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Trends and forecasts of red meat consumption in the world and in Poland in the years 2015 – 2025

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ABSTRACT

The work was aimed at presenting the consumption of red meat, beef, pork, mutton in 2015 and consumption trends in 2025. Data from Central Statistical Office, Eurostat, OECD and FAO were used to determine current and forecast consumption in the world. According to OECD-FAO data, meat consumption per capita in 2016. In the European Union amounted to 65.7 kg. According to the OECD forecasts, in 2025 meat consumption in the world will be: 30.4 kg of poultry meat, 23.1 kg of pork meat, 14.3 kg of beef and veal and 1.3 mutton perperson.

Keywords: red meat, consumption, meat consumption, promotion of red meat, forecasts

1. INTRODUCTION

Meat and its products are an important addition to a varied diet. They are a source of wholesome, easily digestible protein, heme iron, essential fatty acids to which belong omega-3 and omega-6 fatty acids, vitamins, microelements and macronutrients [21]. Consumption of red meat in the recommended amounts by the World Health Organization (WHO), ie 500g per week per person, eliminates the occurrence of anemia, cardiomyopathy, provides fully absorbed by the body vitamins soluble in water and fats . Currently, there is also an upward

trend in meat consumption [1]. The purpose of this work was to present the consumption of red meat, i.e. beef, pork, mutton in 2015, and trends in consumption by 2025.

2. TRENDS IN THE CONSUMPTION OF RED MEAT

Over the last years, the development of consumer requirements has distinguished three eras of development: the era of quality, quality and health safety as well as quality and health safety and health-promoting properties of meat [2]. According to the aforementioned author, the quality era began with the derivation of ISO 9000 quality management systems. The growing interest in the quality of health safety resulted in the introduction of the obligatory HACCP system by the European Union in 2004, which was accepted as a precautionary measure to guarantee health safety [3]. The era of quality, health safety and health-promoting properties of meat began in the 21st century [2].

The structure and level of meat consumption depend on economic, psychological, demographic, geographical, cultural, social and psychological factors (Figure 1). The main role is attributed to economic factors to which they belong: consumer purchasing power, price and food supply [4].

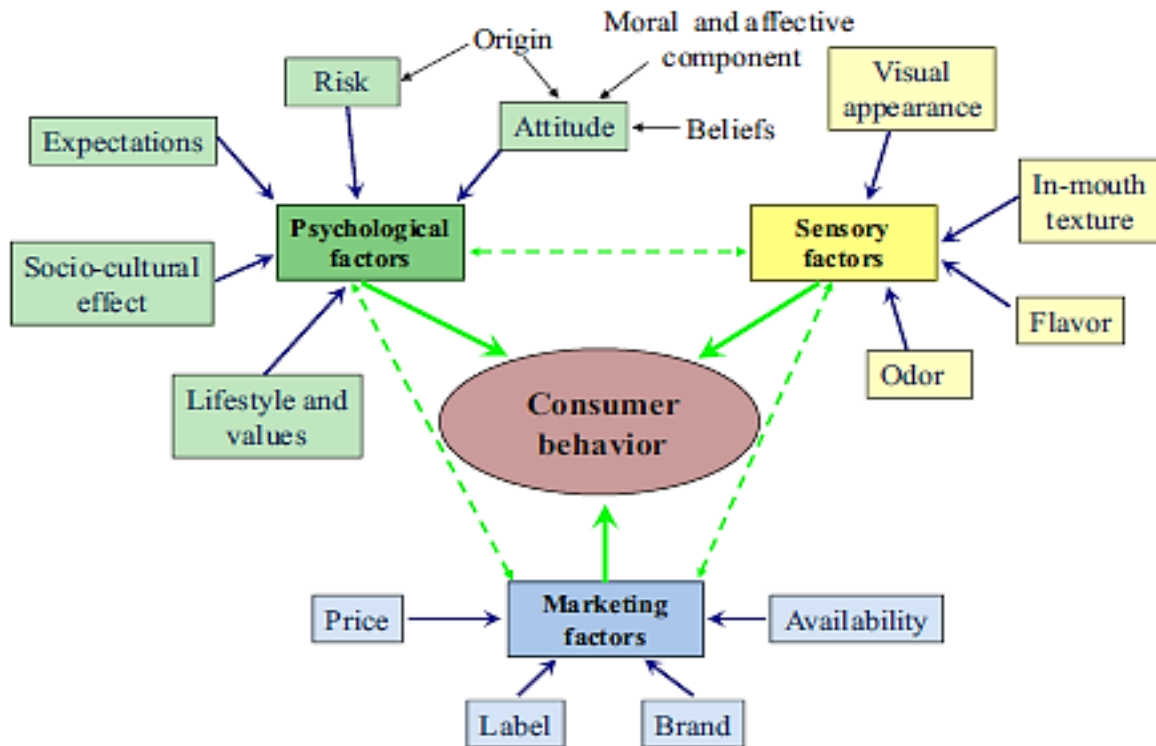


Figure 1. Multidisciplinary model of the main factors affecting consumer behavior in a food domain.

At present, there is an upward trend in livestock production in both Europe and the world. This is due to the increase in the world population, which in 2050 is to reach 9 billion and from industrial animal husbandry [5]. Food products of animal origin are the main segment of the food economy. The dominant component of animal products in the diet of the citizens of countries around the world is the meat of slaughter animals and poultry [22]. In Poland, the division into livestock and meat is clear. The production of meat depends on the price and size of the animal population

3. CATTLE PRODUCTION IN 2015 IN THE EUROPEAN UNION

In 2015, according to Eurostat data, the largest beef production in France was recorded (1451 thousand tonnes), pork (5562 thousand tonnes) in Germany and mutton (117 thousand tonnes) in Spain. Poland took the 7th position in the European Union, respectively, producing 471 thousand tons of beef, 4th place for pork (1906 thousand tons) and 9th place along with several other countries in the case of mutton, producing only 1 thousand tonnes (Table 1)

Table 1. Cattle production in 2015 in the EU (in thousands of tons)

	Beef	Pork	Mutton
EU-28 countries	7590	22958	724
Belgium	268	1124	3
Bulgaria	5	61	-----
Czech Republic	68	228	0
Denmark	121	1599	2
Germany	1124	5562	21
Estonia	10	42	0
Ireland	564	276	58
Greece	42	90	55
Spain	634	3896	117
France	1451	1968	81
Coatia	42	73	1
Italy	788	1486	34
Cyprus	5	43	3

Latvia	17	29	0
Lithuania	44	66	0
Luxembourg	9	12	0
Hungary	26	409	0
Malta	1	6	0
Netherlands	383	1456	13
Austria	229	528	7
Poland	471	1906	1
Portugal	89	377	11
Romania	44	330	9
Slovenia	34	20	0
Slovakia	8	45	1
Finland	86	192	1
Sweden	144	234	5
Great Britian	883	898	300

According to OECD-FAO data, meat consumption per capita in 2016. In the European Union it amounted to 65.7 kg. According to data from the Central Statistical Office (2016), the meat consumption per capita in Poland in 2014 amounted to 69.5 kg. The highest consumption was recorded for pork meat of 39.1 kg per person, followed by poultry meat 28.2kg per person in second place, and beef 1.6kg per person on the third. In Poland, the consumption of mutton meat is negligible. According to Central Statistical Office the largest increase in consumption and production in recent years is recorded for poultry meat. This is conditioned by the low price of raw material purchase, ease in its preparation and dietary values. According to OECD-FAO data, Global meat production in 2015 amounted to 319,216,000. tone.

4. PROJECTED MEAT CONSUMPTION IN THE WORLD IN 2025

According to OECD - FAO in 2025 meat consumption in the world will amount to 30.4 kg of poultry meat, 23.1 kg of pork meat, 14.3 kg of beef and veal and 1.3 barnays per person. In comparison to 2015 there will be an increase in consumption of mutton by 0.1 kg, beef and veal 0.3 kg and 1.8 kg of poultry per person. There will also be a drop in pork consumption by 0.1kg per person (Table 2).

Table 2. Predicted consumption of beef and veal, poultry, pork and mutton, in kg per person in 2025.

Country	Beef and veal	Pork	Poultry	Mutton
Algeria	4,2	0,0	6,5	7,6
Argentina	40,8	9,2	37,7	1,2
Australia	22,5	20,8	44,1	6,8
Bangladesh	0,9	0,0	1,6	1,3
Brazil	25,7	13,1	42,9	0,4
BRICS	4,7	17,0	11,4	1,9
Canada	17,4	15,4	34,9	0,9
Chile	15,5	17,9	32,0	0,4
China	4,6	34,9	13,3	3,7
Columbia	12,3	5,4	29,2	0,2
Egypt	10,5	0,0	9,2	1,3
Ethiopia	2,8	0,0	0,6	1,4
European Union	10,5	32,4	23,7	1,9
Gana	0,7	0,8	6,8	1,9
Haiti	4,1	3,7	6,7	0,6
India	0,6	0,2	2,1	0,5
Indonesia	2,5	2,7	7,8	0,4
Iran	3,3	0,0	25,2	3,9
Israel	20,5	1,4	57,3	1,9
Japan	6,9	15,5	14,3	0,1
Kazakhstan	18,0	5,2	17,8	8,4
Korea	10,8	29,4	16,2	0,2
Malaysian	6,1	6,4	44,2	0,9
Mexico	8,8	12,0	29,3	0,5

Mozambique	1,0	4,2	1,9	0,8
New Zealand	13,5	18,6	40,5	2,1
Nigeria	1,8	1,2	1,0	2,3
OECD- all	14,3	23,1	30,4	1,3
Pakistan	6,5	0,0	4,8	2,2
Paraguay	30,5	23,3	6,8	0,6
Peru	5,0	3,5	40,1	1,3
Philippines	2,9	14,1	12,5	0,5
Russia	12,6	22,0	30,6	1,2
Saudi Arabia	3,9	0,2	41,6	5,5
South Africa	10,8	3,4	35,5	3,1
Sub-Saharan Africa	3,3	1,3	2,6	2,2
Sudan	5,2	0,0	1,0	11,8
Tanzania	4,2	0,3	1,7	1,3
Thailand	2,0	11,5	10,9	0,0
Turkey	8,6	0,0	17,5	4,3
Ukraine	7,3	16,4	29,5	0,4
United States	25,6	23,4	49,8	0,3
Uruguay	49,2	14,8	14,3	5,9
Vietnam	10,2	31,1	17,7	0,1
World	6,7	12,5	14,2	1,9
Zambia	10,6	1,7	3,1	0,6

5. DETERMINANTS IN THE CONSUMPTION OF RED MEAT

As mentioned earlier, pork has been the leader of consumption in Poland invariably for over a dozen years. What follows from the tradition and eating habits of Poles. The population as of 1 June this year. amounted to 10239,4 thousand. pcs and it was lower by 12 percent. (1400.4 thousand items) as compared to last year. According to Central Statistical Office This is a result of sustained economic sanctions against Poland imposed by Russia in 2014, an

advantage since 2008 of import over exports and the suspension of imports by some countries after the appearance of ASF (African swine fever) in feral pigs in February 2014 and in pigs in a later period. In 2015, 647,000 tonnes of livestock, meat, fats and pig products, and 829 thousand imported from abroad tonnes. According to OECD - FAO The largest pork producers in 2015 were China (55,380 thousand tonnes), the European Union (23 349 thousand tonnes) and the United States (11 121 thousand tonnes) (FAO, 2016). The largest importers of this type of meat in 2015 were China (1447 thousand tonnes), Japan (1286 thousand tonnes) and Mexico (845 thousand tonnes). The largest consumption of pork in 2015. It was recorded in the EU (33kg / person), China (31.6kg / person) and Vietnam (29.1kg / person). The annual world production of pork amounted to 117 223 thousand. Tonne Beef and veal are eaten in small amounts by Poles (GUS, 2016). This is due to the high price, poor quality of meat and the emergence of mad cows (BSE) disease in cattle. The largest producers of this type of meat in 2015 were the United States (10815 thousand tonnes), Brazil (9425 thousand tonnes) and China (6710 thousand tons). (FAO, 2016). Annual global beef production in 2015 amounted to 167 764 thousand. tone. (FAO, 2016) The largest importers in 2015 were: United States (1393 thousand tonnes), China (1207 thousand tonnes) and Japan (703 thousand tonnes). According to OECD-FAO the largest consumption in 2015 in the world was recorded in Uruguay (46.4kg / person), Argentina (40.4kg / person), Paragwaju (25.6kg / person), the United States (24.7kg / person) and Australia (24.2) kg / person. According to GUS data, in June 2016, the cattle population in Poland amounted to 15 938.7 thousand. pieces. In relation to the previous year it was lower by 0.4 percent. ie 22.0 thousand. On the other hand, the number of calves of less than 1 year increased by 3.6%. which is 1728.1 thous. pieces. According to Central Statistical Office there was also an increase in the cattle herd from 1 to 2 years old, ie by 3.1%. compared to last year.

The most mutton in 2015 was produced in China (4185 thousand tonnes), then in the European Union (919 thousand tonnes) and India (730 thousand tonnes). The largest global importer in 2015 was China (252 thousand tonnes), EU (166 thousand tonnes) and USA (103 thousand tonnes). According to OECD-FAO data the highest consumption of this type of meat was recorded in 2015 in Sudan (10.5kg / person), Kazakhstan (8.1kg / person), Australia (7.4kg / person) and Algeria (7.1kg / person). World production of mutton in 2015 amounted to 14045 thousand tone. According to data, in June 2016, the sheep population increased by 3.9% compared to June last year. During the year there was a decrease by 4.1%, ie by 5.9 thousand. pieces up to 137.5 thousand. pieces of sheep ewe. The domestic sheep population is characterized by a low level, which has been maintained since the reduction in the nineties. According to Central Statistical Office this is due to the lack of greater demand on the Polish market for wool, milk and meat obtained from this animal species.

6. PROMOTION OF RED MEAT

Currently, the Agricultural Market Agency supports five meat promotion funds as part of the support of the red meat market: the Pork Meat Promotion Fund, the Beef Promotion Fund, the Horse Meat Promotion Fund and the Sheep Meat Promotion Fund. As part of the funds, activities are organized to inform about quality and features, including product benefits, activities aimed at promoting consumption of a product or its products, participation

in exhibitions and fairs, market research, research and development, training of producers and processors and the activities of domestic industry organizations.

7. THE USE OF FUNDS FOR RED MEAT PROMOTION FUNDS

Expenses from red meat promotion funds for individual information tasks amounted to PLN 14,000. PLN to 560 thousand PLN, and for promotional activities from 3 thousand. PLN to 764 thousand PLN (Table 3).

Table 3. Expenses incurred from promotion funds in 2013-2015 for information and promotional tasks

Specifications		Found for the Promotion of Pork	Beef Promotion Found	Found of the Promotion of Horse Meat	Found of the Promotion of Sheep
Works information	Expenses in thous. PLN	5 043	1 457	41	14
	Numer of tasks	9	8	3	1
	Expenses for one tasks in thous. PLN	560	182	14	14
Works promotional	Expenses in thous. PLN	30 566	11 543	50	45
	Numer of tasks	40	41	6	13
	Expenses for one tasks in thous. PLN	764	282	8	3

8. SELECTED INFORMATION AND PROMOTION CAMPAIGNS FOR RED MEAT

"Information campaign on pork produced according to the national quality system Pork Quality System (PQS)" - the campaign was carried out in 2010-2013. Both from public funds (PLN 18,095 thousand) and from the Pork Meat Promotion Fund (PLN 6,312 thousand) PLN).

The goals of the campaign were:

- 1) Informing about the national PQS quality system,
- 2) to build the recognition of the PQS mark and its relation to high quality pork
- 3) familiarizing consumers with the benefits associated with the purchase of PQS-certified pork
- 4) to enrich advisers' knowledge about the new product offer

"Pork picnic" - the task was carried out in 2015 by the National Council of Agricultural Chambers from the funds from the Pork Meat Promotion Fund. The amount earmarked for

this purpose was 973.4 thousand. PLN. The goal of the organized task was to raise the awareness of consumers participating in the "Pork Picnic", which was associated with increased purchases of pork and meat products. "

"QMP - beef is always good" - the campaign was carried out in 2012-2015. Both from public funds (PLN 7.299 thousand) and from the Beef Promotion Fund (PLN 2,327,000). The goals of the campaign were:

- 1) Informing about the QMP system, resulting in increased awareness of target groups by 30% on the QMP system and the benefits of beef produced under this system.
- 2) Increased sales of QMP beef: quantitatively up to 720 tonnes; in value to the level of approx. PLN 5,400,000 EUR, according to the EUR 1 exchange rate = PLN 4, which is a 44-fold increase, taking as a point of reference the estimated sales data for 2011, where beef sales amounted to 16 tonnes.
- 3) The increase in QMP beef consumption among target groups

"Beef picnic" - the task was carried out in 2013 by the National Council of Agricultural Chambers from the funds from the Beef Promotion Fund. The amount allocated for this purpose amounted to 196.1 thousand. PLN. The goal of the organized task was to raise the awareness of consumers participating in the "Pork Picnic", and as a consequence increase the consequences of sales of beef and meat products on the Polish market.

"Promotion of horse meat in Tokyo" - the task was implemented in 2016 by the Polish Horse Breeders Association from the funds from the Koźle Meat Promotion Fund. The amount allocated for this purpose amounted to 11.1 thous. PLN. The task was to establish close cooperation with the Japanese side in the sale of meat. In 2010, the "Long-term pork promotion strategy" was developed by the Pork Meat Promotion Fund. Currently, work is underway on "Strategy for the reconstruction and development of pig production by 2030". On the other hand, in the Beef Promotion Fund it is planned to develop a strategy for the development of the beef sector up to 2022, in which short and long-term goals and measures of their implementation will be defined. In the area of promotion of Polish meat products, associations and organizations participate in each Fund for the Promotion of red meat (Table 4)

Table 4. Associations and organizations operating in the field of promotion of Polish agri-food products

Promotion found/industry	The name of the association or organization
Meat processing	<ol style="list-style-type: none"> 1. Association of Butchers and Cold Meat Producers of the Republic of Poland 2. Polish Meat Association 3. Union of UPEMI Producers and Employers Of Meat Industry 4. Polish Association of Pig Exporters and Importers

Found for the Promotion of Pork	5. Polish Association of Pig Breeders and producers „POLSUS”
Beef Promotion Found	6. Polish Association of Meat Cattle Producers 7. Polish Association of Cattle Breeders and Producers
Found of the Prootion of Horse Meat	8. Polish Horse Breeders Association
Found of the Promotion of Sheep	9. Polish Sheepdog Association

9. NEW TRENDS IN CONSUMPTION MEAT- FUCTIONAL FOOD

Benefits resulting from the consumption of functional foods are: reducing the risk of development: cardiovascular diseases, neoplastic diseases, osteoporosis, civilization diseases, i.e. atherosclerosis, hypertension, obesity, diabetes [5]. Functional food is intended for people: living under stress, elderly, metabolic and digestive disorders, athletes, pregnant and lactating women and infants. The functional food market is developing in fast pace around the world. [6]. The reasons for the expansion of functional food in the XXI are: aging of societies, increase in the cost of medical and social care, an increase in the incidence of chronic diseases related to nutrition, the development of knowledge about biologically active, so-called non-nutrient food ingredients and their physiological impact on the human body, increase of consumer affluence in developed and developing countries, development of techniques and technologies of food processing, availability of nutraceuticals [7].

Modifications of meat products for health-promoting purposes:

- 1) Increasing the content of essential fatty acids (EFAs)
- 2) Reducing the salt content
- 3) Reducing the content of nitrates
- 4) Increase the content of antioxidants
- 5) Increase in the content of dietary fiber
- 6) The participation of probiotics and prebiotics [13]

Increasing the content of essential fatty acids (EFAs)

EFAs lower cholesterol and inhibit the accumulation of platelets [16]. The change in the composition and nutritional value of meat products is obtained at the stage of slaughter animals farm and change in the recipe of products. In order to limit the share of fat in meat, selection of breeds and lines in cross-breeding is carried out and an increase in the share of LCFA in feed mixtures by the addition of linseed oil, linseed, marine algae and fish oil. In the production of meat products, the modification of the fatty acid composition is possible by introducing the vegetable fat (mixture of linseed and sunflower oil or sunflower oil) or fish, as well as microencapsulated preparations that are neutral in terms of taste and smell and reduce undesirable oxidative changes [17].

Reducing the salt content

The reduction of NaCl content in meat products serves to give them health-promoting properties. Limitation of salt to the minimum quantities in which the microbiological, sensory and technological criteria of meat products will be met. The World Health Organization (WHO) recommends salt intake in the amount of 5g / day (WHO 2012). It has been shown that it is possible to reduce the level of salt in meat products to 1.7% without changing its sensory characteristics. The above limits the necessity of using water and fat binding agents such as phosphates or soy protein preparations [8]. According to many authors, the above may occur due to the use of other chlorides (KCl, MgCl₂, CaCl₂), as well as non-chloride salts, e.g. lactates or phosphates [9]

Reducing the content of nitrates

In order to prolong durability, produce characteristic organoleptic characteristics (taste, smell, color) and inhibit the growth of pathogenic bacteria (eg Clostridium botulinum) and putrefaction in the production of meat products, the process of curing meat. It consists in using a mixture of table salt with nitrate (III) or sodium nitrate (V). Due to the high reactivity and the ability to form N-nitrosoamid, including carcinogenic N-nitroso-dimethylamine (NDMA), its use is limited. In order to inhibit the formation of N-nitrosoamid, L-ascorbic acid or L-ascorbate are used in the production. The action of L-ascorbic acid and L-ascorbate is based on the reduction of diadium trioxide (N₂O₃) to nitric oxide by ascorbate. It is recommended to use an excess of ascorbic acid to effectively inhibit the formation of nitrosamide in the presence of oxygen. The most important lipophilic substance inhibiting nitrosation is alpha-tocophero [23].

Increase the content of antioxidants

Obtaining an increased content of antioxidants in meat and meat products is possible due to the addition of vitamin E, carotenoids, plant extracts, eg tea, grapes, olives to the animal diet and during technological processes increasing the content of bioactive substances in muscle tissue [14]. Carotenoids reduce the risk of anticancer diseases and reduce the risk of cardiovascular disease (CVD). Antioxidants of vegetable origin are obtained from such plants as: rosemary, sage, tea, soybeans, citrus fruit peels, sesame seeds, olives and grapes. They are used to inhibit lipid oxidation. Green tea extract lowers total cholesterol, increases HDL fractions and reduces lipoprotein oxidation. Extract of citrus fruits and grapes improves the circulatory system. Included in the diet of animals may also be carnitine, glutathione and carnosine, which have a positive effect on increasing the oxidative stability of meat

Increase in the content of dietary fiber

Regular fiber intake provides many health benefits. Increased fiber intake lowers blood pressure, serum cholesterol, suppresses appetite, facilitates intestinal motility and slows down absorption of glucose and fats [18]. People who consume the recommended amount of fiber, ie 30 to 40g per person per day, according to the Healthy Diet Index (HDI), are less likely to develop coronary heart disease, stroke, hypertension, diabetes, obesity and some gastrointestinal diseases. Enriching the diet of obese people significantly increases weight loss. Dietary fiber is also characterized by technological properties, e.g. the ability to maintain water, the ability to bind cations, emulsify fat, sorption capacity and increase the viscosity of

the systems. The addition of fiber in the meat industry results in a better preservation of the shape of heat-treated meat products and an increase in their efficiency [20]. The addition of dietary fiber to meat products also has a positive effect on their color. The addition of various types of fiber to meat products with a reduced fat content, reduces their brightness (L^*) and the intensity of the yellow color (b^*), while increasing the intensity of the red color (a^*) [11]

The participation of probiotics and prebiotics

Probiotics are bacterial strains that have a beneficial effect on human health as a result of the development of a beneficial intestinal microflora. Prebiotics are food ingredients that stimulate the growth of defined groups of microorganisms, improving the functioning of the human body. Probiotic microorganisms are able to colonize the digestive system, thus limiting the adhesion of pathogenic pathogenic cells to the intestinal epithelium. Probiotics lower cholesterol levels, improve intestinal motility, stimulate intestinal epithelial reconstruction and inhibit unfavorable microflora development [15]. Meat products with the participation of probiotics have been available on the German and Japanese market since 1998. In Poland, the trend of using probiotic bacteria as an addition to meat products is growing, especially for the production of ripening meat products. Strictly maturing sausages could be the source of probiotics in the human diet, vaccinated by *Bifidobacterium lactis*, *Lactobacillus casei*, *L. paracasei*, *L. rhamnosus*. The development of production for this type of product market must overcome barriers related to technology, microbiology, consumer taste and production economics. Studies in humans with healthy volunteers showed that a four-week consumption of fermented sausages from *L. paracasei* brought some probiotic effects: increase in CD4 T-helper cell values, increase of phagocytosis index and reduction of CD54 expression. It is expected that in meat products, in a manner analogous to fermented milk products, probiotic bacteria may increase the formation of CLA [12].

10. GLOBAL FUNCTIONAL FOOD MARKET

The value of the global enriched food market (in minerals, vitamins and other nutrients) is estimated at USD 258.8 billion (including the functional one at USD 129 billion). In 2020, according to forecasts, it can grow up to 377.8 billion dollars [19].

The Asian functional products market is worth USD 51 billion (40% of the global market). Almost 33 percent. goes to the US market and 20 percent - to Europe, mainly to Great Britain, France and the Netherlands.

Due to demographic trends (in 2020 there are to be 723 million people in the world aged 66 and over), functional products that delay the effects of aging and strengthen the structure of bones and joints are becoming popular. It is mainly about products enriched with omega acids (their market is expected to double in the coming years) and functional chocolate. According to analysts, the sales of bitter chocolate in 2016-2021 will increase by 27%, mainly due to increased awareness and pro-health effects of polyphenols.

Among the Asian countries, India is still a small but growing market. According to Frost & Sullivan's estimates, the sales of functional foods are expected to grow at a rate of 17.1 per cent. annually to reach 4 billion dollars in 2020 (Table 5). This food is mainly for city dwellers.

Table 5. Worldwide sales of functional foods 2015-2024 (USD billion)

Continent	Sales in bilion U.S dolars									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Middle East and Afica	7	8	6	7	8	8	10	10	10	12
Central and South America	10	9	11	13	13	13	13	17	17	17
Europe	26	29	30	32	40	40	41	43	49	52
North America	34	37	42	44	36	49	55	58	62	68
Asia Pacific	51	55	58	64	70	75	81	96	96	104

11. CONCLUSIONS

- 1) The consumption of meat in the world and in Europe is growing, considering the increasing number of human populations in the world.
- 2) In Poland, the most pork is eaten the most, which is conditioned by tradition and eating habits.
- 3) The Agricultural Market Agency supports the red meat market by promoting and informing about the benefits of meat under the red meat promotion funds.
- 4) The consumption of meat in the world in kilograms per person by 2025 will increase and will amount to 30.4 kg of poultry meat, 23.1 kg of pork meat, 14.3 beef and veal and 1.3 kg of mutton.
- 5) The Pork Meat Promotion Fund, the Beef Promotion Fund, the Horse Meat Promotion Fund and the Sheep Meat Promotion Fund are funds that the Agricultural Market Agency supports in support of the red meat market

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