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Medicinal Exploitation of *Coriandrum sativum* L.

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ABSTRACT: *Coriandrum sativum* L. is a potential herb that is commonly known as coriander or Chinese parsley is being possessed to have various medicinal properties. Almost all the parts of the herb have been examined for its effectiveness in various human diseases such as migraine, hypertension and diabetes specifically. The diseases considered for the current review are migraine, hypertension and diabetes, which are highly prevalent as well as major co-morbidity for other clinical conditions. The extracts of different parts of *C. sativum* have been identified to have roles in treating and managing migraine, hypertension and diabetes. The genetic inter-relationship of *C. sativum* with the diseases are also being discussed in this review. The literature surf was done in platforms for the journals life science and medicinal research using the keywords *C. sativum*, herbal medicine, anti-diabetic, anti-hypertensive, migraine, genetics etc. The results obtained through the clinical trials conducted by various researchers globally were satisfactorily acceptable in treating these diseases along with some other diseases to a certain extent, whereas the genetic studies were insignificant. Henceforth, the current literature review highlights the medicinal exploitation of *C. sativum* in accordance with the treatment and management of migraine, hypertension and diabetes.

1. INTRODUCTION

Coriandrum sativum L. (commonly referred as coriander) is an edible herb used in the culinary purposes (Abbassi et al., 2018; Burdock & Carabin, 2009), which belongs to the Apiaceae family (NCBI, 2020). The herb grows at the moderate temperature and the image captured after the complete growth of the herb has been shown in Figure 1 . This herb grows majorly in the Asian countries, which estimates roughly about 71.4% of the total world's production (Song et al., 2020).

Being a significant edible herb, coriander has also been encountered with enormous number of medicinal properties including anti-microbial (Ozkinali et al., 2017; Sumalan et al., 2019; Zare-Zardini et al., 2012), anti-cancer (Gomez-Flores et al., 2010; Tang et al., 2013), anti-diabetic (Asgarpanah & Kazemivash, 2012), anti-inflammatory (Nair et al., 2013) as well as against hypertension and various other diseases (Laribi et al., 2015; Sangeetha et al., 2022). The current literature review mainly focuses on the various exploitations of the *C. sativum* in the field of treatment of human clinical diseases.

2. PHYTOCHEMICAL COMPONENTS OF *C. SATIVUM*

The leaves of *C. sativum* has been analysed for the presence of quantity and characterisation of phytochemical components by various spectroscopic techniques like gas chromatography–mass spectroscopy (GC-MS) and it has been concluded that the herb is found to be rich in vitamins (C, B_1, B_{12}) as well as carotene pigment (Prachayasittikul et al., 2018; Song et al., 2020). *C. sativum* leaves are also rich in components like flavonoids, alkaloids, tannins and sterols (Hussain et al., 2018). Along with the nutritional values, the presence of ascorbic acid

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Figure 1. *Coriandrum sativum* L.

has also been confirmed (Tang et al., 2013). The other chemical components present in the plant have been shown in Figure 2.

3. MEDICINAL EXPLOITATION

The *C. sativum* is an entire edible herb filled with medicinal properties that can be exploited in the clinical field for the treatment of various diseases and disorders. The current study on the literature survey of *C. sativum* has concentrated on the particular diseases such as, migraine (neurological), hypertension (cardiac), diabetes mellitus (endocrinal) and other diseases.

3.1. *C. sativum* and migraine

One of the most common conditions, which affect 15% of common people in the world, is migraine that is capable of originating the dysfunction of bodily abilities (R. Liu et al., 2013; S. Mansouri et al., 2020; Zhang et al., 2016). A recent study by S. Mansouri et al. (2020), have reported that the syrup extracted from the *C. sativum* has the ability to reduce the extent of exposure to the migraine as well as the frequency of migraine attacks. Apart from the leaves of *C. sativum*, the fruits may also have considerable effects on the migraine attacks (Kasmaei et al., 2016). The fruits of *C. sativum* in combination with the extracts of flowers of *Viola odorata* (commonly called wood violet or sweet violet belonging to Violaceae family) and *Rosa damascena* (commonly called damask rose, a hybrid variety) have a crucial role in controlling the pain in migraine patients (Kamali et al., 2018). From the available literature, it may be observed that, only very few studies have been conducted on the effects of extracts of *C. sativum* in the migraine patients and all the studies have reported positive effects on the control and management of migraine by the extracts of leaves, stem and fruits of *C. sativum*.

3.2. Antihypertensive nature of *C. sativum*

A predominant risk factor for most of the fatal chronic diseases is hypertension, which affects more than half of the human population worldwide. Angiotensin I converting enzyme (ACE), which plays a crucial role in hypertension management is being analysed with the extracts of *C. sativum*. The inhibitors of ACE have the therapeutic effects of reducing hypertension Hussain et al. (2018); Kouchmeshky et al. (2012); M.K. Pathan and Cohen (2020). The fresh leaves of *C. sativum* have rich flavonoid contents and they have a very high notable role in controlling the increased blood pressure (Hussain et al., 2018; R.H. Liu, 2003). The powdered extracts of *C. sativum*, used in the study involving human individuals indicated increased production of cardio–protective agents, indicating its role in cardio protection (Farzaei et al., 2017; Takii et al., 2001). The fruit extracts of *C. sativum* reduces the effects of hypertension in animal model, rabbit, by relaxing the valves of aorta (Disi et al., 2016; Jabeen et al., 2009). The efficiency of extracts of *C. sativum* in preventing the arterial pressure due to accumulation of fats is very significant in the in vivo studies (Patel et al., 2013).

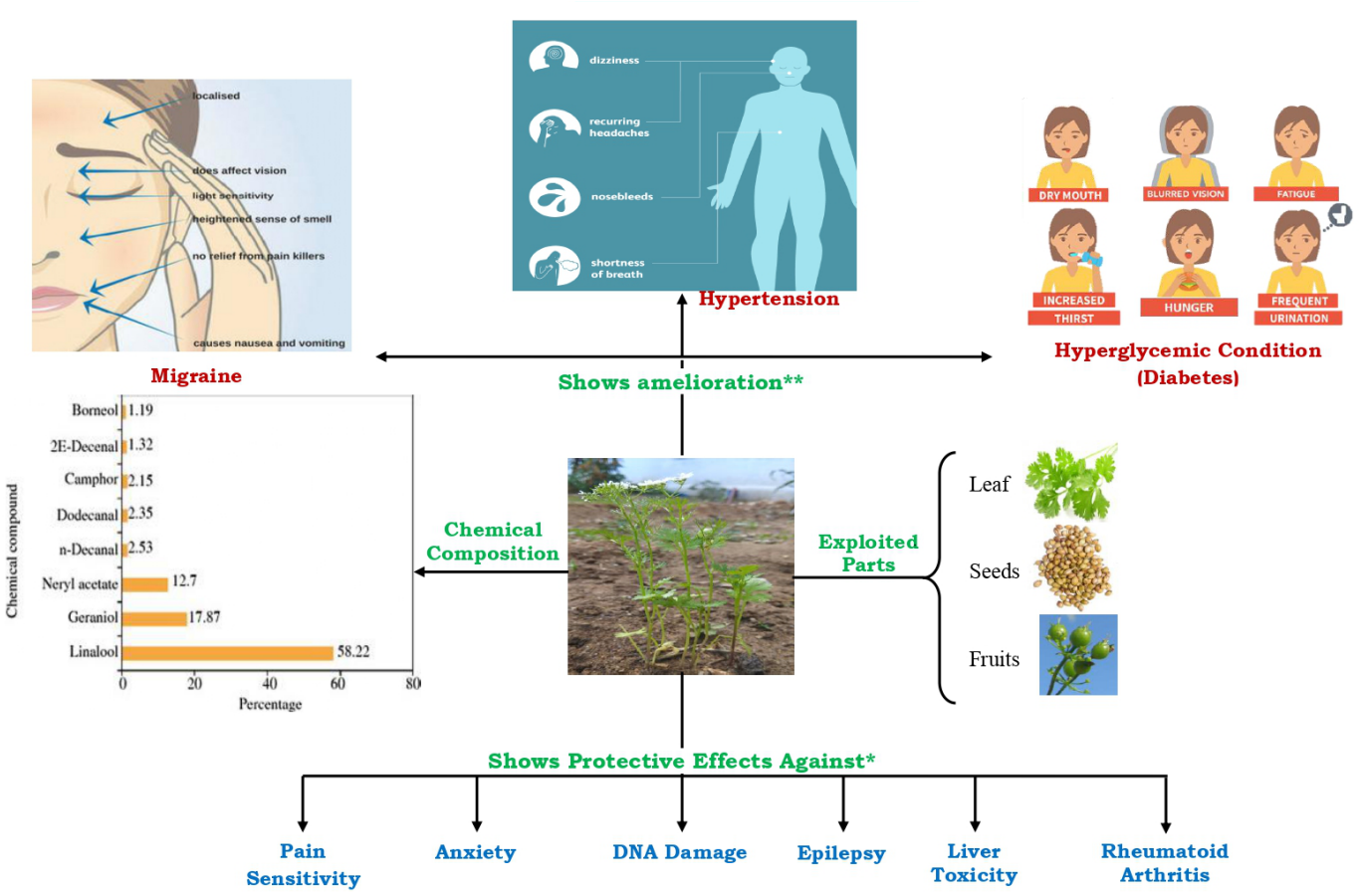
3.3. *C. sativum* against diabetes

Diabetes mellitus, an endocrinal disorder is characterized by the far above glucose levels in the body, which may be either due to improper secretion of insulin or improper utilization of insulin by the human body (Association, 2009). An animal-based study by Eidi et al. (2009) have obtained positive relationship between the fruits of *C. sativum* and the balancing of glucose levels Farzaei et al. (2017). The seeds of *C. sativum* have been found to be associated with the reducing hyperglycaemia and it has been reported by Swanston-Flatt et al. (1990) via *in vivo* studies (Luna et al., 2016). Nephropathy in diabetic condition may be treated by using the seed extracts of *C. sativum*, in which hyperglycaemic condition gets better after the treatment in animal models (Kajal & Singh, 2019).

3.4. *C. sativum* and other diseases

On treatment with the extracts of *C. sativum* on the chicks by Khubeiz and Shirif (2020) elevation in the weight of heart have been observed. A *in vivo* study by Nair et al. (2012) have reported a positive correlation of seed extracts of *C. sativum* as an effective curative for rheumatoid arthritis. The root extracts of *C. sativum* have promising effects against the cancerous growth by restraining the DNA damage (Tang et al., 2013) . According to the literature analysis, only very few studies have focussed on the activity of *C. sativum* extracts of root, against cancerous growth but the results were not reported with more positive correlation. To the current updating of literature review, no study has been reported on the correlation of *C. sativum* extracts in the treatment of anaemia, a blood disorder due to the lower concentration of haemoglobin.

Taherian et al. (2012) reported that the aqueous extracts of the seeds of *C. sativum* may be employed in blocking the pain receptors and the effects were positive in albino mice



** - Highly Significant Results Available through literature; * - Further studies need to be performed

Figure 2. *Coriandrum sativum* and its clinical exploitations

Table 1
Various parts of *C. sativum* and their medicinal properties

S. No	Part of the Plant	Extract	Medicinal Property	References
		Essential Oil	Anti-fungal	Ide et al. (2014)
1.	Leaf	Aqueous	Anxiolytic Activity	Latha et al. (2015)
		Petroleum Ether and Ethyl Acetate	Nephroprotective	Lakhera et al. (2015)
4.	Fruits	Hydroalcoholic and Essential Oil	Anti-inflammatory	Heidari et al. (2016)
		Essential Oil	Antibacterial	N. Mansouri et al. (2018)
5.	Seeds	Ethanolic	Radio protective	Samarth et al. (2017)
		Aqueous	Anti-diabetic	Al-Rowais (2002); Otoom et al. (2006); Skalli et al. (2019); Tahraoui et al. (2007)
8.	Seed, Stem and Leaf	Hydroalcoholic	Increases Appetite	Nematy et al. (2013)

models, when compared to the analgesic like dexamethosone. The leaf extracts of *C. sativum*, on administration in albino rats expressed considerable protection against the liver damage and liver toxicity (Pandey et al., 2011). It has also showed considerable effects in reducing the anxiety levels in neuro-diseased mice models (Khazdair et al., 2018; A. Pathan et al., 2011). Anti-epileptic activity was also been expressed by the seeds of *C. sativum* (Hosseinzadeh & Madanifard, 2000; Khazdair et al., 2018).

4. GENETIC DATUM OF *C. SATIVUM*

C. sativum have been found to have approximately 40,747 genes (Song et al., 2020). The studies on the inter relationship of the genes and phenotypical expression of the human individuals with the *C. sativum* has been found to be related in a hypothetical manner, yet the pathophysiology remains undetermined. Olfactory Receptor family 6 subfamily A member 2 (OR6A2), a gene which plays a role in the perception of smell, was found to be affected in the humans. A polymorphic presence in this gene has been found the people, who were not able to detect the smell of *C. sativum* (Eriksson et al., 2012; NCBI, 2020). Olfactory Receptor family 4 subfamily N member 5 (OR4N5), a receptor for neuronal olfactory response is being investigated for the relationship with *C. sativum* and the results showed a polymorphic appearance at rs7277172 (Eriksson et al., 2012; Hayes et al., 2013; Robino et al., 2019). Other than olfactory receptors, a single nucleotide polymorphism at rs427871 has also been observed in a gene, Taste 2 Receptor Member 1 (TAS2R1), which is responsible for taste receptors and the polymorphic individuals showed hatred towards coriander leaves (Hayes et al., 2013). Table 1 shows the medicinal properties of various parts of *C. sativum*. Henceforth, from the available literature, the genetic studies available so far in *C. sativum*, is mainly linked with smell and taste receptors of human beings.

5. CONCLUSION

The current literature survey has been framed to analyse the various clinical exploitations of the herb, *C. sativum*. From the available literature, all the parts of the herb have been observed to contain a significant range of medicinal value. Leaf and seeds of coriander shows higher medicinal value. Although, a vast range of human diseases prevail, we have considered the most common and the diseases, to which the people are vulnerable easily. Herewith, we are concluding that the extracts of *C. sativum* is more effective in treatment of migraine, diabetes and hypertension and effective to certain extent in treating some other clinical conditions too.

6. LITERATURE SURVEY AND THE STUDY DESIGN

The research and review articles published in the very recent years have been read and the suitable articles have been selected based on the nature of the study and the data. Almost all the search engine databases of life sciences were browsed including the articles in Elsevier, Nature, PubMed, Web of Sciences, PubMed Central and Springer. The data has been double checked before inserting into the manuscript. The authors are being performing their current research on *C. sativum* and hence, the authors have thorough understanding of the manuscript and the images inserted in the manuscript are being originally captured by the authors during the research work.

CONFLICTS OF INTEREST

Given his role as Associate Editor, Balamuralikrishnan Balasubramanian has not been involved and has no access to information regarding the peer review of this article. Full responsibility for the editorial process for this article was delegated to Editor in Chief Jesus Simal-Gandara. The authors declare no conflicts of interest.

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AUTHOR CONTRIBUTIONS

ST, VAA, BB - Research concept and design; NBT, KP, AM - Collection and/or assembly of data; KP, AM - Data analysis and interpretation; ST - Writing the article; VAA, KP, AM, BB - Critical revision of the article, F - Final approval of the article.

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