complex and multifaceted problem existing both globally and in European countries [Bielski and Marks-Bielska 2018, Bielski et al. 2019]. The outcomes of surveys concerning the production and consumption of basic agricultural raw materials indicate that Poland is a self-sufficient country featuring a most food production surplus.

From 2010 to 2020, Poland was (and still is) a country generating food production surplus generally in all ranges of agricultural products (except fruit and pork). A particularly advantageous food surplus occurred in 2018–2020. A notable increase in the production surplus of cereals, milk, eggs, beef and poultry can be observed in those years.

The balance of foreign trade in agri-food trade in Poland suggests that from 2015 to 2020, Poland was a self-sufficient country in terms of food, which means that the value of its imports of agri-food products was higher than the value of its exports. A negative balance was observed in 2010, which was not favourable for the Polish economy.

Despite growing food prices, economic access to food remained stable, probably due to the income wages in Poland. However, many of the poorest households (nearly 15%) declare a risk of poverty if social transfers are taken into consideration, and as many as 6.45% (in 2020) are not able to have a meal of red meat, poultry or fish every other day (material deprivation). A systematic reduction in the calorific value of food consumed is also puzzling. In 2019 it reached a distressing daily intake value of 1987 kcal per average Pole and 1999 kcal per average Polish farmer. The reference value per capita is 2350 kcal. This is an alarming situation as in 2010, the general daily calorie intake was 2340 kcal, and that of farmers amounted to 2512 kcal.

According to legal regulations, the accession of Poland to the European Union increased the food safety of Poland, particularly to the extent of the food quality. According to legislative acts (national and European), the exact and accurate terms and conditions for maintaining safety, hygiene, product identity and composition, and care for the natural environment, plant and animal health and animal welfare were set out. Despite Poland's good situation, hazards related to food safety should not be neglected. The Common Agricultural Policy should remain the basis of the European Union's policy on food security.

Polish agriculture is supported by government programmes and the Common Agricultural Policy, which – apart from ensuring sufficient production of food of plant and animal origin – contributes to relative profitability of maintaining national food security.

Generally, it can be concluded that food policy should tackle the issue of providing people with access to safe food (food security*)*, protection of consumers through food safety surveillance (food safety*)*, taking into account the area of production, processing, distribution and natural environment protection.

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