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A BRIEF REVIEW OF THE LITERATURE ON ANIMAL AND VEGETABLE FATS WITH PARTICULAR EMPHASIS ON MUTTON TALLOW AND HEMP OIL®

Krótki przegląd literatury w zakresie tłuszczów zwierzęcych i roślinnych ze szczególnym uwzględnieniem tłuszczu baraniego i oleju konopnego®

Key words: fats, muton tallow, hemp oil, properties of fats.

The paper updates information about animal and vegetable fats. The global market for oils and fats is presented and their potential industrial applications are pointed out. Due to ever-changing dietary preferences, the paper pays more attention toward two fats. Mutton tallow was presented as an animal fat. A fat that, compared to beef tallow and lard, has a lower palmitic acid content and a higher stearic acid content. In the opinion of the authors, a fat that is insufficiently popular but with beneficial nutritional characteristics is hemp oil. In addition to the characteristics of this oil, the paper presents the world acreage of hemp cultivation and the volume of hemp seed production.

Słowa kluczowe: tłuszcze, łój barani, olej konopny, właściwości tłuszczów.

W artykule uaktualniono informacje w zakresie tłuszczów zwierzęcych i roślinnych. Przedstawiono światowy rynek olejów i tłuszczów oraz wskazano na ich potencjalne zastosowania w przemyśle. Ze względu na ciągle zmieniajcie się żywieniowe preferencje w artykule większą uwagę zwrócono w kierunku dwóch tłuszczów. Jako tłuszcz zwierzęcy przedstawiono łój barani. Tłuszcz który w porównaniu z łojem wołowym i smalcem charakteryzuje się niższą zawartością kwasu palmitynowego a wyższą kwasu stearynowego. W opinii autorów tłuszczem niedostatecznie popularnym, ale o korzystnych cechach żywieniowych jest olej konopny. W artykule poza charakterystyką tego oleju przedstawiono światowy areał uprawy konopi oraz wielkość produkcji nasion z konopi.

INTRODUCTION

Fats and oils are essential components of the human diet. In terms of physiology, they are the main source of energy, while being a carrier of fat-soluble vitamins (A, D, E and K) and components needed for the proper development and functioning of the body, i.e., essential fatty acids (EFAs) or antioxidants [16]. The content of the indicated ingredients, unique rheological properties as well as the versatility of use make fats a raw material in the food, cosmetic, pharmaceutical and oleochemical industries [51]. In recent years, they have also become the object of interest for scientists and technologists related to the biofuel industry [51].

From a chemical point of view, natural fats and oils are mixtures of lipids [22]. As defined by Nichols et al. [43] lipids belong to organic compounds of natural origin. Continuing the statement of the above author, these compounds are insoluble in water, but soluble in organic solvents, and their basic molecular building blocks are hydrocarbon chains. On the other hand, another author [16], indicates that this definition should not be interpreted literally and rigorously, because there are also lipid compounds that are partially or completely soluble in water. Regarding the division of lipids, due to the similarities in chemical structure, they were divided into three groups, including: simple, complex and derivative (secondary) lipids [16].

The terms "fats" and "oils" are often used interchangeably, although the use of this nomenclature is also guided by their melting point or the origin of the raw material [43, 44]. From a chemical point of view, triacylglycerols are the main constituent of fats and oils, which are esters of fatty acids (FA) and glycerol [16]. Triacylglycerols belong to the subgroup of lipids, belonging to simple lipids [16]. They usually account for more than 95% of all fat components [22]. The remaining components are most often mono- and diacylglycerols, free fatty acids, phospholipids, sterols, hydrocarbons, vitamins, or antioxidants [16, 22].

Kowalski and Makara [32] provide a different classification of fats. The authors focus mainly on the origin of these ingredients, hence their division into animal and vegetable fats. Animal fats are obtained from milk or tissues of land and sea animals, while vegetable fats are obtained from fruits, nuts or oilseeds [3, 32]. In order to extract oil or fat from plant

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and animal raw materials, the following methods are used: pressing, rendering and solvent extraction. The selection of the technique for obtaining the product depends on the type of raw material [20].

Fats and oils used as ingredients in food, cosmetic or pharmaceutical products have a key impact on shaping their quality, giving them unique sensory and physicochemical properties [54]. The fatty components of the above-mentioned products contribute, among others, to the consumer's senses during contact with them, such as taste, smell or appearance [45]. Moreover, these compounds influence the improvement of the functional features of products, shaping, among others, their texture, consistency or spreadability [62]. The quality of fat is shaped by its stability in relation to physicochemical interactions, and precisely changes that occur under the influence of physical and chemical factors. An important criterion of the quality of fats is also microbiological stability [16]. The criteria for consumer evaluation of fats are taste and aroma, and recently also the quality of fat is associated by consumers with its nutritional value (the presence of essential unsaturated fatty acids or omega-3 and omega-6 acids). In general, it can be said that fat is a very important component of the products in which it occurs. The essential features of products, for which, among others, fat is responsible, are presented in Figure 1.

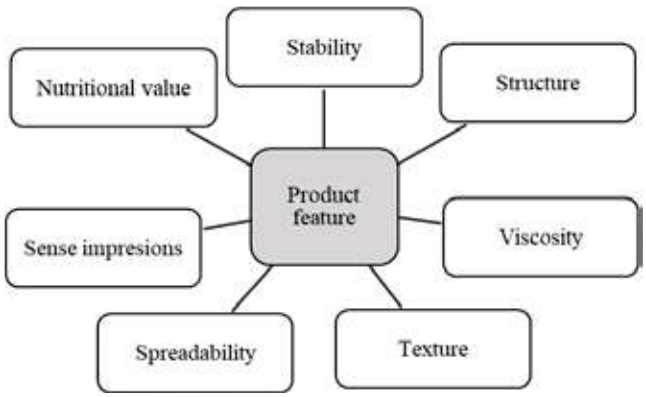

Fig. 1. Selected product features depending on the properties of the fat used.

Rys. 1. Wybrane cechy produktu zależne od właściwości użytego tłuszczu.

Source: Based on: [1, 23, 45, 62]

Źródło: Opracowano na podstawie: [1, 23, 45, 62]

The aim of the study was to compile in a new look information in the field of fats, while emphasizing two well-known but still not quite popular fats: hemp oil and mutton tallow.

FATS AND THEIR QUALITY DETERMINANTS

The quality of fats or oils is influenced by parameters, both physical and chemical, which depend mainly on the source of their origin, the processing they have been subjected to as well as the transport and storage conditions in which the fat or the product containing it is kept [55]. Thus, it can be concluded that the quality of fats and oils is shaped not only by their manufacturers or distributors, but also by consumers after the purchase. Despite the huge impact of proper storage and use of fat after purchase, as indicated by Shahidi and Ambigaipalan [55], consumers often ignore this fact and do not pay much attention to these actions. Table 1 presents selected parameters determining the quality of fats and oils.

Table 1. Selected parameters determining the quality of fats and oils

Tabela 1. Wybrane parametry determinujące jakość tłuszczów i olejów

Physical parameters	Chemical parameters
Relative density	Fatty acid composition and their distribution
Refractive index	TAG composition
Viscosity	Iodine value
Colour	Saponification value
Melting point	Acid value
Turbidity	Polar lipids and phospholipids content
Consistency	Heavy metals content
Solidification point, solid fat content	trans-fatty acids content
Odour and taste	Oxidative stability (e.g., peroxide value, p-anisidine value, TOTOX, OSI, Rancimat AOM)

Source: [55]

Źródło: [55]

THE GLOBAL OILS AND FATS MARKET AND THEIR INDUSTRIAL APPLICATIONS

According to an analysis performed by Expert Market Research, the value of the global animal and vegetable fats and oils market in 2019 was USD 227.9 billion. Further dynamic growth in the value of this market is forecasted, which may reach nearly USD 361.65 billion in 2025 (Expert Market Research, 2020). According to the information provided by Mielke [39], the global consumption of the 17 most important fats and oils (identified by *Oil World*) doubled between 1995 and 2015, from 92.9 million tonnes to 204.3 million tonnes (**Fig. 2**). For many years, the global market of fats and oils has seen an increasing dominance of raw materials of plant origin, mainly palm, soybean, sunflower and rapeseed oils (**Fig. 3**). Animal fats are a minority on the market compared to those of plant origin. In 2015, the global consumption of vegetable fats and oils was 179.4 million tonnes, while that of animal origin was only 26.7 million tonnes [39]. Among animal fats, beef tallow and pork lard have the largest market share, which account for 4.4% and 4.1% of the total production of fats and oils, respectively (Expert Market Research, 2020).

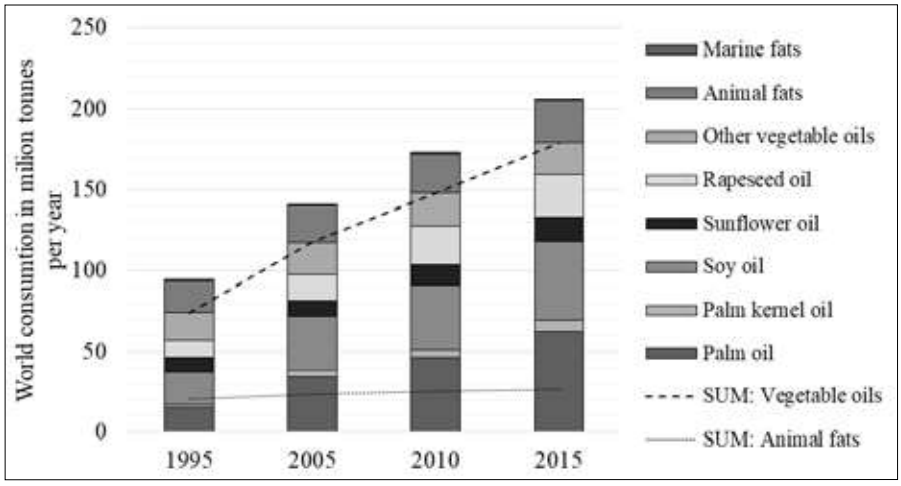

Fig. 2. World consumption of the 17 most important fats and oils between 1995 and 2015.

Rys. 2. Światowe spożycie 17 najważniejszych tłuszczów i olejów w latach 1995–2015.

Source: [39]: 175

Źródło: [39]: 175

Animal fats are generally a component accompanying animal raw materials, or they are a waste from the process of obtaining these materials [2]. For this reason, the production of animal fats is not dictated by the demand for them, but increases with the increasing demand for animal products, i.e., milk, meat or wool [2]. Compared to vegetable oils, animal fats have a much more diverse fatty acid composition [61]. The main fatty acids characterizing triacylglycerols of fats and oils from terrestrial animals are saturated acids, i.e., palmitic, stearic, and monounsaturated oleic acid [8]. The fatty acid profile is most influenced by the animal species, its health condition, maturity, lactation phase and the location of fat in its body [44]. The main fatty acids found in marine fat triacylglycerols are: palmitic, oleic, docosahexaenoic (DHA) and eicosapentaenoic (EPA). The last two fatty acids are among the health-promoting factors recommended in the consumer's diet, especially when it should be aimed at lowering the content of saturated fatty acids, cholesterol and the risk of coronary heart disease [33]. For this reason, it is believed that among many types of animal fats, fish oils are of the greatest importance for health [8]. Another fatty acid characteristic for animal fats, also showing health-promoting value, is conjugated linoleic acid (CLA). This acid is present mainly in the milk and meat of ruminants [31]. Many clinical studies have shown that CLA exhibits various biological effects, i.e., it has anti-inflammatory, anti-atherosclerotic, anti-cancer and antioxidant properties [24, 31].

The quality of fats is the main criterion for the use of animal fats in many industries. The highest quality fats are used in the food industry. However, only less than 5% of the produced fats of animal origin is used in human nutrition ([8]. For food purposes, pork lard and beef tallow are most often used, which are utilized for frying and baking [2, 8]. Another important direction of the usage of these raw materials is their application as animal feed ingredients, where they are the main source of energy, a carrier of vitamins and EFAs [2]. Animal fats of lower quality are used for technical purposes. Due to the demand for saturated fatty acids in the oleochemical industry, they are utilized in the production of soaps, cosmetics and lubricants. Animal fats have also found application in the biofuel industry, although, for economic reasons, their importance as a raw material for the production of biofuels is much lower than that of vegetable fats and oils [2].

The most common fatty acids present in triacylglycerols of vegetable fats and oils are unsaturated fatty acids - oleic and linoleic, and saturated fatty acids - palmitic and stearic [8, 41]. In vegetable oils, unsaturated fatty acids are predominant, which from a nutritional point of view are very beneficial and recommended in the human diet as opposed to saturated acids [30]. However, it should be noted that the fatty acid profile is not always identical for a given plant species, it depends, among others, on the maturity and condition of the plant, soil type or climatic conditions [44].

Analysing the directions of use of vegetable fats and oils, it can be concluded that the production of food products with their participation is of the greatest importance. The current nutritional trends focus mainly on consumer needs and the nutritional quality of food products [34]. The goal is that the consumer should be well informed and consciously make purchasing decisions in the selection of fat and the product containing it. Broader knowledge allows consumers to react much earlier and, above all, to act preventively in terms of diseases caused by an inadequate diet. There are many scientific reports in which the authors confirm that replacing animal fats with vegetable oils in the diet is justified and pro-health behaviour [38, 49, 60]. As indicated by Forouhi et al. (2018) [19], increasing the consumption of unsaturated fatty acids while reducing the consumption of saturated fatty acids may result, among others, in reduced risk of developing coronary heart disease.

Vegetable fats and oils are also utilized in the cosmetics industry. Currently, these materials are successfully used in skin care products [4]. They can show various properties, depending on the raw material they come from. Fats in cosmetic preparations have a moisturizing, protective, nutritional, smoothing, soothing, etc. functions [4]. Due to the natural, active ingredients present in vegetable fats and oils, some of them have been used in medicine as they have a therapeutic or supportive effect, for example in the treatment of liver diseases [4]. Most vegetable fats and oils are also used in the oleochemical industry. Examples are coconut oil and palm kernel oil, which serve in this industry as a source of lauric acid [22]. In recent years, there has been an increase in the use of vegetable fats and oils as raw materials supplying fatty acid methyl esters for the production of biofuels [21]. In Europe, rapeseed oil is most often used for this purpose, in Japan - waste frying oil, in the USA - soybean oil (or beef tallow), and in Malaysia - palm oil [21]. Moreover, vegetable fats and oils are used in the production of lubricants, soaps, wood preservatives, as well as components of animal feed [4, 7, 34].

PHYSICOCHEMICAL PROPERTIES OF MUTON TALLOW

Mutton tallow is obtained from various parts of the sheep carcass (*Ovis aries*) [50]. It accounts for about 3% of the body weight of the sheep [7]. This fat is characterized by a specific smell and usually a white colour, although it also occurs in a shade of cream or light pink [32]. At a temperature of 15–20°C, mutton tallow shows a firm or brittle consistency [32].

The main fatty acids in mutton tallow triacylglycerols are palmitic, stearic and oleic acids (Table 2). Saturated fatty acids constitute about 70% of all fatty acids present in this fat (Table 2). As indicated by Richards et al. (2020) [50] compared to beef tallow, which also comes from a ruminant mammal, mutton tallow has a higher stearic acid content and, at the same time, a lower oleic acid content (Table 2). This is due to the rumen mediated biohydrogenation of unsaturated fatty acids, with varying levels depending on the species [50]. In the process of biohydrogenation of linoleic acid to stearic acid, a nutritionally beneficial conjugated linoleic acid (CLA) is also formed [29]. According to the same authors, mutton tallow has the highest CLA content among animal fats.

Table 2. Main fatty acids (%) of selected animal fats

Tabela 2. Główne kwasy tłuszczowe (%) wybranych tłuszczów zwierzęcych

Fatty acid	Beef tallow	Mutton tallow	Pork lard	Chicken fat
Myristic acid	2.7 – 4.8	2.8 – 4.9	1.4 – 1.7	1.3
Palmitic acid	20.9 – 28.9	19.5 – 21.3	23.1 – 28.3	23.2
Palmitoleic acid	2.3 – 9.1	1.4 – 2.3	1.8 – 3.3	6.5
Stearic acid	7.0 – 26.5	17.6 – 28.9	11.7 – 24.0	6.4
Oleic acid	30.4 – 48.0	33.2 – 40.4	29.7 – 45.3	41.6
Linoleic acid	0.6 – 1.8	1.2 – 3.4	8.1 – 12.6	18.9
Trans fatty acid isomers	1.3 – 6.6	11.0 – 14.6	1.1 – 1.4	nd

Source: Richards et al. [50]

Źródło: Richards et al. [50]

In general, the fatty acid composition of mutton tallow is similar to the fatty acid composition of vegetable solid fat, i.e., cocoa butter, although they are distinguished by the melting profile [37]. This is due to the distribution of fatty acids in triacylglycerol molecules. The saturated fatty acids in mutton tallow, but also in other fats of animal origin, are mainly located in the internal position of the TAG (*sn*-2) [52]. Contrary to animal fats, in vegetable fats, saturated fatty acids are found mainly in the outer positions of the TAG (*sn*-1 and *sn*-3) [37].

PRODUCTION AND DIRECTIONS OF USE OF MUTTON TALLOW

Mutton tallow is a waste product formed mainly in meat processing plants and slaughterhouses [5]. This fat is mainly produced in countries with a high consumption of mutton, and large numbers of sheep [7]. According to the statistical data shared by the Food and Agriculture Organization of the United Nations [18], the world production of mutton tallow in 2018 was about 560,000 tonnes (Table 3). The largest share, amounting to over 50% of world production, was recorded in Asia (Table 3). In Europe, about 74,000 tonnes of mutton tallow were produced in 2018, which accounts for approximately 13% of world production (Table 3).

Table 3. Mutton tallow world production

Tabela 3. Światowa produkcja łoju baraniego

Region	Mutton tallow – production (x 10^3 ton)	Mutton tallow – percent of world production (%)
Africa	61	11.0
North America	2	0.4
South America	11	2.0
Central America and Caribbean	3	0.5
Asia	293	52.6
Europe	74	13.3
Oceania	112	20.1
World	557	100.0
Poland	0.10	0.02

Source: FAOSTAT (2020), data may include official, semi-official, estimated or calculated data [18]

Źródło: FAOSTAT (2020), dane mogą zawierać dane oficjalne, półoficjalne, szacunkowe lub obliczone [18]

The main world producers of mutton tallow in 2018 were China, Australia and Iran, whose share in the global production of this waste was 18.6%, 14.8% and 7.9%, respectively (Table 3, Figure 3). The countries in the top ten largest producers of mutton tallow manufactured about 64% of the world's production of this fat (Figure 3). In the case of European countries, the largest producers are Great Britain, Spain and Romania (Figure 3). The production volume of mutton tallow in 2018 in Poland was about 100 tonnes (Table 3) (26^{th} place among European countries) [18].

In general, mutton tallow is usually used for technical purposes [58]. The main direction of its use is in the soap industry [17]. In contrast, in some countries where pork is not eaten for religious reasons, mutton tallow is often found in consumers' diets. It is usually used in Turkish, Moroccan, Algerian and Tunisian dishes [57]. However, due to the specific smell of both mutton meat and fat, which is not always accepted by consumers, the use of mutton tallow for food purposes is limited [59]. Moreover, due to current consumer concerns about saturated fatty acid intake and its effect on blood cholesterol level, consumption of saturated fatty acids has been reduced [27]. Other potential uses of mutton tallow in the food industry mentioned by Irshad et al. (2015) [25] is using it as an ingredient in margarines, shortenings or sweets.

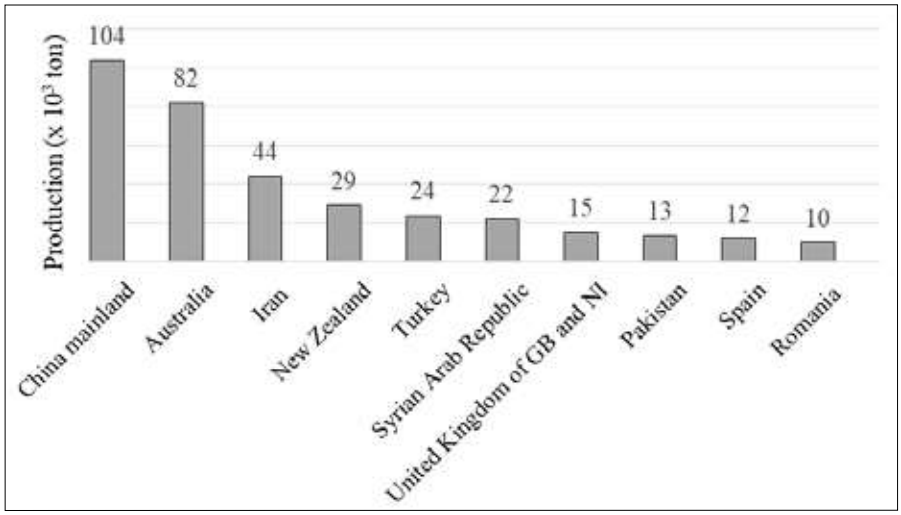

Fig. 3. The production volume of mutton tallow.
Rys. 3. Wielkość produkcji łoju baraniego.

Source: FAOSTAT (2020), data may include official, semi-official, estimated or calculated data [18]

Źródło: FAOSTAT (2020), dane mogą zawierać dane oficjalne, półoficjalne, szacunkowe lub obliczone [18]

Many authors have proposed the potential use of waste mutton tallow in other industries. Authors [6, 42, 47] showed that mutton tallow is a suitable raw material for obtaining high-quality fuel - biodiesel. Such use of waste fat brings not only economic benefits, due to the low price of the raw material, but also environmental benefits [53]. Mutton tallow can also be used as an ingredient in animal feed to change their texture and facilitate the combining of ingredients [53].

HEMP SEED OIL CHARACTERISTICS (*CANNABIS SATIVA* L.)

Hemp seed oil is obtained from the seeds of the hemp (*Cannabis sativa* L.). These plants have been used in the world for thousands of years [9]. Currently, hemp has great social and economic importance due to the variety of its uses [14]. These plants are a raw material for the production of food, special-purpose textiles, biodegradable plastics, and animal feed [14]. In addition, hemp is also used for medicinal purposes, and it was first mentioned in traditional Chinese medicine [9].

The oil constitutes about 36% in hemp seed [10]. It is mainly obtained by pressing or extraction methods. Hemp seed oil has a multidirectional effect on the human body, when applied both internally and externally [12]. Due to the fact that hemp seed oil is a source of EFAs, it is used as a component of light body oils, which show high penetration into the skin [46]. Its high nutritional value is related with, among others, a unique composition of fatty acids and a favourable ratio of omega-6 and omega-3 fatty acids [14].

Generally, despite the enormous potential of hemp seed oil in terms of its nutritional and health-promoting properties, the awareness of consumers in Poland about this material and its possible use is quite low [48]. In their study, the authors presented the respondents' knowledge of the active ingredients of hemp seed oil, its effect on the skin, and its use in cosmetic formulations. They stated that a significant proportion of respondents did not know the active substances found in hemp seed oil, nor their beneficial effects on healthy as well as pathologically changed skin. As many as a quarter of respondents indicated that this oil has a hallucinogenic effect. The authors also concluded that consumer education is needed to increase their awareness of hemp seed oil.

HEMP CULTIVATION AREA

Hemp has been cultivated for centuries, mainly to produce fibres for making fabrics and clothes, around the world [11, 36]. In the twentieth century, there was a significant reduction in the cultivation of hemp in many parts of the world due to, among others, introduction of acts prohibiting the cultivation of hemp due to the content of psychoactive cannabinoids, and the dissemination of other sources of textiles [11, 36]. Some countries have regulated the legal limit of the concentration of psychoactive cannabinoids in the plant, which facilitated the expansion of the cultivation area of this species [36]. Overall, in recent years there has been a significant increase in interest in hemp seeds, especially in terms of their nutritional properties and therapeutic action [35, 36].

Statistical data on the global area of hemp cultivation in the literature are not consistent. According to EIHA (European Industrial Hemp Association), in 2015 the area of hemp cultivation in Europe was approx. 25,000 hectares [13]. The main European hemp producers in Europe in 2015 were France and the Netherlands [13]. The same authors claim that the latest data on the volume of hemp seed production in Europe indicated by EIHA refer to 2013, and according to the report, it was 11,500 tonnes. In the same year, around 13% of the seeds produced in Europe were used to produce food-grade oil. According to the statistical data provided by the Food and Agriculture Organization of the United Nations [18] the global hemp cultivation area in 2018 was approximately 32,000 hectares (Table 4). The largest area of hemp cultivation, representing just over 50% of the global area in 2018, was recorded in France (Table 4). The remaining countries with a relatively large area of cultivation were Russia, China and Chile, whose acreage constituted, respectively: 14.6%, 13.5% and 8.3% of the global acreage. The main global producer of hemp seeds in 2018 was France, and its share in world production was almost 88% of world production, which corresponds to less than 12,000 tons (Table 4).

Comparison of the statistical data with other studies, discussed in this subsection, indicates a general trend that definitely draws interest in the production and use of this plant raw material. According to the data of both EIHA and Faostat [13,18] an increase in the cultivation area has been observed in recent years in Europe, as well as worldwide.

Table 4. The global area of hemp cultivation and the volume of hemp seed production

Tabela 4. Światowy areał uprawy konopi i wielkość produkcji nasion konopi

Country	Cultivation area (ha)	Percent of world cultivation area (%)	Hemp seed – production (x 10^3 ton)	Percent of world production (%)
Chile *	2660	8.3	1.5	1.1
China *	4342	13.5	11.8	8.3
France **	16511	51.4	125.4	87.7
Hungary *	1606	5.0	0.4	0.3
Iran *	193	0.6	0.2	0.1
Poland *	59	0.2	0.03	0.02
Romania *	799	2.5	0.1	0.1
Russia **	4691	14.6	2.1	1.5
Spain **	140	0.4	0.8	0.5
Turkey **	6	0.02	0.003	0.002
Ukraine *	1133	3.5	0.6	0.4
World	**32140**	**100.0**	**142.9**	**100.0**

* FAO estimates

** official data

Source: FAOSTAT [18]

Źródło: FAOSTAT [18]

PROPERTIES, STRUCTURE AND IMPORTANCE OF HEMP SEED OIL

Refined hemp seed oil is clear and colourless [58]. Unrefined, is characterized by a dark green colour, resulting from the presence of chlorophyll substances [36]. The antioxidant components present in hemp seed oil, thus protecting it against oxidation, are tocopherols, polyphenols and carotenoids [26]. Other compounds also found in unrefined hemp seed oil include tocotrienols, phospholipids, minerals, and phytosterols [40].

The health-promoting effects of hemp seed oil are related, among others, with the fact that it is a source of cannabinoids [15]. Hemp seeds themselves do not contain these compounds, but are contaminated with them when in contact with other parts or secretions of the plant [15]. The content of tetrahydrocannabinol (THC) in hemp, which has psychoactive properties, is regulated by law. The limit of concentration of this compound in plant dry matter in the European Union is 0.2% [14]. Due to such limitations, the THC content in hemp seed oil is very low and usually does not exceed 5 mg/kg [15].The cannabinoid with the highest percentage in hemp seed oil is cannabidiol (CBD), which has no psychoactive effects, but has many positive effects on the human body [15]. Cerino et al. (2020)[14] indicate that CBD has immunomodulatory, spasmolytic, anticonvulsant, anti-inflammatory and anti-anxiety effects.

The fatty acid composition of hemp seed oil is significantly different from that of other commercial oils on the market (Figure 4). Unsaturated acids account for over 90% of all fatty acids in this oil. In contrary to most vegetable oils, hemp seed oil is characterized by a high content of polyunsaturated fatty acids (PUFA), which constitute about 84% of all acids found in this oil. Among the vegetable oils shown in Figure 4, only

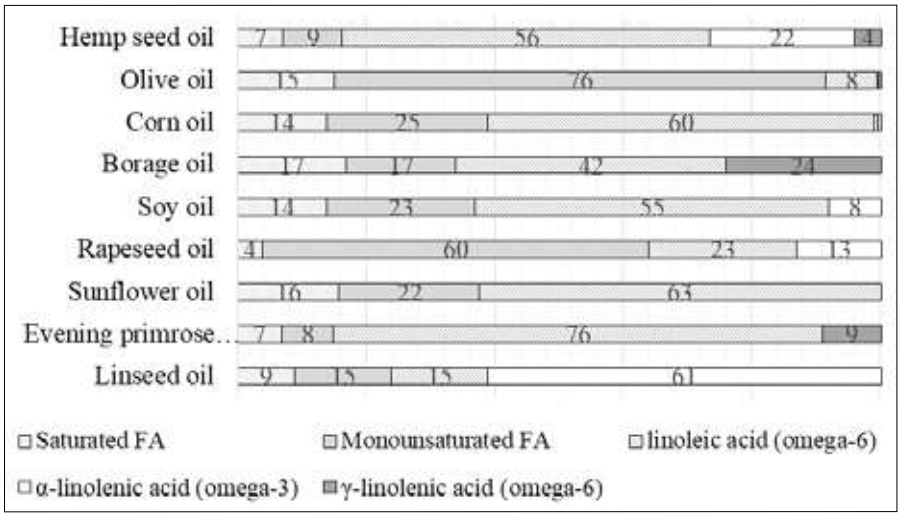

Fig. 4. Profile of main fatty acids (%) of selected vegetable oils.

Rys. 4. Profil głównych kwasów tłuszczowych (%) wybranych olejów roślinnych.

Source: Based on: Callaway and Pate [10]

Źródło: Opracowano na podstawie: Callaway and Pate [10]

one – evening primrose oil – has a similar PUFA content to hemp seed oil.

The main fatty acids with the highest percentage in hemp seed oil are linoleic acid (omega-6), α-linolenic acid (omega-3) and oleic acid [36]. The presence of linoleic and α-linolenic acids is beneficial for consumers, especially for those who are looking for food or a diet that includes antiarrhythmic, anticoagulant or anti-inflammatory effects [35]. As indicated by Oomah et al. (2002) [46] and Cerino et al. (2021) [14] the ratio of omega-6 to omega-3 polyunsaturated fatty acids in this oil is approx. 3:1, which is the correct proportion in relation to proper human nutrition [56]. Such a ratio may have the effect of lowering the level of „bad" cholesterol in the blood (LDL – low-density lipoproteins), as well as lowering blood pressure [10]. The nutritional value of hemp seed oil is additionally enhanced by the presence of γ-linolenic acid, belonging to the omega-6 fatty acids [36]. It reveals a pharmacological effect, among others, in regulating the body's inflammatory responses [28].γ-linolenic acid is a rather rare acid not found in the popular used vegetable oils. In addition to being present in hemp seed oil, it is also a component of evening primrose oil or borage oil [10].

SUMMARY

The material presented above confirms that fats are important components of food. They are raw materials in many industries, i.e. such as food chemical, pharmaceutical and chemical. The data presented in the paper in terms of interest in these ingredients confirm that there is still more interest on the side of vegetable fats. The fatty acid composition of hemp oil indicated in the paper confirms the beneficial nutritional values for this oil. Unsaturated acids account for more than 90% of all fatty acids present in this oil, which allows it to stand out from other vegetable oils and thus draw closer attention to it. Despite the fact that mutton tallow is an animal fat, the authors believe that it is a fat that should also be of interest to consumers or producers in the fat industry. This type of fat is characterized by reduced amounts of palmitic and stearic acids compared to other solid fats. In addition, it has the important ingredient linoleic acid CLA.

PODSUMOWANIE

Przedstawiony powyżej materiał potwierdza, że tłuszcze są ważnym składnikiem żywności. Są surowcami w wielu gałęziach przemysłu, tj. takich jak spożywczy, farmaceutyczny i chemiczny. Przedstawione w pracy dane w zakresie zainteresowania tymi składnikami potwierdzają, że wciąż większe zainteresowanie jest po stronie tłuszczów roślinnych. Wskazany w pracy skład kwasów tłuszczowych oleju konopnego potwierdza korzystne wartości odżywcze tego oleju. Kwasy nienasycone stanowią ponad 90% wszystkich kwasów tłuszczowych obecnych w tym oleju, co pozwala mu wyróżnić się na tle innych olejów roślinnych, a tym samym zwrócić na niego baczniejszą uwagę. Pomimo faktu, że łój barani jest tłuszczem zwierzęcym, autorzy uważają, że jest to tłuszcz, który powinien zainteresować również konsumentów czy producentów z branży tłuszczowej. Ten rodzaj tłuszczu charakteryzuje się zmniejszoną ilością kwasów palmitynowego i stearynowego w porównaniu do innych tłuszczów stałych. Ponadto posiada ważny składnik kwas linolowy CLA.

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