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

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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.

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

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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.

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

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.

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