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HEMP (*CANNABIS SATIVA* L.) SEEDS NUTRITIONAL ASPECTS AND FOOD PRODUCTION PERSPECTIVES: A REVIEW

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KEY WORDS:
culture, economy, food, functional properties, nutritional value

ABSTRACT
This review is devoted to an analysis of the hemp (*Cannabis sativa* L.) seeds' nutritional aspects and food production perspectives, that can become a valuable source of multifunctional components for functional food production. *Cannabis sativa* L. is a multipurpose crop with low- environmental impact traditionally cultivated in Western cultures for fiber production. The propagation of synthetic fibers and the production of intoxicating drugs from certain narcotic strains resulted in the banning of its cultivation. Thus, culturing the varieties that are widely known as „industrial hemp" has only been practiced for the past two decades. Hemp (*Cannabis sativa* L.) is grown not only for its economic importance but also for the seeds' nutritional value. Hemp seeds consists of 25–35% lipids with perfectly balanced fatty acids (FAs); 20–25% proteins, which are easy to digest and contain all essential amino acids; 20–30% carbohydrates, mainly dietary fiber; and vitamins and minerals. Besides its nutritional value, hempseed is also rich in antioxidants and bioactive compounds such as bioactive peptides, polyphenols with high free radicals scavenging activity, and cannabinoids. Therefore, this study reviews the scientific knowledge about *Cannabis sativa* L. seeds and their progressive aspects of cultivation, functional and therapeutic potential, and its use in functional food production.

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АСПЕКТЫ ПИТАТЕЛЬНЫХ СВОЙСТВ И ПЕРСПЕКТИВЫ ПРИМЕНЕНИЯ СЕМЯН КОНОПЛИ (*CANNABIS SATIVA* L.) В ПРОИЗВОДСТВЕ ПРОДУКТОВ ПИТАНИЯ

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КЛЮЧЕВЫЕ СЛОВА:
культура, экономика, продукты питания, функциональные свойства, пищевая ценность

АННОТАЦИЯ
Работа посвящена анализу питательных свойств семян конопли (*Cannabis sativa* L.) и перспектив ее применения в производстве продуктов питания, так как эти семена могут стать ценным источником многофункциональных компонентов для производства функциональных продуктов питания. *Cannabis sativa* L. — многоцелевая культура с низким уровнем воздействия на окружающую среду, традиционно выращиваемая в западных культурах для производства волокна. Распространение синтетических волокон и производство влияющих на сознание препаратов из некоторых наркосодержащих видов привело к запрету выращивания конопли. Таким образом, выращивание сортов конопли, широко известных как «техническая конопля», практикуется лишь в течение последних двух десятилетий. Коноплю (*Cannabis sativa* L.) выращивают не только из-за ее экономического значения, но и из-за пищевой ценности семян. Семена конопли состоят на 25–35% из липидов с идеально сбалансированными жирными кислотами (ЖК); на 20–25% из белков, которые легко усваиваются и содержат все незаменимые аминокислоты; на 20–30% из углеводов с высокой долей пищевых волокон, также из витаминов и минералов. Помимо своей питательной ценности, семена конопли также богаты антиоксидантами и биологически активными соединениями, такими как биоактивные пептиды, высокоактивные полифенолы, борющиеся со свободными радикалами, а также каннабиоиды. Таким образом, в этом исследовании рассматриваются научные данные о семенах конопли *Cannabis sativa* L. перспективных аспектах ее выращивания, функциональном и терапевтическом потенциале, а также данные о ее применении при производстве функциональных продуктов питания.

ФИНАНСИРОВАНИЕ: Исследование поддержано институциональным проектом 020405 "Оптимизация технологий переработки пищевых продуктов в контексте циклической биоэкономики и изменения климата", Bio-OpTehPAS, реализуемым в Техническом университете Молдовы.

1. Introduction

Cannabis sativa L. originates from Central Asia and grows annually. Among the most exploited crops, hemp (*Cannabis sativa* L.) provides fiber, seeds, and wood pulp for a variety of commercial applications. The cultivated area has increased significantly from 1993 to 2012, reaching 34.960 ha in 2019. France and Germany account for 20.000 ha and 5.362 ha respectively. *Cannabis sativa* L. is climatically favorable for cultivation in the Republic of Moldova, however a number of legislative restrictions make its cultivation difficult. It is estimated that hemp (*Cannabis sativa* L.) harvest could generate about 10% of the state's revenue. As a result of the physicochemical and therapeutic properties, hemp (*Cannabis sativa* L.) seeds are attracting increasing interest. Thus, they are a good source of vitamins and other nutrients with high proportion of proteins (20–30%) and essential fatty acids (50–55%). Throughout history, hemp (*Cannabis sativa* L.) has been used as the traditional food source in all parts of Europe. In addition to hemp (*Cannabis sativa* L.) seeds, its leaves, flowers and hemp extracts have been used for centuries as a food source and dietary supplement. Prior to the Industrial Revolution, hemp (*Cannabis sativa* L.) oil (extract) was one of the most commonly consumed vegetable oils, so hemp extracts and cannabinoids were highly consume [1]. Italy, Germany, Lithuania, Poland, Sweden, and Slovakia, among others, have documented the benefits of hemp (*Cannabis sativa* L.) for human

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health [2]. Hemp has been found to have antioxidant, anti-inflammatory and neuroprotective effects. It has also been studied for its potential to reduce symptoms of anxiety, depression and chronic pain [3]. Additionally, hemp is a sustainable crop that can help reduce soil pollution [4]. Due to its characteristics perfect for making textile fibers and cordage, the crop was more popular in temperate regions. In contrast, its popularity in tropical regions is more limited due to its lower yield under those conditions. Along with flax, hemp (*Cannabis sativa* L.) is one of the oldest natural fibers used by human. Additionally, the UN Single Convention incorrectly listed hemp (*Cannabis sativa* L.) along with cannabis flower (marijuana) as a narcotic substance. Over the years, this has caused much confusion, since the cultivation of cannabis plants for industrial purposes clearly falls beyond international jurisdiction. Due to onerous licensing procedures, unclear EU and national regulations on hemp-derived food products, and burdensome licensing procedures, the industrial hemp sector (*Cannabis sativa* L.) has been severely restricted.

2. Materials and methods

The objects of study were the scientific publications of the foreign authors in the field of evaluation of new agro-industrial sources in order to obtain multifunctional biologically active compounds. PubMed, Scopus, Web of Science, Science Direct and open Internet sources were searched for the studies published between 2003 and 2023 using several combinations of keywords, including the following: *Cannabis sativa* L., hemp cultivation, functional and therapeutic potential, hemp composition, food waste, functional food products.

3. Results and discussions

3.1. The progressive aspects of the cultivation of Cannabis sativa L.

Industrial hemp (*Cannabis sativa* L.) has been cultivated in Europe for hundreds of years. In many European countries, such as Great Britain, France, the Netherlands, Germany, Spain, and Italy, Romania and Ukraine it was an important crop [5]. Hemp (*Cannabis sativa* L.) has also been cultivated by the Moldovans since the ancient times, used for food, roofing, clothing and livestock feed. Nowadays the cultivation of industrial hemp (*Cannabis sativa* L.) is prohibited in the Republic of Moldova. This leads to the stagnation of the sector and producers lose more opportunities. According to the Associations in question, hemp (*Cannabis sativa* L.) would ensure a profit of approximately 7 to 10 thousand euros per hectare, depending on the purpose of use. At the same time, it is a crop with increased resistance to drought, which would ensure the development of several sectors. About 10% of the state's income could be generated by this crop. Figure 1 shows the evolution of the cultivated area in the EU between 2015–2022.

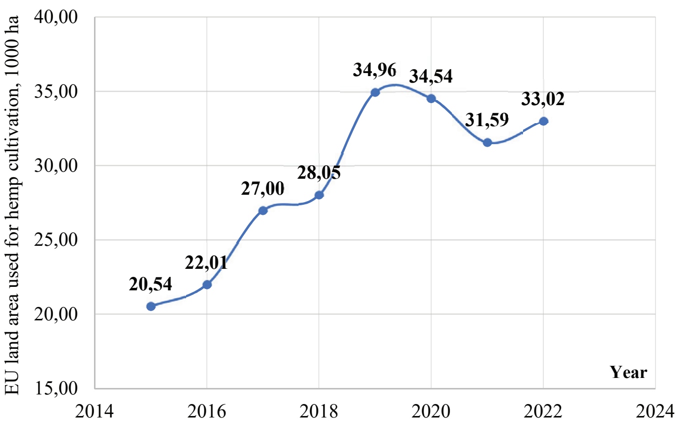

Figure 1. **Hemp (*Cannabis sativa* L.) cultivation area in the EU2015–2022 [6]**
Рисунок 1. **Посевная площадь конопли (*Cannabis sativa* L.) на территории ЕС в 2015–2022 [6]**

Most Member States legalized the cultivation of industrial hemp (*Cannabis sativa* L.) between 1993 and 1996, others followed later. Cultivated area fell to its lowest value since 1994 in 2011 (about 8.000 ha), but increased in 2012, 2013, 2014 and 2015, finally reaching over 34.96 ha in 2019. France, with an area of 20.00 ha of hemp, and Germany, with an area of 5.35 ha, are the main growing member states [6]. Romania is in the list of countries with 7%, namely 1130 ha. Recently, many new European countries have begun or developed hemp (*Cannabis sativa* L.) cultivation, primarily to produce hemp seeds [7].

Most of the raw material used by hemp processors comes from Europe. In Europe, dietary supplements are produced from more than half of the flowers and leaves being sold [8]. Because textiles are mainly niche markets, production is limited due to high raw material prices, fiber shortages, and production facilities shortages [9]. Before World War II, hemp fiber (*Cannabis sativa* L.) occupied huge share of the consumer market [10].

3.2. The functional and therapeutic potential of hemp seeds (Cannabis sativa L.)

In the food industry hemp seeds (*Cannabis sativa* L.) have limited applications due to both legislative restrictions and insufficient information on the composition and benefits of hemp seed compounds, so the newest processing methods have been developed to capitalize on their nutraceutical potential. In addition, production technologies are being developed that incorporate hemp seeds into the existing food products [11].

Hemp is the plant the vegetative parts of which can be exploited, constituting the raw material for diverse range of products (Figure 2). There is a need for better use of the organic production of hemp (*Cannabis sativa* L.) in the country, as well as taking advantage of the ecological effects of hemp (*Cannabis sativa* L.) cultivation in crop rotation [12].

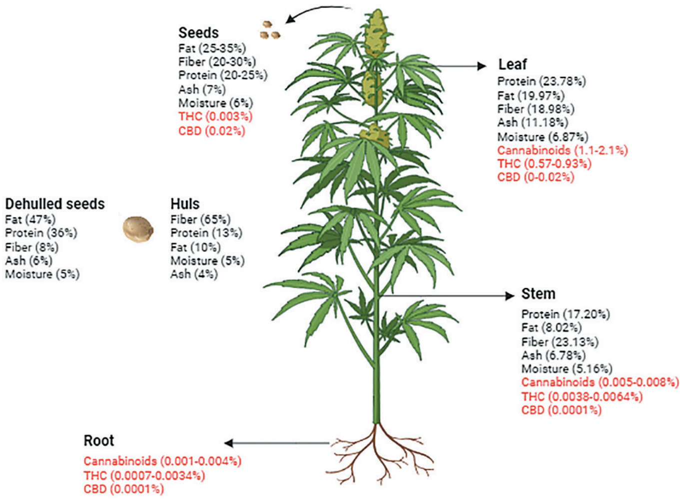

Figure 2. **Hemp (*Cannabis sativa* L.) chemical composition [13], this figure was prepared using BioRender**
Рисунок 2. **Химический состав конопли (*Cannabis sativa* L.) [13], данный рисунок подготовлен при помощи BioRender**

Cannabis sativa L. culture is cultivated for medicinal and industrial purposes [14]. Hemp (*Cannabis sativa* L.) seeds contain 35–45% lipids with the unique and perfectly balanced composition of fatty acids [15,16]. Depending on environmental and varietal factors, the protein content of whole hemp seeds (*Cannabis sativa* L.) can vary from 25–30% [17,18]. The total carbohydrate content of hemp seeds (*Cannabis sativa* L.) can vary between 20–30% [19]. It should be mentioned that it is of particular interest from the point of view of the content of vitamins B_1, B_2, B_6 [20]. At the same time, 100 g of seeds contain the average daily dose of phosphorus, potassium, magnesium, manganese and zinc [12]. The chemical composition provides the hemp seeds (*Cannabis sativa* L.) high therapeutic effect. The amount of essential nutrients increases along with the elimination of the fat fraction [21]. After extracting hemp (*Cannabis sativa* L.) oil, oil cake, which has been recognized as one of the most valuable sources of protein, constitutes 45–55% [22], which is not used in the food industry in the Republic of Moldova, but is used only for feeding the livestock.

Among the fatty acid precursors of ω-3 polyunsaturated fatty acids, stearidonic acid is found in *Cannabis sativa* L. seeds oils. An infant's development, health; and immunity depend on these fatty acids [22]. Researchers have investigated hemp seed oil (*Cannabis sativa* L.) for its effect on human health, but research on its effect on human nutrition is lacking.

This superfood is:

- ❑ very balanced;
- ❑ easy to digest;
- ❑ allergens free;
- ❑ suitable for vegans;
- ❑ with fast satiety effect;
- ❑ 95% digestible proteins produced locally, without processing;
- ❑ this superfood meets societal and environmental expectations [24,25].

According to genotypes and environmental conditions, certain studies have indicated that hemp seeds exhibit a great degree of heterogeneity in their content. For example, the authors Vonapartis E. et al. [26] describe hemp seeds as having a high content of protein (23.8–28.0 mg/g), lipids between 26.9–30.6 mg/g [26], but Mattila P. et al [27], indicates the amount of carbohydrates present in the seeds of *Cannabis sativa* L. being 34.4 mg/g, dietary fiber of 33.8 mg/g [28]. Instead, Lan Y. et al [29], states the protein content as 24.3–28.1 mg/g, lipids as 32.8–35.9 mg/g, carbohydrates as 32,5–3 7.5 mg/g [29].

Organic hemp (*Cannabis sativa* L.) could set the way for a regional sector for the production and processing of gluten-free grains and foods (Figure 3).

The North American gluten-free food market is booming and supply is failing to meet demand. These products are demanded by people with celiac disease or gluten-induced enteropathy which affects almost 1% of the population [30]. In addition, this type of „healthy" food is gaining popularity among the general public, as it is increasingly used in the daily diet, either as a food supplement or as such in the preparation of pastry-confectionery products, flour-based bread of hemp (*Cannabis sativa* L.) and the use of hemp seed oil (*Cannabis sativa* L.) [31,32].

After processing the hemp seeds, several of by-products are obtained, which have an increased biological value compared to the seeds in terms of vegetable proteins, dietary fibers and minerals [33,34] (Figure 4).

In a variety of food applications, hemp-based ingredients have significant potential. Hemp seed can be used to produce a wide range of products [36]. As an alternative to milling hemp seed into flour, fractions enriched with oil and protein can also be isolated from whole or dehulled hemp seeds [37]. Additionally, interest in phytochemical extracts is rising as their importance and ways of application in nutrition and health become more widely understood [35].

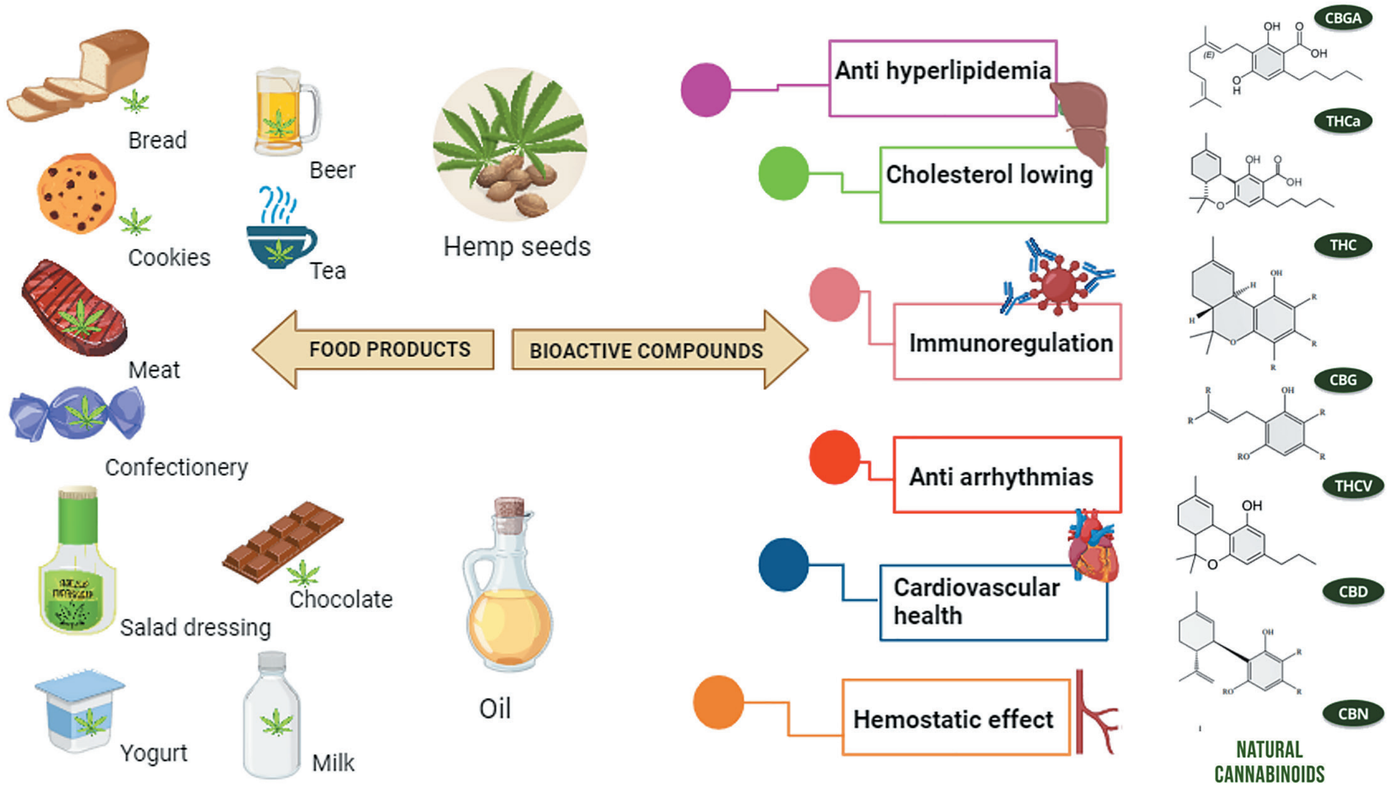

Figure 3. **Food products infused with hempseed sources and their influence [19,25]**
Рисунок 3. **Пищевые продукты с добавлением ингредиентов, изготовленных из конопляного семени и их влияние на здоровье [19,25]**

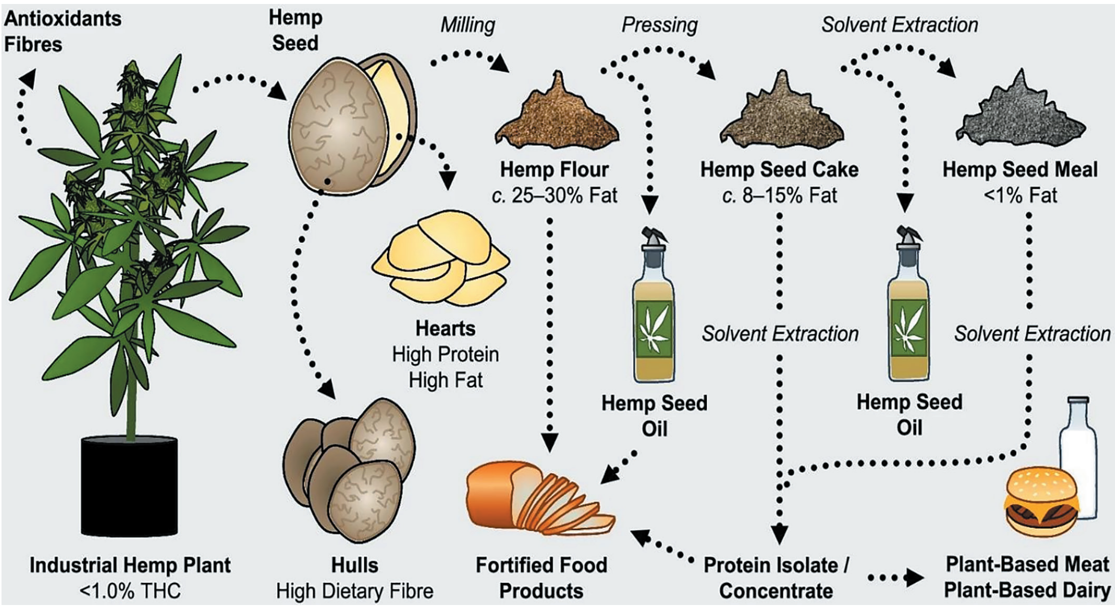

Figure 4. **Hemp oil byproducts characterization [35]**
Рисунок 4. **Характеристика побочных продуктов, получаемых при производстве масла [35]**

In the food industry, hemp (*Cannabis sativa* L.) seeds are widely used as a means of enriching or fortifying food products. Derivatives as well as hemp (*Cannabis sativa* L.) seeds were evaluated as an added ingredient in products consumed daily, such as bakery products (bread, biscuits), energy bars, meat and meat products, yogurt. Concerning the nutritional quality of the products enriched with hemp (*Cannabis sativa L.*) flour, the addition of hemp (*Cannabis sativa* L.) seeds or derivatives was found to significantly change the nutritional quality, because it increases the total protein and fat content, total dietary fibers, both soluble and insoluble, the content of macroelements and trace elements such as: Mg and Ca, Mn, Cu, Fe and Zn.

3.3. Fatty acid composition

The fat content is one of the most important aspects of hemp (*Cannabis sativa* L.) seeds, especially from an industrial point of view. Hemp seeds (*Cannabis sativa* L.) are oleaginous fruits, thus the main food product of industrial value that could be obtained is hemp seed oil. For this reason, the fat obtained from hemp seeds (*Cannabis sativa* L.) is commonly called oil. More research proved that the fat amount of *Cannabis sativa* L. seeds ranges from 25 to 35% of the whole seed [38,27,39,40].

According to research published in the literature, hemp oil contains high concentration of polyunsaturated fatty acids (PUFA) in addition to low concentration of saturated fatty acids (SFA). In particular hemp oil contains up to (84%) unsaturated fatty acids depending on genotype and environmental conditions, the author Callaway reports [28]. Oleic acid (18:1, ω-9, OA), the most abundant monounsaturated fatty acid (MUFA), was found to occupy the greatest share (18.78%) according to Lan et al. [29]. Linoleic acid (18:2, ω-6, LA) was the most typical PUFA in hemp oil across all genotypes that were examined, accounting for 59% of the total fatty acids. The second prominent PUFA was α-linolenic acid (18:3, ω-3, ALA) with a percentage of 22% [40]. So, these two fatty acids, also known as essential fatty acids (EFA), are particularly abundant in hemp oil [41]. They are essential for maintaining a healthy human life and must be included into a diet. In order to meet our daily dietary needs, hemp seeds or derived products can be consumed.

3.4. Protein content

Depending on the environmental factors and variety, the protein content of whole hemp (*Cannabis sativa* L.) seeds can vary from 20 to 25% [42]. The amount can increase even more in some processed products, for example: shelled seeds, hemp meal (*Cannabis sativa* L.), that is; the remaining fraction of hemp (*Cannabis sativa* L.) seeds obtained after the extraction of its oil fraction [27,43].

Proteins are found predominantly in the inner layer of the hemp seed (*Cannabis sativa* L.), only a small share of proteins was found in the shell [11]. The high protein content found in processed products is a result of removal of those components that are devoid of protein, such as the hull, which is a rich source of fiber, thus its removal leads to an increase in the amount of protein and oil. A greater amount of protein is recorded when both the hull and the oil are removed [44].

While following the research stages, it was found that the temperature for denaturation of proteins isolated from hemp (*Cannabis sativa* L.) is equal to 92 °C. The heat treatment influences the structured characteristics of the proteins and their digestibility. High temperatures favor protein-protein interactions instead of protein-water interactions [45].

The main factors that indicate the quality of a protein are their bioavailability and digestibility. A number of authors studied the amino acid profile of hemp (*Cannabis sativa* L.) protein [46,47]. The analyzed product was the protein extracted from whole hemp (*Cannabis sativa* L.) seeds, and the protein isolate from commercial hemp, so that the obtained results are expressed either in regards to the whole seeds (g of amino acids per 100 g of seeds), or in regards to the total proteins (g of amino acids per 100 g of protein) [33].

The essential amino acids (EAA) needed by humans are all found in the proteins of hemp (*Cannabis sativa* L.) seeds. Glutamic acid (3.74–4.58% of whole seeds) and arginine (2.28–3.10% of whole seeds) are the two most important EAA [41]. Whole hemp (*Cannabis sativa* L.) seeds can be regarded as a rich source of protein that contains a higher or similar amount of protein found in other products, like buckwheat (27.8%), chia seeds (18.2–19.7%), quinoa (13.0%) [28], and flax seeds (20.9%) [29]. From a dietary perspective, the protein fraction of hemp (*Cannabis sativa* L.) seeds is quite digestible. Similar to casein, it contains an excellent profile of the essential amino acids required for the infants. In addition to the rich EAA the benefits offered by arginine should be noted.

The cardiovascular system's health depends dramatically on arginine, a potent regulator of vascular tone. The best immunological response and muscle recovery are related to arginine and nitric oxide, so it could be mentioned that hemp (*Cannabis sativa* L.) seed protein is a crucial source of arginine that is easily absorbed [48]. Hemp (*Cannabis sativa* L.) seeds and the products derived from them (meal, protein isolate), being a rich source of protein, can be used in the vegetable-based diets [49].

3.5. Carbohydrates and dietary fiber content

Hemp seeds contain between 20 and 30 percent of total carbohydrates, most of which are dietary fiber, predominantly insoluble [47]. However, some scientists have noted that the high amount of fibers in hemp seeds may cause negative impact on the protein's ability to be digested [50]. On the other hand, it is especially important to keep in mind that eating dietary fiber has numerous positive effects on one's health. It improves insulin sensitivity being a functional product with microbial activity, has the potential to lower hunger and prevent excessive food consumption, decrease of the obesity and diabetes are just a few of these advantages. Finally, dietary fiber lowers total blood cholesterol and low-density lipoproteins. Because it is not digested in the small intestine, it passes into the large intestine and is fermented there by the gut microbiota, which creates short-chain fatty acids with anti-inflammatory and anticancer properties [51].

3.6. Mineral content

The mineral profile of (*Cannabis sativa* L.) seeds was analyzed by few researchers [52,53], but it was demonstrated that seeds are the rich source of necessary macro- and microminerals. The main minerals found in hemp (*Cannabis sativa* L.) seeds are: magnesium (Mg), potassium (K), sodium (Na), phosphorus (P), and calcium (Ca), and the trace elements are as follows: zinc (Zn), copper (Cu), iron (Fe), and manganese (Mn). The ash content was also analyzed in other oleaginous seeds, such as chia seeds [29] and flax seeds [54], while examining the obtained data it was noticed that hemp (*Cannabis sativa* L.) seeds feature the highest content per 100 g of the analyzed product (4.9–6.0/100 g for hemp (*Cannabis sativa* L.) seeds, 4.56–5.07 g/100 g for chia seeds and 3.5 g/100 g for flax seeds).

3.7. Phenolic content and free radicals scavenging activity

Regarding the functional potential, it has been shown that a large part of the phenolic compounds in hemp (*Cannabis sativa* L.) seeds have a high free radicals scavenging activity, particularly quercetin, the phenolic amide N-transferorilyramine, the lignanamides 3,3'-demethyl-grossamide, and 3,3'-demethylheliotropamide have the ability to inhibit the enzyme acetylcholinesterase (AChE) *in vitro* at a concentration of 100 μg/ml, showing similarities to the properties of the medications used to treat mild to moderate Alzheimer's disease (AD) [55].

According to some research, N-trans-caffeoyltyramine, which is derived from hemp (*Cannabis sativa* L.) meal, was discovered to have the highest antioxidant and arginase inhibitory action. In addition to improving endothelial functionality and decreasing oxidative stress, which is a key factor in the initiation and progression of endothelial dysfunction associated with a variety of disorders, including cardiovascular disease, arginase inhibition may boost bioavailability of nitric oxide (NO) [56]. Phenylpropionamides extracted from hemp (*Cannabis sativa* L.) are thought to have anti-inflammatory and neuroprotective properties, which are the most significant biological impacts. Thus *N-trans*-caffeolyltyramine exhibit DPPH free radicals scavenging activity and ORAC antioxidant activity, LDL protection against oxidation, arginase inhibitory activity, and *in vitro* prevention of H_2O_2 induced cell death [57,58,59,60]; *N-trans* feroryyltyramine, *N-trans*-cafeoloctopamine, *N-trans*-coumaroyltyramine, Cannabisin A, B, C, D and E present in *Cannabis sativa* L. seeds have anti-neuroinflammatory action *in vivo,* DPPH free radical scavenging activity [17,56,61–65]; Sativamide A and B can reduce cell death induced by endoplasmic reticulum (ER) stress [57]; coumaroylaminobutanol glucopyranoside might decrease the nuclear factor kappa-light-chain-enhancer of inflammatory pathway of activated B cells (NF-κB) and activate of the Nfr-2 antioxidant pathway [64].

From a chemical standpoint the sativamides A and B, which are the unique bioactive hemp (*Cannabis sativa* L.) substances, are non-lignanamide molecules produced from *N-trans*-caffeoyltyramine. Pretreatment of the human neuroblastoma cell line SH-SY5Y with 50 μM of sativamide A or B demonstrated its ability to prevent cell mortality induced by endoplasmic reticulum stress, which has been proven to play a major role in neurodegenerative disorders such as Parkinson's and Alzheimer's disease (AD [56,62].

The neuroprotective effect of various phytochemicals obtained from hemp (*Cannabis sativa* L.) has demonstrated to be specifically connected to some of the listed chemicals' ability to reduce inflammation and to function as antioxidants onto microglia cells, which are immune cells of the brain's central nervous system that control immunological reactions, thus having a significant impact on brain inflammation and brain infection. Multiple sclerosis, in reality, is characterized by chronic inflammation and oxidative stress, and the persistence and overactivation of these cells are frequently connected to the destruction of neurons and the emergence of neurodegenerative disorders, such as AD and Parkinson's disease [62].

3.8. Bioactive hemp (Cannabis sativa L.) seed peptides content

Bioactive peptides are functional components found in hemp (*Cannabis sativa* L.) seeds in addition to phenolic substances. Hydrolyzed proteins of hemp seeds (*Cannabis sativa* L.) showed high bioactive properties [66], including antioxidant [44], antihypertensive [67], antiproliferative [68], hypocholesterolemic [69,70], anti-inflammatory and neuroprotective [69].

These researches demonstrate that bioactive peptides are scattered in the local design of proteins and are delivered during the hydrolysis cycle. Contingent upon the hydrolysis conditions, hydrolysates with different kinds and levels of action proficiency can be gotten. This is because the hydrolysis conditions can impact the sort of peptides obtained, to be specific the size and profile of the amino acids, subsequently the design which thus impacts the movement and capability of the peptides.

Another bioactive property attributed to the hemp (*Cannabis sativa* L.) protein hydrolyzate was its antihypertensive activity [42]. After some researches it was discovered that the majority of bioactive peptides that may inhibit renin and proteases — angiotensin-I-converting enzyme (ACE) comprised of three or four amino acids as well as of certain structural traits related to their amino acid sequence.

In conclusion of this clause, *in vitro* and some *in vivo* studies have shown the functional benefits of protein hydrolysates and peptides extracted from hemp (*Cannabis sativa* L.) seeds, the stability of peptides in the gastrointestinal system and their bioavailability, namely their capacity to arrive at the desired location in an active and functional state, have not yet been studied in humans.

3.9. Cannabinoids content

Cannabis sativa L. contains over 120 cannabinoids, each having the unique effect on the human body. Cannabidiol (CBD) is one of the most abundant cannabinoids that do not cause any harmful side effects, followed by Tetrahydrocannabinol (THC), the psychotropic substance of hemp (*Cannabis sativa* L.).

The therapeutic application of cannabinoids is a very controversial subject, because despite the therapeutic properties, these compounds also have psychotropic effects. Two examples of drugs developed based on cannabinoid compounds are Marinol ® (Dronabinol, (–)-D9-THC), developed by Roxane (Columbus, USA) and Cesamet ® (Nabilone), developed by Eli Lilly (Indianapolis, USA) and currently released for therapeutic use in Great Britain. Medicines are marketed to control vomiting caused by chemotherapy treatments and as appetite stimulants to beat anorexia processes developed in patients with acquired immunodeficiency syndrome (AIDS) [71].

Although, cannabinoids have a direct impact on a variety of human vital systems, such as the immunological and reproductive. The central nervous system is the primary target of cannabinoids' pharmacological effects [72]. Cannabinoids have been found to have an analgesic effect [73], that participates in the control of spasms in patients with multiple sclerosis [74], it provides positive effect in the treatment of glaucoma, it has bronchodilator and anticonvulsant effects [75]. Some adverse reactions may also occur, such as: cognitive and memory changes, euphoria, depression, sedative effect and others [76].

Despite their multiple therapeutic properties, cannabinoids also have psychotropic properties as a side effect, thus limiting their use as medicine in many countries of the world. However, studies are being carried out on the relationship between the chemical structure and biological activity, with the aim of modifying the structure and suppressing its psychoactivity. The study of structure-activity relationships (SAR) aims to establish relationships between the molecular descriptors and the biological activity in question, helping to elucidate the mechanism of action of cannabinoid compounds [77].

4. Conclusion

Cannabis sativa L. culture is cultivated in almost all countries of the world for medicinal and industrial purposes. The cultivation of this crop has a beneficial effect on the soil, increasing its fertility for the further growth of other crops.

As the nutritional and therapeutic benefits of hemp (*Cannabis sativa* L.) were researched and recognized, the interest of the population and the production of hemp (*Cannabis sativa* L.) seeds increased, they are currently used even in the food industry, in the production of oil, flour, protein extract, milk or simply used as an additive food.

Hemp (*Cannabis sativa* L.) seeds contain 25–35% lipids with the unique, perfectly balanced composition of fatty acids (FA); 20–25% easily digestible proteins that are abundant in essential amino acids; 20–30% of carbohydrates, large part of which are made up of dietary fibers, mostly insoluble; as well as vitamin B_1, B_2, B_6 and minerals. 100 g of seeds contain the average daily rate of phosphorus, potassium, magnesium and manganese. This content of vitamins and minerals provides hemp (*Cannabis sativa* L.) seeds with high therapeutic effect.

Although it has been proven by research to be a functional and therapeutic product, the side effect, i. e. psychoactivity as well as the name itself, still serves as an obstacle regarding the wide use of *Cannabis sativa* L. plant derivatives for therapeutic purposes and in the food industry.

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