Physiological effects claimed for hemp seeds contained in food preparations: an update

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Abstract

Food supplements are one of the most widely marketed food categories in the world. In relation to several cases of adverse effects reported due to the plant substances contained in these products, the attention of the scientific communities and public decision-makers should be directed to the physiological effects that can be attributed to these substances and that encourage their increasing sales to consumers. This is the case of the plant *Cannabis sativa L.* In order to evaluate the scientific validity of the physiological effects attributable to *Cannabis sativa*, a bibliographic search was carried out on the evidence published. This short manuscript has highlighted how, despite the presence on the market of a large number of plant substances present in food preparations, there is not always clear evidence to support the physiological effects attributed to these products. As a result, it is essential to monitor the market to safeguard the food safety of consumers worldwide.

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Introduction

In recent years, diet and nutrition have increasingly become the focus of the health needs of the population worldwide, and in Europe, their interconnection to the food system is also highlighted in the Green Deal strategy (Neufeld *et al.,* 2023). The categorization of foods used to supplement the common diet encompasses foods for specific groups of populations, fortified foods, and food supplements (FS) (Zovi *et al.,* 2024; Zovi *et al.,* 2025). Specifically, FS are food products intended to integrate the common diet. Nowadays, FS are one of the most widely marketed food categories in the world, thus pharmacists and healthcare professionals have a crucial role in dispensing them and monitoring their consumption (Lordan, 2021). Data from markets around the world on the sale and consumption of FS indicate that herbal supplements have a large size of this market (Djaoudene *et al.*, 2023). In 2021, the global market for functional foods, which includes food and herbal supplements, reached 500 billion USD, with an anticipated growth rate of 6.9% per year, aiming for approximately 745 billion USD by 2027 (European Commission, 2018). As an example, the United States and Italy represent significant contributors, with Italy ranking second globally, where the industry's annual revenue exceeds 5 billion euros (Eurostat, 2023). Such growth is stimulated by increased consumer health awareness, especially post-COVID-19, and the trend toward sustainable wellness. Investments in herbal and food products are expected to support not only consumer health but also global economic growth and job creation in high-tech and scientific fields (Circular Economy Network, 2023). Concerning the well-being and the One Health approach and in relation to several cases of reported adverse effects due to the plant substances contained in food products, the attention of the scientific and regulatory communities should be placed on the physiological effects that are attributed to these substances and that encourage their growing sale to consumers (Colombo *et al.,* 2020). This is the case, for example, of the plant *Cannabis sativa L.* of the Cannabaceae family, whose parts used in the composition of some FS are the seed and the oil obtained from the seed, which is used for their high nutritional value and functional characteristics (Vodolazska and Lauridsen, 2020; Banskota *et al.,* 2022).

Methods

According to research conducted on the European market, the main physiological effects attributed to Cannabis are the integrity and functionality of cell membranes, the trophism and functionality of skin, the contrast of menstrual cycle disorders, and the improvement of joint functionality (European Food Safety Authority, 2024). All these properties can induce and stimulate the consumer to purchase these preparations. As a result, to evaluate the scientific validity of the physiological effects attributable to *Cannabis sativa*, a bibliographic search has been carried out by consulting the PubMed database. The study focused on studies conducted in humans, and the results of the bibliographic search are illustrated in Table 1 (Callaway *et al*., 2005; Schwab *et al*., 2006; Kaul *et al*., 2008; Rezapour-Firouzi, Arefhosseini, Mehdi *et al*., 2013; Rezapour-Firouzi, Arefhosseini, Farhoudi *et al*., 2013; Rezapour-Firouzi *et al*., 2014; Del Bò *et al*., 2019; Chaves *et al*., 2020). The search query set on the database included the terms "physiological", "effects", "cannabis", "hemp", "seed", "food", "human", "animal" and the words "AND", "OR", "NOT".

Results

A total of 8 studies out of 20 analyzed the activities and physiological properties attributable to hemp seeds as components of foods consumed by humans. The research showed that the studies examined are not always comparable due to the use of different parameters, including the types of experimental designs used, the different dosages between the preparations under study, and the individual constituents of the hemp-based preparations, such as oils, particularly concentrated in omega 3 (>70%). Furthermore, it is well known that in the literature, there is limited and not always recent evidence with respect to food studies conducted on humans, unlike preclinical studies conducted on animals. Overall, scientific literature seems to highlight some beneficial effects for humans due to the consumption of Cannabis, in particular in the treatment of atopic dermatitis, the functionality of some blood parameters, and the modulation of the inflammatory state. However, these effects are mostly attributable to hemp for its pharmacological activity and not to its use as a food. On the other hand, with reference to other physiological effects, such as the contrast of premenstrual syndrome, the improvement of joint functionality and cell membranes, there does not seem to be evidence attributable to the properties of *Cannabis sativa* seed oil.

Discussion and Conclusions

In conclusion, the studies examined in the literature available to date do not allow us to draw definitive answers regarding the plausibility of the physiological effects potentially related to the consumption of the plant *Cannabis sativa* contained in FS. It is noteworthy that FS are products that are increasingly occupying a share of the health product sales market. The freedom of access of consumers to this market, as well as the wide variability of ingredients and substances contained in these products, necessarily focuses attention on regulations that protect consumer safety and that are based on solid scientific evidence. This short communication has sought to highlight how, in the face of great demand from consumers and the presence on the market of a large number of plant substances present in food preparations, there is not always clear evidence to support the physiological effects attributed to these products. For public policymakers in matters of food safety, it is essential to monitor the market from this point of view. Similarly, for healthcare professionals, this criticality could repre-

Table 1. Studies on humans focused on the physiological effects attributable to *Cannabis sativa* in foods (in chronological order of pub-

Study, year	Type of study	Plant derivative tested	Aim of the study	Results
Callaway *et al.*, 2005	Randomized clinical trial	Cold pressed hemp seed oil (82% PUFA) 30 ml/die	Evaluation of the effects on: plasma lipid profiles, transepidermal water loss, skin quality and topical drug use.	Significant increase in plasma levels of LA, ALA and GLA. Significant improvement in skin quality and atopic symptoms without adverse reactions. Reduction in transepidermal water loss, skin dryness, itching and use of topical medications.
Schwab *et al*., 2006	Randomized clinical trial	Consumption of 30 mL/day of hemp seed or flaxseed oil	Comparison of the effects of hemp oil and linseed oil on plasma lipid profile, glycemia and insulinemia, and haemostatic factors.	No significant changes in glycemia, insulinemia and haemostatic factors.
Kaul *et al.*, 2008	Clinical study not randomized	Capsule containing 1 g of hemp seed oil (78.4% PUFA)	Evaluation of the effects on cardiovascular parameters (lipid profile, LDL oxidation, inflammatory markers and platelet aggregation)	No statistically significant effect
Rezapour-Firouzi, Arefhosseini, Mehdi *et al.*, 2013	Randomized clinical trial	Blend consisting of hemp seed oil and evening primrose oil (9:1) (PUFA: ND)	Evaluation of the protective effect of the "Hot-natured" diet in association with a mixture of hemp seed oil and evening primrose oil (9:1) or of the oil mixture alone on inflammatory status	Significant improvement in the clinical condition and inflammatory status of patients, without any side effects
Rezapour-Firouzi, Arefhosseini, Farhoudi *et al.*, 2013	Clinical study not randomized	Blend consisting of hemp seed oil and evening primrose oil (9:1) (PUFA: ND)	Evaluation of the effect of the "Hot-natured" diet in association with a mixture of hemp seed oil and evening primrose oil (9:1) on the type and levels of cytokines produced	Significant improvement in extended disability status score. Significant decrease in proinflammatory cytokine production (IFN- and IL-17). Significant increase in anti-inflammatory IL-4 production.
Rezapour-Firouzi *et al.*, 2014	Randomized clinical trial	Blend consisting of hemp seed oil and evening primrose oil (9:1) (PUFA: ND)	Evaluation of the effect of the "Hot-natured" diet in association with a mixture of hemp seed oil and evening primrose oil (9:1) or the oil mixture alone on liver dysfunction in patients with multiple sclerosis.	The treatment significantly improved liver dysfunction, without any adverse effects. Both treatments significantly improved the extended disability status score; both treatments significantly reduced AST levels; only the "Hot-natured" diet associated with the oil blend significantly reduced serum levels of the enzymes ALT and GGT.
Del Bò *et al.*, 2019	Randomized clinical trial	Soft capsule containing 0.75 g of hemp seed oil (76.7% PUFA)	Evaluation of the modulation of hyperlipidemia and cardiovascular risk	No effect on TC, LDL, HDL and TG levels. No effect on body weight, BMI and blood pressure.
Chaves *et al.*, 2020	Randomized clinical trial	THC Rich Cannabis Oil (24.44 mg/mL THC and 0.51mg/mL cannabidiol)	Evaluation of the beneficial effects on the quality of life in patients with fibromyalgia	Significant increase in quality of life and reduction of symptoms. Treatment well tolerated.

ALA, α-linolenic acid; ALT, alanine aminotransferase; AST, aspartate aminotransferase; BMI, body mass index; FVIIa, coagulation factor VIIa; GGT, γ-glutamyl transferase; GLA, γ-linolenic acid; HDL, high-density lipoprotein; LA, linoleic acid; LCPUFAs, long-chain polyunsaturated fatty acids; LDL, low-density lipoprotein;

sent an opportunity to carve out a key role in the health landscape to safeguard the health and safety of consumers.

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