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The IJEHS is an official publication of Save The Environment (STE). It publishes peer reviewed quarterly, original articles (Research paper, Review articles, Short Communication, Case studies, etc.) related to all fields of Environment and Health Sciences. It disseminates the scientific research and recent innovations.

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International Journal of Environment and Health Sciences

From The Editor's Desk...

As we welcome the New Year 2022, the time has come to work together for creating a sustainable and environment-friendly earth around us by making the most of this recovery phase. New policies are being formulated for improving air, soil and water quality which will further improve the health status of public as well as the environment quotient. Undoing the economic losses and health crisis incurred in the past two years, by implementing more responsible actions will be the main pledge.

One important aspect of the 75th year of Indian independence under 'Azaadi ka Amrit Mahotsav' theme has been designated as repurposing natural compounds for therapeutic functions by harnessing the vast knowledge about traditional medical systems available in our ancient texts. Also, another major focus will be necessitating agricultural reforms in order to reduce gaps in crop production, while ensuring benefits of farmers, who are one of the most important pillars of nation-building.

In view of this, all of us have to act more responsibly by 'life management' such that we move a step closer towards achieving the goal of sustainability, as suggested by The United Nations.

Striving to achieve the aforesaid, The International Journal of Environment and Health Sciences (IJEHS) proposes to provide a reliable platform to discuss relevant technologies and strategies. IJEHS will be quintessential to academicians, industry professionals and researchers who are actively engaged in the areas of environmental issues and related health effects. We are pleased to inform that ISSN for IJEHS is available as 2582-5283. IJEHS is referenced in Crossref, the official Digital Object Identifier Agency (doi 10.47062). IJEHS is now also indexed in the International Scientific Indexing (ISI).

We invite original research articles, short communications and critical reviews directed towards an academic, clinical and industrial audience. The first section of the journal focuses on burning environmental issues like pollutants and their fate, waste management, resource conservation, remediation technologies, etc. The second section includes all topics relevant to physiological impact of environmental risk factors and application of alternative medicinal approaches as remedial measures. Detailed scope can be found in the home page of the journal (www.stenvironment.org/journals). Notes on development of any novel and validated strategy or tool to address environmental challenges are welcome. Discussion on proceedings of conferences conducted on environmental themes and related health aspects will also be considered.

All submissions will be meticulously scrutinized by pioneers in the field to ensure publication of only articles of high quality and relevance. Authors are requested to take special precautions to avert plagiarism and redundancy. It is high time that we realize the gravity of circumstances and take potent steps to undo the adversities already triggered. In this pursuit, IJEHS expects to be the ideal platform to discuss sustainable ideas and potential solutions.

We thank all authors who have contributed to the journal and have consistently been with us in the past years. With this, I wish all our readers a Very Happy New Year, 2022 and I hope our audience and patrons shall come together in this effort to promulgate their part in resurrecting our valuable environment.



Dr. Kshipra Misra
Editor-in-Chief, IJEHS

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A.
Environmental Sciences Section



ASSESSMENT OF GROUNDWATER QUALITY FOR DRINKING PURPOSE IN PIPLI BLOCK, KURUSHETRA DISTRICT, HARYANA

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Abstract

Water is important for living beings on the Earth. Groundwater is excessively used for drinking, irrigation and industrial purposes because of its easy availability. Groundwater is maximum used in irrigation which leads to the declining of groundwater depth and quality deterioration. Groundwater quality for drinking purpose assessed in the study area Pipli block in Kurukshetra district of Haryana state. The geo-coordinates of the study area are latitudes 29.91° N to 30.09° N and longitudes 76.81° E to 76.99° E and covers an area of 184.40 km². Geologically alluvium and geomorphologically alluvial plain are present. In the study area eight groundwater samples were collected in 250 ml double capped plastic bottles from tube wells. Geo-coordinates of sample locations were noted with the help of mobile GPS. Chemical analysis of eight groundwater samples were done using Tamilnadu Water Supply and Drainage (TWAD) Board, Chennai prepared Field Water Testing kit for twelve chemical parameters viz. pH, alkalinity, hardness, chloride, total dissolved solids (TDS), fluoride, iron, nitrite, nitrate, ammonia, phosphate and residual chlorine. Results of groundwater samples analysis were compared with BIS drinking water standards (IS 10500:2012) to know the suitability of groundwater for drinking purpose. In the study area pH ranges 6.5 to 7.5, alkalinity 220 mg/l to 350 mg/l, hardness 120 mg/l to 280 mg/l, chloride 20 mg/l to 80 mg/l, total dissolved solids (TDS) 492 mg/l to 828 mg/l, fluoride nil to 1.5 mg/l, iron is nil in all the eight groundwater samples, ammonia nil to 1mg/l, nitrite 0.2 mg/l to 0.5 mg/l, nitrate 45 mg/l to 75 mg/l, phosphate nil in all the eight groundwater samples and residual chlorine nil to 0.2 mg/l. The study is highly useful for planning and monitoring of groundwater quality for drinking purpose in the study area.

Keywords

Groundwater, quality, drinking, Pipli, Kurukshetra, Haryana

INTRODUCTION

Present developmental activities have put pressure on water resources. In the states like Haryana where agriculture is dominant and groundwater is used for irrigation purpose in the areas where canal network is less mainly in northern districts of the state. Excessive use of groundwater leads the decline of groundwater depth as well as groundwater quality deterioration. Good quality water is important for drinking to avoid many health problems. Belousova (2006), Samson and Elangovan (2011), Ishaku et al. (2012), Ocheri et al. (2014), Perween and Fatima (2015), Singh et al. (2015), Boskabady et

al. (2016), Khan and Rehman (2017), Bansal and Dwivedi (2018), Al-Hadithi et al. (2019) did work on groundwater quality for drinking purpose in different areas.

STUDY AREA

Pipli block is located in Kurukshetra district of Haryana (Fig.1). The geo-coordinates of the study area are latitudes 29.91° N to 30.09° N and longitudes 76.81° E to 76.99° E and covers an area of 184.40 sq. km. In the study area geologically alluvium and geomorphologically alluvial plain are present.

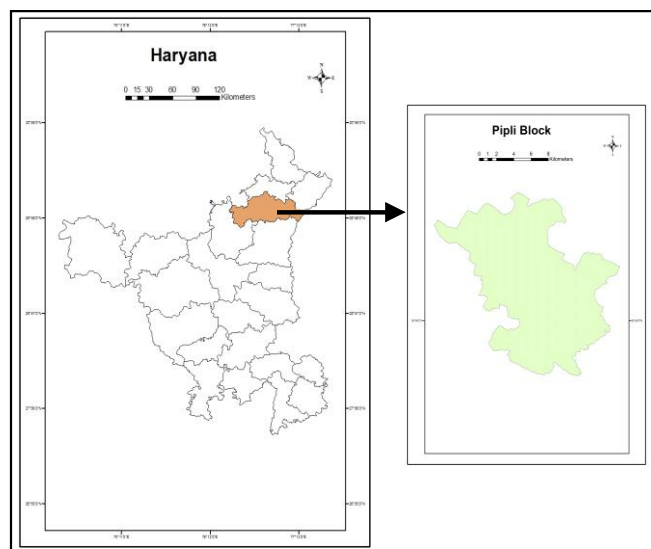


Fig.1: Location map of the study area.

OBJECTIVE

The main objective was to assess groundwater quality for drinking purpose in the study area.

MATERIALS AND METHODOLOGY

In the study area eight groundwater samples were collected in 250 ml double capped plastic bottles from tube wells (TW). Geo-coordinates of sample locations were noted with the help of mobile GPS. Chemical analysis of eight groundwater samples were done using Tamilnadu Water Supply and Drainage (TWAD) Board, Chennai prepared Field Water Testing kit for twelve chemical parameters viz. pH, alkalinity, hardness, chloride, total dissolved solids (TDS), fluoride, iron, nitrite, nitrate, ammonia, phosphate and residual chlorine. Result of chemical analysis of groundwater samples were entered in excel software and prepared bar graph for each chemical parameter. Result of groundwater samples analysis was compared with BIS (IS 10500:2012) drinking water standards (Table 2).

Table 1: Results of chemical analysis of groundwater samples.

S. No.	Sample Location	Latitude	Longitude	Source	pH	Alkalinity (mg/l)	Hardness (mg/l)	Chloride (mg/l)	TDS (mg/l)	Fluoride (mg/l)	Iron (mg/l)	Ammonia (mg/l)	Nitrite (mg/l)	Nitrate (mg/l)	Phosphate (mg/l)	Residual Chlorine (mg/l)
1	Jirbari	29.93	76.90	TW	7	250	150	80	576	1.5	0	0	0.5	75	0	0.2
2	Mathana	29.98	76.95	TW	6.5	300	120	20	528	1.5	0	0.5	0.5	45	0	0.2
3	Sodhi	29.93	76.93	TW	7.5	230	150	30	492	1	0	1	0.5	45	0	0.2
4	Untsal	30.03	76.92	TW	7.5	350	280	60	828	1	0	0	0.5	75	0	0
5	Ramgarh	30.01	76.89	TW	7	220	150	40	492	1	0	0.5	0.2	45	0	0
6	Partap Garh	29.99	76.88	TW	7	230	210	40	576	0	0	0	0.2	45	0	0
7	Sanwala	30.00	76.88	TW	7	260	240	50	660	0	0	0.5	0.2	45	0	0
8	Kanipla	30.05	76.86	TW	7.5	250	250	70	684	0	0	0	0.5	75	0	0

Table 2: BIS drinking water standards (IS 10500:2012).

Sl. No.	Parameters	Potable		Non potable Permissible
			Desirable	
1.	pH	6.5 - 8.5	-	<6.5 and >8.5
2.	Alkalinity (mg/l)	<200	200-600	>600
3.	Hardness (mg/l)	<200	200-600	>600
4.	Chloride (mg/l)	<250	250-1000	>1000
5.	Total Dissolved Solids (mg/l)	<500	500-2000	>2000
6.	Fluoride (mg/l)	<1.0	1.0-1.5	>1.5
7.	Iron (mg/l)	<0.3	-	>0.3
8.	Ammonia (mg/l)	<0.5	-	>0.5
9.	Nitrite (mg/l)	<1.0	-	>1.0
10.	Nitrate (mg/l)	<45	-	>45
11.	Phosphate (mg/l)	<1.0	-	>1.0
12.	Residual Chlorine (mg/l)	<0.2	0.2-1.0	>1.0

RESULTS AND DISCUSSION

i. pH

In the study area pH ranges 6.5 to 7.5 (Table 1, Fig.2). As per BIS (IS 10500:2012) drinking water standards pH is desirable between 6.5 to 8.5 and non-potable if less than 6.5 and more than 8.5 (Table 2). pH is desirable in all the eight groundwater samples (Jirbari, Mathana, Sodhi, Untsal, Ramgarh, Partapgarh, Sanwala, Kanipla).

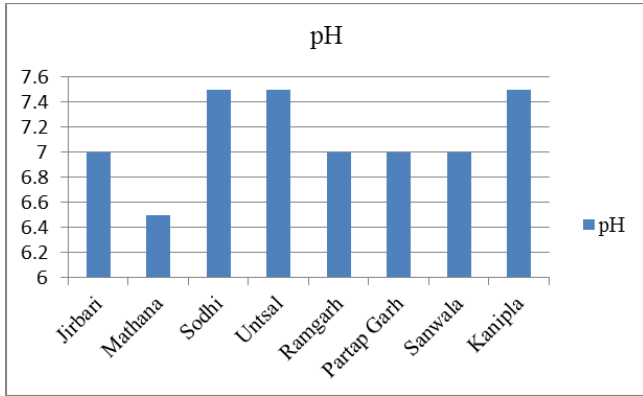


Fig. 2: pH in groundwater samples.

ii. Alkalinity

Alkalinity ranges 220 mg/l to 350 mg/l in the study area (Table 1, Fig.3). As per BIS (IS 10500:2012) drinking water standards alkalinity is desirable if less than 200 mg/l, permissible between 200 mg/l- 600 mg/l and non-potable if more than 600 mg/l (Table 2). Alkalinity is permissible in all the eight groundwater samples (Jirbari, Mathana, Sodhi, Untsal, Ramgarh, Partapgarh, Sanwala, Kanipla).

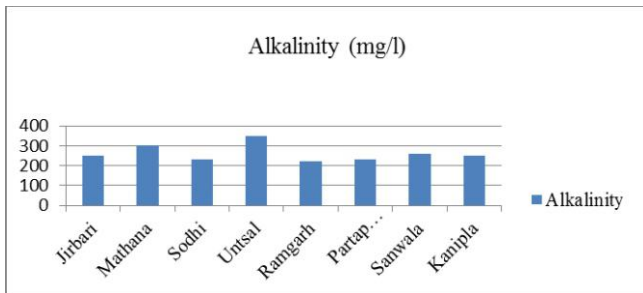


Fig. 3: Alkalinity in groundwater samples.

iii. Hardness

Hardness ranges 120 mg/l to 280 mg/l in the study area (Table 1, Fig.4). As per BIS (IS 10500:2012) drinking water standards hardness is desirable if less than 200 mg/l, permissible between 200 mg/l - 600 mg/l and non-potable if more than 600 mg/l (Table 2). Hardness is desirable in four

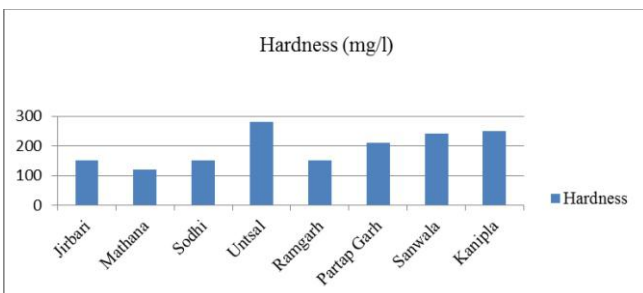


Fig. 4: Hardness in groundwater samples.

groundwater samples (Jirbari, Mathana, Sodhi, Ramgarh) and permissible in four groundwater samples (Untsal, Partap Garh, Sanwala, Kanipla).

iv. Chloride

In the study area chloride ranges 20 mg/l to 80 mg/l (Table 1, Fig.5). As per BIS (IS 10500:2012) drinking water standards chloride is desirable if less than 250 mg/l, permissible between 250 mg/l - 1000 mg/l and non-potable if more than 1000 mg/l (Table 2). Chloride is desirable in all the eight groundwater samples (Jirbari, Mathana, Sodhi, Untsal, Ramgarh, Partapgarh, Sanwala, Kanipla).

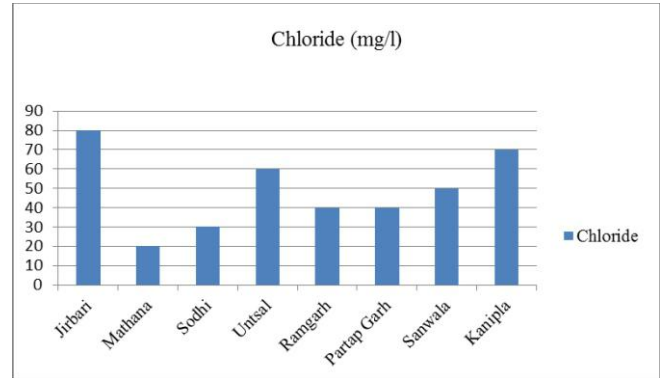


Fig. 5: Chloride in groundwater samples.

v. Total Dissolved Solids

Total dissolved solids (TDS) ranges 492 mg/l to 828 mg/l in the study area (Table 1, Fig.6). As per BIS (IS 10500:2012) drinking water standards TDS is desirable if less than 500 mg/l, permissible between 500 mg/l-2000 mg/l and non-potable if more than 2000 mg/l (Table 2). TDS is desirable in two groundwater samples (Sodhi, Ramgarh) and permissible in six groundwater samples (Jirbari, Mathana, Untsal, Partapgarh, Sanwala, Kanipla).

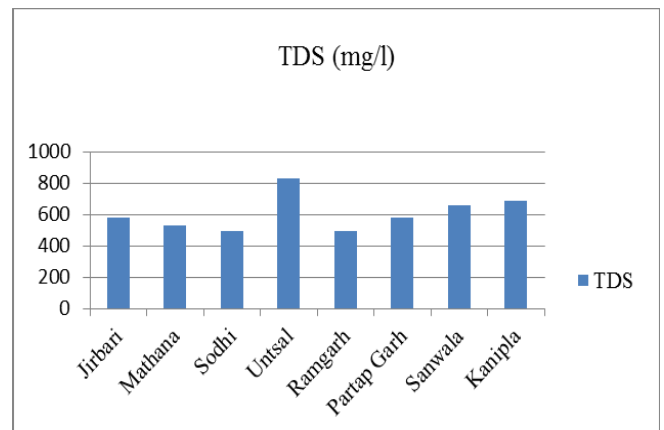


Fig. 6: TDS in groundwater samples.

vi. Fluoride

Fluoride ranges nil to 1.5 mg/l in the study area (Table 1, Fig.7). As per BIS (IS 10500:2012) drinking water standards fluoride is desirable if less than 1.0 mg/l, permissible between 1.0 mg/l -1.5 mg/l and non-potable if more than 1.5 mg/l (Table 2). Fluoride is desirable in three groundwater samples (Partapgarh, Sanwala, Kanipla) and permissible in five groundwater samples (Jirbari, Mathana, Sodhi, Untsal, Ramgarh).

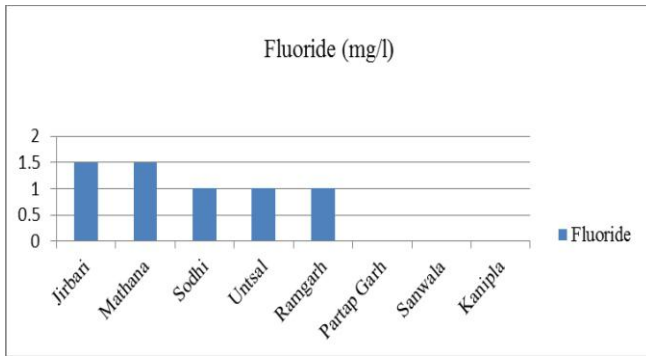


Fig.7: Fluoride in groundwater samples.

vii. Iron

Iron is nil in all the eight groundwater samples (Table 1, Fig.8). As per BIS (IS 10500:2012) drinking water standards iron is desirable if less than 0.3 mg/l and non-potable if more than 0.3 mg/l (Table 2). Iron is desirable in all the eight groundwater samples (Jirbari, Mathana, Sodhi, Untsal, Ramgarh, Partapgarh, Sanwala, Kanipla).

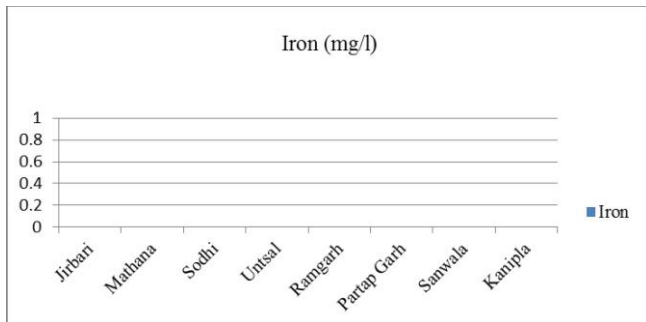


Fig. 8: Iron in groundwater samples.

viii. Ammonia

Ammonia ranges nil to 1mg/l in the study area (Table 1, Fig.9). As per BIS (IS 10500:2012) drinking water standards ammonia is desirable if less than 0.5 mg/l and non-potable if more than 0.5 mg/l (Table 2). Ammonia is desirable in seven groundwater samples (Jirbari, Mathana, Untsal, Ramgarh, Partap Garh, Kanipla) and ammonia is non-potable in one groundwater sample (Sodhi (1 mg/l)).

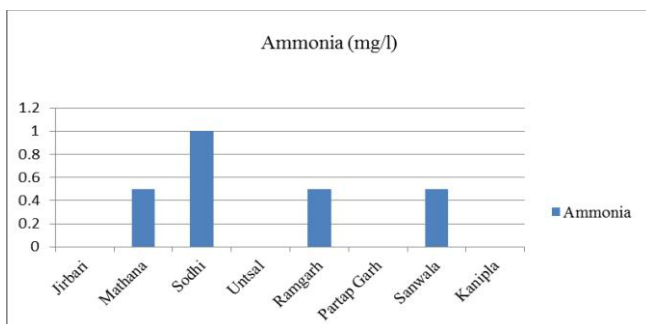


Fig. 9: Ammonia in groundwater samples.

ix. Nitrite

Nitrite ranges 0.2 mg/l to 0.5 mg/l in the study area (Table 1, Fig.10). As per BIS (IS 10500:2012) drinking water standards nitrite is desirable if less than 1.0 mg/l and non-potable if more than 1.0 mg/l (Table 2). Nitrite is desirable in all the eight groundwater samples (Jirbari, Mathana, Sodhi, Untsal, Ramgarh, Partapgarh, Sanwala, Kanipla).

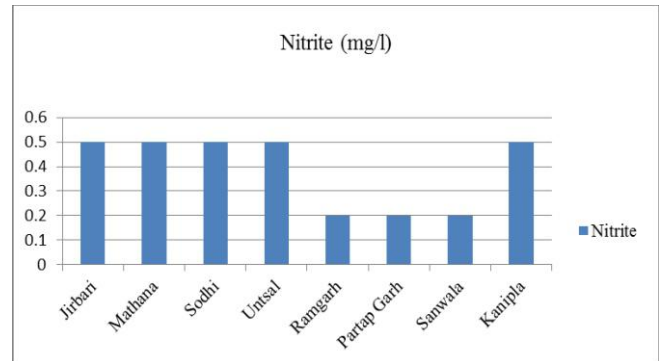


Fig. 10: Nitrite in groundwater samples.

x. Nitrate

Nitrate ranges 45 mg/l to 75 mg/l in the study area (Table 1, Fig.11). As per BIS (IS 10500:2012) drinking water standards nitrate is desirable if less than 45 mg/l and non-potable if more than 45mg/l (Table 2). Nitrate is desirable in five groundwater samples (Mathana, Sodhi, Ramgarh, Partapgarh, Sanwala) and non-potable in three groundwater samples (Jirbari (75 mg/l), Untsal (75 mg/l), Kanipla (75 mg/l)).

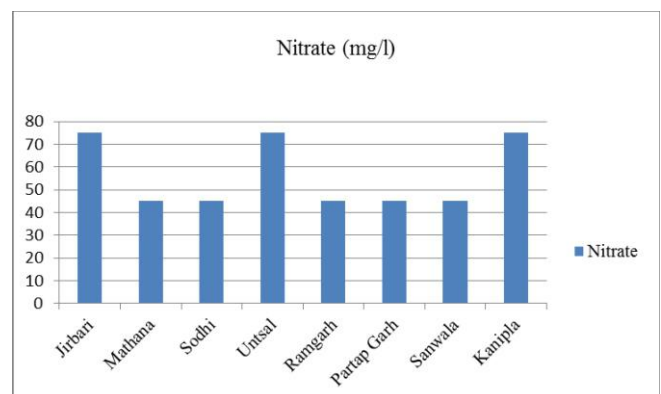


Fig. 11: Nitrate in groundwater samples.

xi. Phosphate

Phosphate is nil in all the eight groundwater samples in the study area (Table 1, Fig.12). As per BIS (IS 10500:2012) drinking standards phosphate is desirable if less than 1.0 mg/l and non-potable if more than 1.0 mg/l (Table 2). Phosphate is desirable in all the eight groundwater samples (Jirbari, Mathana, Sodhi, Untsal, Ramgarh, Partapgarh, Sanwala, Kanipla).

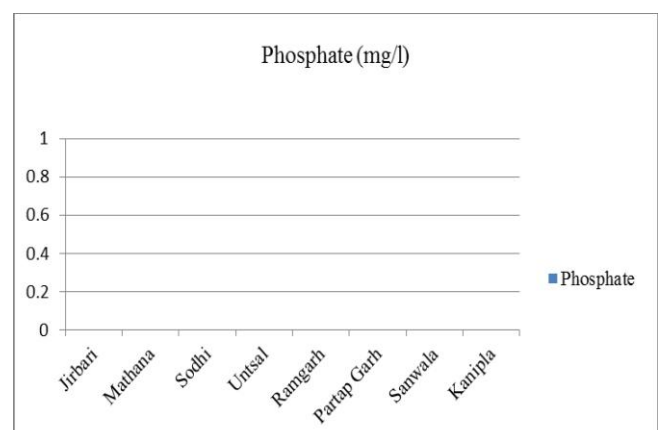


Fig. 12: Phosphate in groundwater samples.

xii. Residual Chlorine

Residual Chlorine ranges nil to 0.2 mg/l in the study area (Table 1, Fig.13). As per BIS (IS 10500:2012) drinking water standards residual chlorine is desirable if less than 0.2 mg/l, permissible 0.2 mg/l-1 mg/l and non-potable if more than 1.0 mg/l (Table 2). Residual Chlorine is desirable in all the eight groundwater samples (Jirbari, Mathana, Sodhi, Untsal, Ramgarh, Partap Garh, Sanwala, Kanipla).

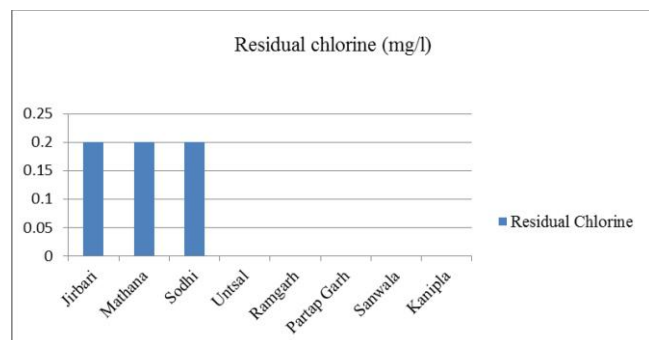


Fig. 13: Residual Chlorine in groundwater samples.

CONCLUSIONS

In the study area pH, chloride, iron, nitrite, phosphate and residual chlorine are desirable in all the eight groundwater samples. Alkalinity is permissible in all the eight groundwater samples. Hardness is desirable in four groundwater samples and permissible in four groundwater samples. Total dissolved solids (TDS) is desirable in two groundwater samples and permissible in six groundwater samples. Fluoride is desirable in three groundwater samples and permissible in five groundwater samples. Ammonia is desirable in seven groundwater samples and non-potable in one groundwater sample. Nitrate is desirable in five groundwater samples and non-potable in three groundwater samples. The study is highly useful for planning and monitoring of groundwater quality for drinking purpose in the study area.

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THE ADVERSE EFFECTS OF ENVIRONMENTAL NOISE EXPOSURE ON HEALTH

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Abstract

Noise has always been very common environmental problem for mankind. Noise leading to hearing loss is one of the most common neurological disorders. In defence scenario, armed forces are exposed to the following types of noise: tanks, aircrafts, bombardment, missile launching, ammunition trials etc. Noise incites both direct (hearing loss, tinnitus) as well as indirect effects (anxiety, depression, annoyance, etc.). Environmental noise has multiple effects on human health. Some of these effects such as raised blood pressure; hearing loss and cognitive impairments may have implications for adult health as well.

In this review, we consigned that noise affects memory storage, cognitive decision making, executive functions that are the foremost requirements for human being. Psychological behaviour like argumentativeness, mood fluctuations, incapability to face stressful situations hamper the performance and lead to a poor quality of life. Noise exposures disturb the balance of awake and sleep modes of brain activity leading to neurological change

Keywords

Noise; Cognitive; Oxidative Stress; Hearing Loss.

INTRODUCTION

Noise is defined as unwanted sound or a combination of sounds that has adverse effects on health. The effects can manifest in the form of physiologic damage or psychological harm through a variety of mechanisms (Bahng and Lee, 2020). WHO reported that around one million healthy life years are lost every year due to environmental noise. Noise Induced Hearing Loss (NIHL) is thought to be one of the major causes of preventable hearing loss. The psychological effects of noise are usually not well characterized and often ignored. However, their effect can be equally devastating and may include hypertension, tachycardia, elevated cortisol levels and increased physiologic stress. Collectively, these effects can have severe adverse consequences on daily living

and globally on economic production (Seidman and Standring, 2010). Currently the armed forces are facing severe disabilities secondary to noise. It has been shown that the top two disabilities now facing the American Military are hearing loss and tinnitus (Bahng and Lee, 2020). It is reported that the physical and emotional effects of persistent noise lead to irritability, anger, nausea, headache, sleep disturbances and higher sense of helplessness, lack of control, tension, stress, unhappiness, anxiety and depression (Fooladi, 2012). In a self-reported study on the uncontrolled noise exposures to honking and shouting, the participants indicated their responses as being rage and frustration (Fooladi, 2012). Noise may cause cognitive impairment by a variety of mechanisms. Earlier studies have demonstrated that children

in noisy environments have decreased attention on task and have lower performance on cognitive assignments compared to children in quiet environment (Hygge et al., 2003); Shield et al, 2015). A more recent study by Ljung et al., found that Traffic noise significantly impaired reading ability and comprehension as well as basic mathematics performance in children (Ljung et al, 2009). These psychological and physiological non-auditory effects of noise result in detrimental health consequence and a decreased quality of life (Seidman and Standring, 2010).

i. NOISE AND HEALTH IMPACT

Increased arousal, learned helplessness, frustration, annoyance and consequences of sleep disturbance on performance are reported to contribute to cognitive changes (Stansfeld et al., 2000; (Evans, 2006). Noise exposure may slow rehearsal in memory, influence process of selectivity in memory and choice of strategies for carrying out a task (Smith et al, 1997). It may reduce helping behaviour, increase aggression and reduce the processing of social cues during task performance (Jones et al., 1981). Other physiological effects of noise exposure include symptoms such as nausea, headache, argumentativeness and change in mood and anxiety (Stansfeld et al., 2000). Noise induced disruption was also found for non- auditory tasks like serial recall of visually presented lists and reading (Klatte et al., 2013). Studies undertaken in rats by Rabat have shown that noise exposure was correlated to an incapability to face stressful situations (Rabat, 2007). Noise annoyance can result from noise interfering with daily activities, feelings, thoughts, sleep, or rest and might be accompanied by negative responses such as anger, displeasure, and exhaustion and by stress related symptoms (Tiesler et al., 2013).

An efficient evaluation of noise effect should include an analysis of its frequency spectrum (Mahendra Prashanth and Venugopalachar, 2011). (Shukla, 2012) showed that traffic noise produces both a high frequency component around 1 kHz and a low frequency component around 63 Hz, responsible for the health relevant hazards. Some of the problems of high frequency noise include hearing impairment, hypertension, high blood pressure, speech interference, annoyance and disturbance to daily activities whereas low frequency noise could lead to annoyance, sleep deprivation, physiological disorders, etc. (Davies and Kamp, 2012; Shukla, 2012). In another study, Prashanth et al. (2008) reported that repeated noise exposures in the low (> 22- 500 Hz) and mid frequency (>500 Hz to 2 kHz) octave bands lead to ear vibration, chronic fatigue, headache, awakening from sleep, neck pain, backache, eye ball pressure, and ear pulsation.

Animal Studies in Wistar rat show that these extra-auditory effects of noise exposure were due to modified levels of oxidative markers in two areas of the brain, mainly the hippocampus and cerebellum (Shukla et al., 2019; Uran et al., 2010). Significant decrease in the volume of granule layer and cells in cerebellum, decrease in somal volume of Purkinje cells and increased plasma corticosterone concentration was

found in noise exposed animals (Hosseini-Sharifabad and Sabahi, 2014).

ii. NOISE AND OXIDATIVE STRESS

Certain environmental challenges can increase the production of reactive oxygen species (ROS) in different structures, which may override the cellular antioxidant defences and can lead to oxidative stress (Vicente et al., 2004). Interestingly, the abundance of polyunsaturated fatty acids and the low-level of defensive mechanisms, together with the high oxygen consumption, make the brain more susceptible to oxidative damage than other organs. In particular, after experimental noise exposure in laboratory animals, superoxide anion radicals emerge in the stria vascularis (Yamane et al., 1995), hydroxyl radicals significantly increase in the cochlea (Henderson et al., 2008), hydrogen peroxide-induced cell damage to the inner ear occurs in vitro (Dehne et al., 2000), glutathione increases in the lateral wall (Yamasoba et al., 1998) and glutathione peroxidase and malondialdehyde activities increase progressively with noise intensity in hair cells (Yamashita et al., 2004). Although experimental data show that loud noise can increase ROS in the auditory pathway (Yamashita et al., 2004; Pouyatos et al., 2005; Le Prell et al., 2007), reports concerning the influence of noise stress on oxidative status in extra-auditory CNS structures are scarce (Manikandan et al., 2006; Rabat et al., 2006; Turner et al., 2005).

In addition, experimental data in developing animals are lacking. In consequence, since the tonotopic organization of the auditory cortex is much more susceptible to perturbations of acoustic inputs in infancy than in older animals, as suggested by Wang studies (2004), the concept of a 'critical' or sensitive period of development after which plasticity is more restricted could be tested by exposing immature animals (Wang, 2004). The adverse effects of environmental noise on human mental health have been reported by several authors. In particular, it has been suggested that loud noise can induce a variety of symptoms, including changes in anxiety, emotional stress, increase in social conflicts, as well as general psychiatric disorders (Rabat et al., 2006). Similarly, animal experiments have demonstrated that acute and chronic noise exposures can also induce temporary or permanent changes related to the central nervous system (CNS) (Goble et al., 2009; Manikandan et al., 2006).

iii. NOISE AND HEARING LOSS

Noise-induced hearing loss (NIHL) acquired in leisure or occupational settings is a common cause of hearing impairment in industrialized countries, with a prevalence second only to age-related hearing loss (ARHL) (Stanbury 2008). Hearing loss associated with mild acoustic overexposure is reversible, and hearing recovers within 2–3 weeks [Dengerink 1985]. This temporary loss is known as a temporary threshold shift (TTS), and is probably due to reversible damage to the stereocilia of hair cells [Gao 1992] and/or swelling, followed by recovery, of cochlear nerve terminals [Pujol 1999]. Noise intensity and duration of exposure determine the level of noise damage to an organism.

High-intensity noise exposure damages inner hair cells (IHCs), primarily through two pathways: direct mechanical damage, in which noise can destroy the static cilia of hair cells, resulting in hair cell loss and damage to supporting cells and spiral ganglia (Shukla et al., 2019)

iv. NOISE AND COGNITIVE FUNCTION

The damaging effect of noise, however, is not limited in the auditory system, but extend to many other systems (Basner et al., 2014). Recent studies have warned of noise-related impairment of learning ability and cognitive performance (Cheng et al., 2011; Cui et al., 2009; Wright et al., 2006). Studies suggest that the evidence of the effects of noise on children's cognition has grown stronger over recent years, with over 20 studies showing detrimental effects of noise on children's memory and reading outcomes [Belojevic

2012]. children exposed to chronic aircraft or road traffic noise at school have poorer reading comprehension and memory than children who are not exposed [Haines 2001].

v. HYPOTHESIZED RELATIONSHIPS BETWEEN HEARING LOSS AND COGNITIVE DECLINE

Several possible relationships have been postulated (see Figure 1). Cognitive decline may reduce the cognitive resources that are available for auditory perception, manifesting as hearing loss. In contrast, Lin and colleagues (Lin et al., 2013) have suggested that hearing loss causes cognitive decline that is either permanent (the “sensory-deprivation”), or potentially remediable (the “information-degradation”). Another possibility is that a third factor causes both declines (the “common cause”).

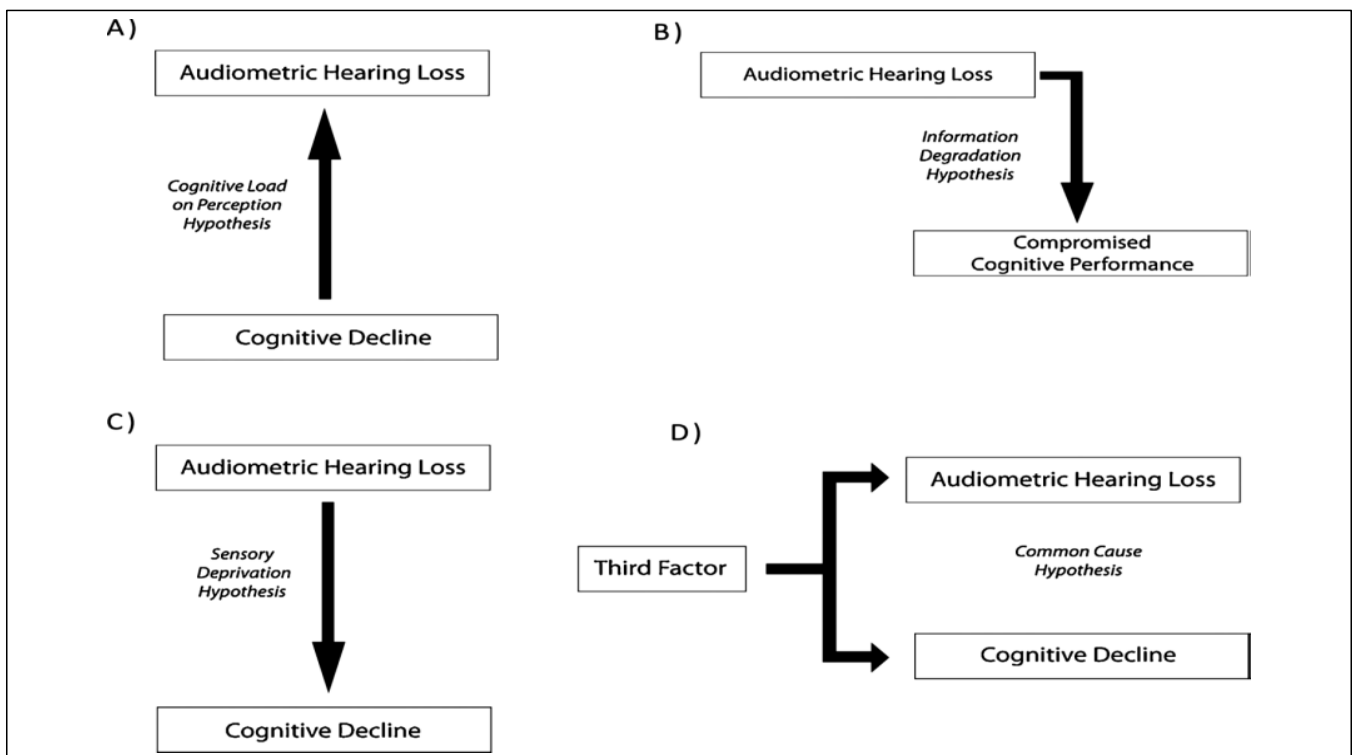


Figure 1: A summary of the four hypotheses for the causal relationship between hearing loss and cognitive decline. (A) Cognitive load on perception hypothesis: cognitive decline leads to audiometric hearing loss; (B) Information degradation hypothesis: audiometric hearing leads to diminished (but reversible) cognitive performance; (C) Sensory deprivation hypothesis: audiometric hearing loss causes cognitive decline; (D): Common cause hypothesis: both audiometric hearing loss and cognitive decline are caused by a third, common factor.

Soldiers who were exposed to unnecessary noise levels including explosions and blast waves shown severe NIHL and tinnitus (Kapoor 2019), as well as cognitive discrepancies and memory impairment (Belanger et al., 2009). The mechanisms underlying cognitive function decline after noise exposure are not entirely clear. Noise exposure impair cognitive functions through different pathway. One is related to the oxidative reaction initiated by noise exposure. Increased oxidative stress has been reported in many studies as the cause of neuronal degeneration seen in many auditory nuclei as well as in the brain regions critical for cognitive functions (Shukla 2019, 2020). The other way is due to change of auditory input to the cognitive brain after

hearing loss induced by noise. This latter approach has not been considered intensively in the past, but the possibility has been supported by the connection between the auditory brain and cognitive brain (Kraus and Canlon, 2012) and established by the hippocampal deterioration and deteriorated spatial memory in C57BL/6J mice with age related hearing loss (Yu et al., 2011) and the destruction of hippocampal neurogenesis in the rat after noise-induced unilateral hearing loss (Kraus et al., 2010) (Shukla 2019; 2020).

In the auditory system, environmental noise induces cell death (Basta, et al., 2005) and a threshold shift (Syka and Rybalko, 2000), and causes abnormal neural coding

(Pienkowski and Eggermont 2012) in the auditory cortex (AC) and other cortical regions responsible for acoustic processing (Cheng 2016). In contrast, environmental noise also affects non-auditory brain regions such as the hippocampus, a major limbic region that receives direct or indirect neural input from the central auditory system (Kraus and Canlon, 2012). Accumulating evidence illustrates a significant effect of noise on hippocampal-related cognition (Manikandan, et al., 2006). A number of studies including our own have highlighted that exposure to moderate noise can affect the physiological structure and subsequently the function of both the AC and hippocampus (Cheng, et al., 2011). However, does the AC, the primary brain region to process acoustic information, have high susceptibility to environmental noise than the hippocampus in non-auditory system? It has not been determined. Previous studies have shown that as a stressor, noise may cause extensive oxidative stress along the lemniscal ascending pathway including the AC and the hippocampus (Manikandan, et al., 2006; Cheng, et al., 2011). A moderate level of noise was used to avoid direct physical damage. The central nervous system undergoes progressive structural and functional maturation during postnatal development, and noise exposure, as a stressor, may therefore affect brain function of mice to a greater extent at this stage than in adults (Chang and Merzenich, 2003).

vi. NOISE AND CARDIOVASCULAR RISK

Both short-term laboratory studies of human beings and long-term studies of animals have provided biological mechanisms and plausibility for the theory that long-term exposure to environmental noise affects the cardiovascular system and causes manifest diseases (including hypertension, ischaemic heart diseases, and stroke) (Basner 2014). Acute exposure to different kinds of noise is associated with arousals of the autonomic nervous system and endocrine system (Lusk 2004). Investigators have repeatedly noted that noise exposure increases systolic and diastolic blood pressure, changes heart rate, and causes the release of stress hormones (including catecholamines and glucocorticoids) Basner 2014. The general stress model is the rationale behind these reactions. Potential mechanisms are emotional stress reactions due to perceived discomfort (indirect pathway), and non-conscious physiological stress from interactions between the central auditory system and other regions of the CNS (direct pathway). The direct pathway might be the predominant mechanism in sleeping individuals, even at low noise levels.

Chronic exposure can cause an imbalance in an organism's homeostasis (allostatic load), which affects metabolism and the cardiovascular system, with increases in established cardiovascular disease risk factors such as blood pressure, blood lipid concentrations, blood viscosity, and blood glucose concentrations (Basner 2014; Babisch 2011). These changes increase the risk of hypertension, arteriosclerosis, and are related to severe events, such as myocardial infarction and stroke. Studies of occupational (Davies 2012) and environmental epidemiology have shown a higher

prevalence and incidence of cardiovascular diseases and mortality in highly noise-exposed groups (Sørensen 2012).

CONCLUSION

In summary, there is sufficient evidence for the effects of environmental noise in human being on hormonal changes, annoyance, well-being and cognitive effects such as reading comprehension, long-term memory and performance. The review finding that aircraft/environmental noise is related to hyperactivity symptoms requires some systematic investigation and undoubtedly the prolonged use of personal listening devices on hearing needs to be assessed in longitudinal studies, not least because of the public health implications of almost universal use in young people.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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B.
Health Sciences Section

PROMINENT USAGE OF CARDAMOM [*Elettaria cardamomum* L. (MATON)] FOR UPLIFTING INVIGORATING HEALTHCARE

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Abstract

Cardamom is one of the most significant, valuable spices in the world. It consists of the small, highly aromatic pods or seed capsules of a perennial plant of the ginger family. Cardamom is a highly valued herbal spice that is used as a culinary spice in Asian cuisines because of its intrinsic flavoring capacity. Moreover, when used as a home remedy it helps cure various ailments like indigestion, nausea, lightheadedness, etc. Cardamom has various chemical compounds that include pinene, sabinene, myrcene, phellandrene, limonene, cineole, terpinene, cymene, terpinolene, linalool, linalyl acetate, terpinen-4-ol, terpineol, terpineol acetate, citronellol, nerol, geraniol, methyl eugenol and trans-nerolidol. It is useful for curing dental diseases and urinary tract infections such as cystitis, nephritis, and gonorrhoea. Cardamom possesses aphrodisiac properties and is also used as a cure for impotence, erectile dysfunction, and premature ejaculation. It possesses antiseptic, aphrodisiac, carminative, digestive, diuretic, stimulant, stomachic, tonic and anti-spasmodic.

Keywords

Cineole, Linalool, Aphrodisiac, Carminative, Geraniol.

INTRODUCTION

The cardamom [*Elettaria cardamomum* L. (Maton)] belonging to family Zingiberaceae contains tiny, brown aromatic seeds and is one of the most important spices. *Elettaria cardamomum*, commonly known as green or true cardamom, is a herbaceous, perennial plant in the ginger family, native to southern India. It is the most common of the species whose seeds are used as a spice called cardamom. It is cultivated widely in tropical regions and reportedly naturalized in Réunion, Indochina, and Costa Rica. It is also known as “Queen of Spices” in India and “Hel” in Iran,

Saudi Arabia, Kuwait, United Arab Emirates, Iraq, because of its very pleasant aroma and taste. This aromatic spice is straw-green to bright-green in color with small, black seeds inside a pod. The fibrous, oval pod has about 8 to 16 seeds. [1-3] There is another variety of this herb, that is, Black Cardamom (*Cardamomum amomum*) which is mostly found in Asia and Australia. Cardamom is the third most expensive spice in the world. The seeds have a sweet aroma and slightly pungent taste. Its essential oil is obtained by steam distillation of cardamom seeds. The oil and left over resin is used in processed foods, liqueurs and perfumes.



Figure 1: Cardamom plant, leaves, Inflorescence.

Cardamom is found in the form of a small pod with black seeds inside. Both the seeds and the pod give a pleasant aroma and flavor. Therefore, they are used as flavoring agents in Indian cuisine. Its use is just not just limited to hot and spicy dishes; the seeds are also added to desserts and beverages to complement the sweet flavor. Cardamom tea is a very famous beverage, along with ginger tea, in India. In India, cardamom was traditionally considered as an herb and was one of the ingredients in Ayurveda and traditional Chinese medicine. It was believed to be a remedy for teeth and gum infections, throat problems, congestion of the lungs, pulmonary tuberculosis, inflammation of the eyelids, gastrointestinal disorders, disintegrating kidneys, and gallbladder stones, and was also used as an antidote for poisons and venoms. [4-5] Cardamom is packed with antioxidants. There are two kinds

of cardamoms, green and black. Black cardamoms help in curing colds and cough and certain respiratory problems. It imparts warmth to the body. Due to its strong aroma, it helps in activating our taste and sensory elements and thus, aid digestion. The floral and sweet aroma of cardamoms makes it a natural breath freshener. A major component of cardamom oil called cineole is known for its antimicrobial properties that promote oral hygiene and it also fights bacteria that cause bad breath. Cardamom is known to increase the blood circulation in your body and especially to your lungs and so, is often used as a natural remedy for respiratory disorders. It maintains vitality and keeps your energy levels up. Black cardamom is often touted as an effective remedy for treating high blood sugar levels. Cardamom is rich in manganese which helps in controlling blood sugar levels.[6-7]

Table 1: Nutritional profile of cardamom.

Principle	Nutrient Value	Percentage Of Rda
Energy	311 Kcal	15.5%
Carbohydrates	68.47 g	52.5%
Protein	10.76 g	19%
Total Fat	6.7 g	23%
Cholesterol	0 mg	0%
Dietary Fiber	28 g	70%
VITAMINS		
Niacin	1.102 mg	7%
Pyridoxine	0.230 mg	18%
Riboflavin	0.182 mg	14%
Thiamin	0.198 mg	16.5%
Vitamin A	0 IU	0%
Vitamin C	21 mg	35%
ELECTROLYTES		
Sodium	18 mg	1%
Potassium	1119 mg	24%
MINERALS		
Calcium	383 mg	38%
Copper	0.383 mg	42.5%
Iron	13.97 mg	175%
Magnesium	229 mg	57%
Manganese	28 mg	1217%
Phosphorus	178 mg	25%
Zinc	7.47 mg	68%

CHEMICAL CONSTITUENTS IN CARDAMOM

Cardamom contains essential volatile oil which is made up of monoterpene constituents, such as 1,8-cineole, α -pinene, α -terpineol, linalool, linalyl acetate, and nerolidol and the ester constituent α -terpinyl acetate which exhibit vascular

relaxant, anti-inflammatory, analgesic, antimicrobial, antioxidant and antispasmodic properties. The major active component of cardamom oil is a potent antiseptic that is known to kill bacteria producing bad breath and other infections. Cardamom contains flavonoids, terpenoids,

anthocyanins, alkaloids, and other phenolic constituents that are responsible for reducing fat storage, cardiovascular,

pulmonary, kidney and lung associated disorders and improves insulin function in the body. [3-7]

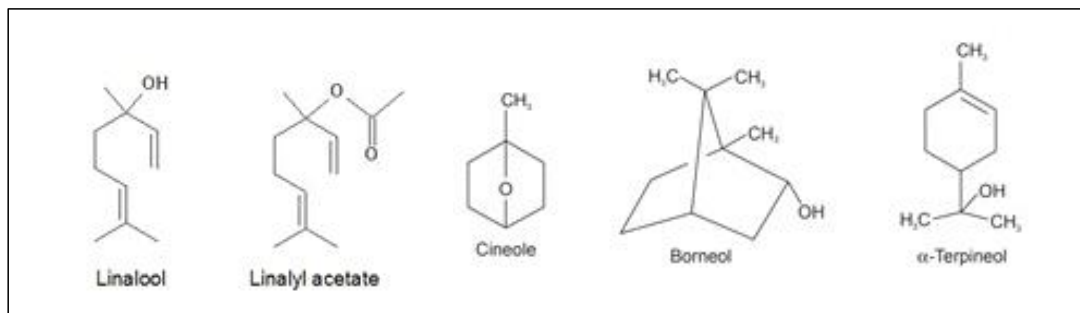


Figure 2: Major Chemical constituents occurring in cardamom.

CARDAMOM BENEFITS

Cardamom boosts energy metabolism and helps the body burn more fat efficiently. Inhaling the sweet and soothing aroma of cardamom essential oil may help in treating sleep issues such as insomnia, restlessness, and anxiety. According to Ayurveda, cardamom is an important spice which is tridoshic which means that helps in balancing all the three doshas - Vatta, Pitta and Kapha in our body. It has significant warming properties that are soothing for your body. It is also believed in Ayurveda that the excess build-up of 'ama', a sticky substance that blocks normal circulation and lowers energy levels, leads to various diseases. Cardamom helps in preventing its accumulation and thus, reduces its negative impact. Since cardamom gives out a sweet flavor, it was traditionally believed to possess aphrodisiac properties. Not only is cardamom regarded as an aphrodisiac, but it is also believed to possess the cure for impotence and premature ejaculation. In Ayurveda, cardamom has been used as a remedy for urinary tract diseases and infections such as cystitis, nephritis, and gonorrhoea. There are several remedies prescribed in folk medicine and one of the most popular among them is startling a person who is hiccupping. This may or may not work most of the time. [5-7] However, cardamom is another very effective remedy. Cardamom pods and seeds can be chewed as a breath freshener. The flavors and aroma found in cardamom are due to the presence of essential oil. It is no wonder that the essential oil of cardamom is being used as a popular ingredient in chewing gum! Cardamom contains a high amount of flavonoids contents especially quercetin which improves anxiety-like behavior and depression. Cardamom benefits are due to essential oil, sterol, phenolic acids and lipids which show relaxation of muscles and reduce the volume of gastric ulcer thus prove gastroprotective effect. The presence of phenolic compounds like flavonoids, terpenoids, and tannins (1,8-cineole) in the cardamom show wonderful effects by delayed the severity of seizures. Cardamom increases the production of a good enzyme (superoxide dismutase and ascorbic acid), restores endogenous antioxidants, preserve histopathology and ultrastructure of the myocardium. In simple words, it improves cardiac function thus delay the initiation, progression, and development of myocardial ischemic injury. Cardamom helps improve digestive health, aids in diabetes treatment and helps you cope with depression. The spice also

stimulates metabolism, given its antioxidant and anti-inflammatory properties. Cardamom is also known to stimulate the secretion of bile acid in the stomach, further aiding in digestion. The spice also prevents other gastrointestinal ailments like acid reflux, heartburn, diarrhea, etc. Its antioxidant properties can promote heart health. Cardamom also contains fiber, the nutrient that can help lower cholesterol levels and enhance heart health. The spice also can lower blood pressure levels – and this benefits the heart. Cardamom has diuretic properties that can benefit cases of hypertension and epilepsy. These diuretic properties of cardamom also aid in detoxification. Cardamom can indeed help people cope with depression. Cardamom plays a role in fighting asthma symptoms like wheezing, coughing, shortness of breath, and tightness in the chest. The spice makes breathing easier by enhancing blood circulation within the lungs. It also fights related inflammation by soothing the mucus membranes. In accordance with another report green cardamom can be used to treat asthma, bronchitis, and numerous other respiratory issues. Cardamom is extremely rich in manganese – a mineral that can lower the risk of diabetes. [3-8] Cardamom possesses antimicrobial properties that enhance oral health. The pungent taste of cardamom even stimulates the salivary flow – and this can help prevent dental caries. Cardamom can also work well in treating bad breath. One study emphasizes on the use of cardamom for treating a lack of appetite. Even cardamom oil can be used as an appetite stimulant. Cardamom can also aid in the treatment of histoplasmosis – a condition in which one of the symptoms is a lack of appetite. Cardamom is a proven aphrodisiac. The spice is rich in a compound called cineole, and just a small pinch of cardamom powder can release nerve stimulants and fuel your passions. Some reports say that cardamom can also treat impotence. Cardamom has muscle-relaxing properties, and these can help relieve hiccups. [8-11]

CARDAMOM USE IN COSMETICS

Cardamom is often used in cosmetics to impart fragrance. Due to its distinct spicy, sweet scent, both cardamom and cardamom oil are used in perfumes, soaps, body washes, powders, and other cosmetics. Oriental style perfumes and other scented products often use cardamom as an ingredient in addition to other essential oils. Cardamom can be used in skin care products for antiseptic and anti-inflammatory

purposes to calm and soothe the skin, thanks to its therapeutic effects. When added to perfumes, it can stimulate the senses. Facial soaps use cardamom to impart a warming sensation to the skin. These cosmetics using cardamom for therapeutic reasons are known as aromatherapy products. The strong scent of cardamom can ward off unpleasant odors. This makes it a great addition to cosmetic products, such as toners, that serve a specific function but smell unappealing due to the inclusion of certain ingredients. Cardamom is added to these products to mask the unpleasant scent while retaining the benefit of the cosmetic. Cardamom essential oil is often added to cosmetics that are applied to the lips (such as lip balms) to impart the taste of the oil and make the lips smooth. The antibacterial properties of the spice even treat scalp

infections, if any. This is a given. Improved scalp health most often means stronger and better-looking hair. The spice strengthens your hair roots and offers shine. The spice helps treat skin allergies and improves skin complexion. It can also be used as a tool to cleanse the skin. One of the benefits of cardamom is that it imparts in making fair skin. Cardamom essential oil helps in removing blemishes, thus giving a fairer complexion. The skin benefits of cardamom can be attributed to its antibacterial and antioxidant properties. Cardamom contains vitamin C, which is a powerful antioxidant. It improves blood circulation throughout the body. Also, the many layers of phytonutrients in the spice can improve blood circulation – which invariably enhances skin health. [9-12]



Figure 3: Green and dried Cardamom, seeds and oil.

USAGE OF CARDAMOM PRODUCTS

Cardamom finds use as products in different forms; cardamom seeds, cardamom powder, cardamom oil, cardamom oleoresin, encapsulated cardamom flavor, etc which is used to flavor sweets, baked goods, and hot beverages such as tea and coffee. Cardamom benefits are gastroprotective, treat Seizures, lowers cholesterol and many more. Cardamom oil is used internally for indigestion, nausea, vomiting and pulmonary disease with copious phlegm. Cardamom oil is used for memory enhancement. It is used to flavor coffee, baked goods, curries and pickles, milk desserts and mulled wine. It is also used for perfumery, beverages, cosmetics and a blend of potpourris. Cardamom is used in perfumery blend for manufacturing of men's perfume. It is especially used in the preparation of Curve Colognes, Eau De Toilette spray for men. [4,6,7-8]

CONCLUSION

Cardamom has digestive, antispasmodic, carminative, anti-inflammatory, anti-microbial, aphrodisiac and diuretic properties. It boosts digestion and stops nausea, vomiting. Plus, the herb aids in eliminating belching and flatulence. Some other health benefits of cardamom include relief from stomach pain, colon spasms and menstrual cramps. Besides, application of cardamom oil cures teeth and gum infections. Its pleasing fragrance removes bad breath (Halitosis). Furthermore, the herb works as a mild circulatory stimulant. This warm spice improves blood circulation to the lungs. Plus, it can help lower blood pressure, especially in case of primary hypertension. The therapeutic herb also promotes urination and aids in detoxification of the body. Cardamom benefits the immune

system as well. In addition, studies show that it has antioxidant properties that can increase the levels of glutathione. It is also believed to have antitumor qualities. Cardamom essential oil has a balsamic aroma and expectorant qualities. Thus, when used in aromatherapy, it helps break up mucus and congestion in sinuses and lungs. It is also beneficial for those suffering from asthma or bronchitis. It has a soothing effect on muscles, nervous system and gives mental clarity. It is high in phytochemical cineole, which is a central nervous stimulant. Further, the herb's diaphoretic properties are useful in increasing perspiration.

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ENORMOUSLY BENEFICIAL CHIA SEEDS IN MODERN FOOD REGIMEN

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Abstract

Chia seed is a potential source of antioxidants with the presence of chlorogenic acid, caffeic acid, myricetin, quercetin, and kaempferol which are believed to have cardiac, hepatic protective effects, anti-ageing and anti-carcinogenic characteristics. Chia seed possesses higher proportion of α -linolenic acid makes chia the superb source of ω -3 fatty acid (~65% of the oil content). It is also a great source of dietary fibre with higher concentration of beneficial unsaturated fatty acids, gluten free protein, vitamin, minerals and phenolic compounds. Therapeutic effects of chia in the control of diabetes, dyslipidaemia, hypertension, as anti-inflammatory, antioxidant, anti-blood clotting, laxative, antidepressant, anti-anxiety, analgesic, vision and immune improver is scientifically established. This comprehensive review paper describes the huge nutritional and therapeutic potential of chia seed to make it the part of an average diet for better healthcare.

Keywords

ω -3 fatty acids, Laxative, Anti-inflammatory, α -linolenic acid, Chlorogenic acid, Kaempferol, Widdrol

INTRODUCTION

Chia seeds are tiny black and white seeds from the *Salvia Hispanica* L. plant that are also a member of the mint family (Labiatae). Chia seeds were originally grown in Central and South America, and were considered a major food crop in Mexico and Guatemala. The word chia is derived from a Spanish word chian which means oily, it is oilseed, with a power house of ω -3 fatty acids, superior quality protein, higher extent of dietary fibre, vitamins, minerals and wide range of polyphenolic antioxidants which safeguard the seeds from chemical and microbial breakdown. Chia can grow up to 1 m tall and has opposite arranged leaves. Chia flowers are small flower (3-4 mm) with small corollas and fused flower parts. The seed color varies from black, grey, and black spotted to white, and the shape is oval with size ranging from 1 to 2 mm. [1-2] Prominently, grown for its seeds, *Salvia hispanica* also produces white or purple flowers. Recently,

chia has regained its popularity by becoming one of the main oil sources that contains high levels of PUFA. Chia, which used to be the major food crop of the indigenous peoples of Mexico and Guatemala, is now widely cultivated and commercialized for its (omega) ω -3 alpha-linolenic acid (ALA) content and antioxidant properties. Today, its cultivation is not only limited to the Americas but is also extended to other areas such as Australia and Southeast Asia. Chia sprouts are used in salads, chia seed is used in beverages and cereals based foods and it can be consumed in raw form. Traditionally seeds have been used as a food, in a wide range of folk medicines, primary cosmetics and a part of religious rituals in pre-Columbian societies. The diets in pre-Columbian regimes were as nutritious as today. The chia seed is widely used in many countries since thousands of years due to its massive nutritional and therapeutic potential. [3-5] Existence of chia as an integral part of the pre-Columbian diet

had made their diets even superior to today's diet which is also admitted by the modern science. The massive nutritional and therapeutic potential of chia offers a great future perspective for pharmaceutical sector. In present times, there exists a cumulative consideration and dispersal of the seeds of the plant for the advantages and uses in cookery. The seeds are known as the very rich foundation of nutrients, first of all, the polyunsaturated omega-3 fatty acids which secure your

health from inflammation, advance the reasoning presentation and decrease the level of cholesterol. Additionally, sugars founded fibers which exist at high attentiveness level, are linked with decreasing inflammation, dropping cholesterol and adaptable bowel functions which eventually lead to healthy life. This appraisal recapitulates the present in-formation on the photochemistry and pharmacological characteristics of the seeds of chia plant. [5-7]



Figure 1: Chia plant.



Figure 2: Chia seeds.

The chia's main fats are α -linolenic acid (ALA) and linoleic acid (LA), with a smaller numbers of (saturated fatty acids), oil (omega-9), and stearic (saturated) acids. The most popular lipids are a α -linolenic acid. ALA and LA are the two only essential fatty acids which individuals have to put into their diet, as they cannot be synthesized by their bodies. For chia, ALA, fatty acids are \sim 60%, LA is about 20%. ALA is a source of many benefits, as well as the correlation of cardiovascular and neurological health, to the long-chain Omega-3 fatty acids DHA and Eicosatetraenoic (EPA) In addition, chia seeds are also used in the preparation of cake for example as healthy supplements with oil, and can be used in beverages, cereal and salads. [8-9] Chia seeds in bread products at a value of no more than 5 per cent, including breakfast, cookies, fruit juices and yogurt, have already been permitted in the European Committee. The seeds of chia contain high fiber content (18 - 30 g/100 g). It has been reported that their use can encourage proper intestinal functioning, reduce the level of blood cholesterol and glucose due to the use of chia seed. Such fatty acids are responsible for the effective functioning of the vision, cardiovascular diseases, cancer, autoimmune and inflammatory diseases, and also for prevention. These fatty acids are not only nutritionally important for health, but also helpful to people with heart disease, and diabetes. [10-11]

PHYTOCONSTITUENTS AND NUTRITIONAL ATTRIBUTES

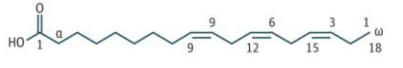
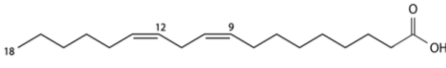
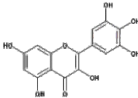
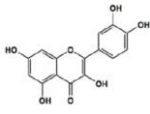
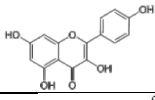
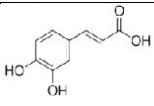
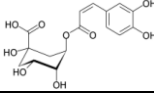
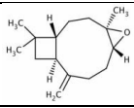
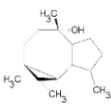
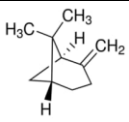

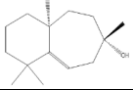
The seed contains ω -3 α -linolenic acid (ω -3ALA) and ω -6 linoleic acid (ω -6LA). Both (PUFAs) Polyunsaturated fatty acids are essential fatty acids required by the human body for

good health, and they cannot be artificially synthesized. The protein, fat, carbohydrate, dietary fibre, ash and dry matter contents of chia seeds ranged from 15 to 25 %, 30–33 %, 41 %, 18–30 %, 4–5 % and 90–93 % with a wide range of polyphenols, respectively. The protein content of chia seed grown in different habitats ranged from 18.8 % to 21.5 %, the variation in protein content was probably be due to agronomic, climatic and soil conditions. In another study regarding the nutritional characterization of chia seed; medicinal characteristics of chia seed reported that seed exhibited 20 % protein, 25 % fibre and 34 % oil. The high fibre content of chia seed as health perspective, fibre increases stool volume, prevent from diverticulosis and cancer. [12-14] Chia is considered as a safe food with no potentially harmful effects and widely used in baked goods, nutritional supplements, cereal bars, cookies, bread, snacks etc. Chia seed contains appreciable amount of fibre, which can absorb up 15x water the weight of seed. The presence of higher extents of fibre help in diabetes mellitus by slowing down the digestion process and release of glucose, it also improves the peristaltic movement of intestine and reducing plasma cholesterol. The biological value of chia is superior to cereals and higher content of calcium, magnesium and potassium than milk. It is revealed from the studies that chia seed had a higher concentration of phytosterols which have and cancer and cardio-protective effect with antimicrobial activities. Recently, it is established that mucilage of chia seed can be utilized as a functional coating with improved functional properties. The leaves of chia contain an essential oil that contains β -caryophyllene, globulol, γ -muroleno, β -

pinene, α -humoleno, germacren-B, and widdrol. [15-18] These compounds are believed to have strong repellent characteristics to a wide range of insects. Two tablespoons of this super-seed contain around 140 calories, 4 grams of protein, 11 grams of fiber, 7 grams of unsaturated fat (omega-3 fatty acids) and contain over 18% of your RDA for calcium. They're also a good source of trace minerals like copper and

zinc. They contain all nine essential amino acids necessary as the building blocks for protein in the body. [19-23] Not only are chia seeds high in calcium, but they are also loaded with manganese and phosphorous, two crucial minerals involved in bone health. Chia seeds also help us get full, faster, due to their high tryptophan content, also helping to regulate appetite, sleep, and improve our mood!

Table 1: Chemical structure of phytoconstituents occurring in Chia Seed and leaf.

ω -3ALA (18:3)	
ω -6LA (18:2)	
Myricetin	
Quercetin	
Kaempferol	
Caffeic acid	
Chlorogenic acid	
β -caryophyllene	
Globulol	
β -pinene	
Germacren-B	
Widdrol	

CULINARY USES

The European Commission approved the use of chia seed (<5%) in bread products. Other than bread, the food industry of various countries around the world including US, Canada, Chile, Australia, New Zealand, and Mexico has widely used chia seeds or its oil for different applications such as breakfast cereals, bars, cookie snacks, fruit juices, cake, and yoghurt. At present, chia

seed is used as a healthy oil supplement and is commonly consumed as salad from chia sprout, in beverages, cereals, and salad dressing from the seed, or it is eaten raw. Biscuits, pasta, cereal bars, snacks and yoghurt and cake are usually supplemented with chia seed. Chia is one of the few medicinal plants that produce essential oil in a great concentration, which is used for the preparation of omega-3 capsules.

CONCLUSION

Seed from *Salvia hispanica* L. or more commonly known as chia is a traditional food in central and southern America. Currently, it is widely consumed for various health benefits especially in maintaining healthy serum lipid level. This effect is contributed by the presence of phenolic acid and omega 3/6 oil in the chia seed. Isolated polyphenolics from chia seed are chlorogenic acid, caffeic acid, myricetin, quercetin and kaempferol. Quercetin, chlorogenic acid, caffeic acid are believed to have anti-carcinogenic, antihypertensive, neuron protective effects. It is already well established that chia does not have anti-allergic, anti-nutritional and toxic effect on human health. Although the presence of active ingredients in chia seed warrants its health benefits, however, the safety and efficacy of this medicinal food or natural product need to be validated by scientific research.

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A COMPREHENSIVE APPRAISAL ON TRADITIONAL USES, PHYTOCHEMISTRY AND PHARMACOLOGY OF FENNEL (*FOENICULUM VULGARE*)

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Abstract

Apart from being used for adding flavor, it is also used for various health benefits that are derived from its anti-oxidants. These anti-oxidants are essential to curb unwanted free radical reactions in the body. This phenomenon also prevents many diseases that can get serious at a later stage. Some of the antioxidants listed in these seeds are kaempferol and quercetin that are known to prevent degenerative reactions. Fennel seeds contain a good amount of dietary fiber that is essential for the body. The fiber content helps improve digestion in the body, by facilitating timely breaking down of food molecules that make energy reactions possible. The carcinogenic diseases should be treated at the right stage so that their effect can be curbed or eliminated in the future. Fiber present in fennel seeds decreases reabsorption of cholesterol, thereby preventing any heart-related diseases. A number of volatile oil compounds like myrcene, fenchone, chavicol, cineole are present in these seeds that assist in digestive, carminative, and antioxidant reactions in the body. Production of Red Blood Cells is enhanced by the consumption of Fennel Seeds. Copper, which is required by the body for the production of red blood cells, is present in these seeds. Zinc, found in the fennel seeds, promotes regular growth and development. The potassium content helps in maintaining the blood pressure and hence the heart rate is also maintained. The review aims to gather the fragmented information available in the literature regarding morphology, ethnomedicinal applications, phytochemistry, pharmacology, and toxicology of *Foeniculum vulgare*. It also compiles available scientific evidence for the ethnobotanical claims and to identify gaps required to be filled by future research. Findings based on their traditional uses and scientific evaluation indicates that *Foeniculum vulgare* remains to be the most widely used herb globally.

Keywords

Cholesterol, Myrcene, Fenchone, Chavicol, Cineole, Carminative.

INTRODUCTION

Fennel is an aromatic herb belonging to the parsley family. It is used as a spice and possesses a sweet taste that is similar to anise. It is an essential ingredient in the Mediterranean cuisine. It is native to the South European region but is consumed well in all of the European regions. It is a two-meter plant with dark green leaves and yellow flowers. Fennel seeds are not only tasty but are also very healthy

owing to their nutritional content. Fennel bulb is also eaten as a vegetable in some parts of the Mediterranean region. [1-4] Saunf or Fennel seeds are an edible and healthy seeds used for many years in cooking as well as medicinal purposes. It is also called as moti saunf in India. It belongs to the Apiaceae or Umbelliferae family and *Foeniculum* genus, cultivated in many countries all over the world. India is the top producer of the saunf however it is cultivated in average amount in Iran,

Mexico, China, Canada, Syria, Bulgaria, United States, Australia and etc. Saunf or Fennel seeds are an edible and healthy seeds used for many years in cooking as well as medicinal purposes. It is also called as moti saunf in India. It belongs to the Apiaceae or Umbelliferae family and

Foeniculum genus, cultivated in many countries all over the world. India is the top producer of the saunf however it is cultivated in average amount in Iran, Mexico, China, Canada, Syria, Bulgaria, United States, Australia and etc. [5-8]



Figure 1: Fennel herb and seeds.

In India, it is an old and most common trend of offering some fennel seeds with mishri (or sugar coated saunf) after a meal to chew. It is mostly carried out in hotels, restaurants and parties in order to prevent after eating problems like gas, indigestion, acid reflux, abdominal cramps, flatulence, and constipation. DO not be confused with the fennel seeds (moti saunf with green or yellowish color, used for cooking purpose) and aniseeds (patli or chhoti saunf with green color, used for raw eating purpose after meal). [9-10]

PHYTOCHEMICAL CONSTITUENTS

Phytochemical research carried out on *Foeniculum vulgare* has led to the isolation of fatty acids, phenolic components, hydrocarbons, volatile components, and few other classes of secondary metabolites from its different parts. Mostly these phytochemicals [(a,b,c,d)1-60] are found in essential oil. [11-20]

Figure 2 : Phytochemical constituents in fennel.

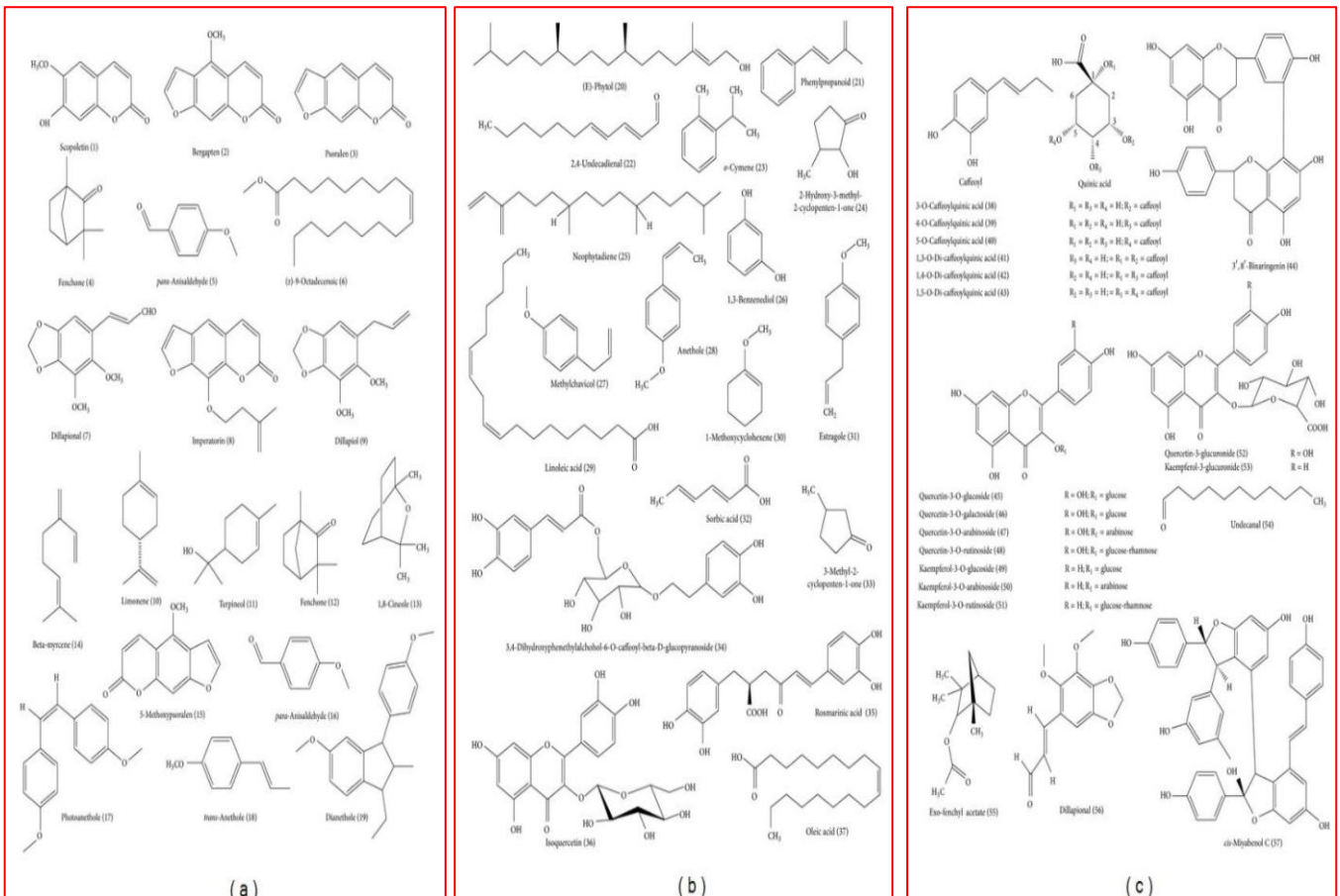


Figure 3: Flowers of fennel plant.



MEDICINAL PROPERTIES

Apart from being used for adding flavor, it is also used for various health benefits that are derived from its anti-oxidants. These anti-oxidants are essential to curb unwanted free radical reactions in the body. This phenomenon also prevents many diseases that can get serious at a later stage. Some of the antioxidants listed in these seeds are kaempferol and quercetin that are known to prevent degenerative reactions. Fennel seeds contain a good amount of dietary fiber that is essential for the body. The fiber content helps improve digestion in the body, by facilitating timely breaking down of food molecules that make energy reactions possible. The carcinogenic diseases should be treated at the right stage so that their effect can be curbed or eliminated in the future. This is made possible by the anti-oxidant capabilities of the fennel seeds. [21-23] Another effect of prevention of free radical reactions by fennel seeds – Neurological diseases are helpfully kept at bay. Cholesterol absorption in the arteries is prevented by the action of the fiber binding to the bile salts. Fiber present in fennel seeds decreases reabsorption of cholesterol, thereby preventing any heart-related diseases. A number of volatile oil compounds like myrcene, fenchone, chavicol, cineole are present in these seeds that assist in digestive, carminative, and antioxidant reactions in the body. Production of Red Blood Cells is enhanced by the consumption of Fennel Seeds. Copper, which is required by the body for the production of red blood cells, is present in

these seeds. The growth and development of the body are geared up. Zinc, found in the fennel seeds, promotes regular growth and development. These days, when people face tensions in their day to day lives, it is very important to maintain the blood pressure and keep the heart rate balanced. Fennel Seeds help a lot in this process. The potassium content helps in maintaining the blood pressure and hence the heart rate is also maintained. [24-26]

Fennel juice is an extremely nutritional beverage. It contains vitamin A, B, C, E, and beta-carotene. It is a rich source of minerals like magnesium, iron, cobalt, potassium, phosphorus, sodium, silicon, and zinc. It also provides high levels antioxidants, carotenoids, and flavonoids. It contains anethole, a phytonutrient that provides fennel juice its strong aroma. The high levels of antioxidants neutralize free radicals in the body, preventing cell damage. Fennel juice has a calming effect on the intestine. The anti-spasmodic properties of fennel juice can reduce intestinal cramps, bloating, and flatulence. The essential oils present in fennel juice stimulate the secretion of digestive juice, reducing stomach inflammation. It also improves the absorption of nutrients from the foods we eat. Fennel juice is widely used as an antacid. The roughage in fennel juice balances the digestive tract, promoting regular bowel movements. Fennel also reduces bad bacteria and increases good bacteria in the gut. [27-29]



Figure 4: Fennel Tea.

The high concentration of iron and histamine in fennel juice makes it a good natural remedy for anemia. Regular consumption of fennel juice increases the production of hemoglobin in the body, reversing anemia. It also prevents the formation of blood clots in the body. Fennel contains several essential nutrients, which helps to improve vision. The antioxidants and amino acids in fennel juice rejuvenate the eyes, preventing macular degeneration. Fennel juice, when applied to the eye, can reduce eye irritations and fatigue. The flavonoids present in fennel juice are very useful in preventing oxidative stress, which helps to prevent macular degeneration. The diuretic properties of fennel juice help to remove the toxic substance from the body through frequent urination. This helps to reduce inflammation that causes rheumatism and swelling. It also prevents the formation of kidney stones. Fennel juice contains phytoestrogen, a chemical that is similar to the hormone estrogen in structure. Thus, fennel juice is very useful for women suffering from menopause and pre-menstrual problems. It also contains folate, which prevents birth defects in unborn babies. Fennel juice eases menstruation problems by regulating hormonal actions in the body. Lactating mothers can regularly drink fennel juice to increase milk production. Fennel juice is believed to release endorphins into the bloodstreams, which relieve depression associated with certain diseases and creates a mood of euphoria. Potassium in fennel juice increases brain function and the cognitive abilities of the brain. In addition to this, fennel juice is also a vasodilator, which increases oxygen supply to the brain and delays the onset of dementia. Fennel essential oil is an aperitif. It helps boost appetite. So if you think you aren't feeling hungry when it is required, fennel essential oil is what you should turn to! Spasms are violent and involuntary contractions of the organs, respiratory tract, intestines, muscles, and nerves. It can lead to chronic cough and acute pain and inflammation. Severe cases of spasms can lead to fainting and even death. Fennel essential oil is an active antispasmodic agent, which relaxes the intestines, muscles and nerves. It provides instant relief from spasms. [30-34] Fennel essential oil contains many chemicals, which exhibit antiseptic and bactericidal characteristics. Fennel oil helps prevent wounds from turning septic. Fennel essential oil prevents tetanus and other post-surgical infections as well. Fennel essential oil is an active carminative agent. It helps release gas from intestines and provides relief from stomach problems like pain, restlessness, heartburn and indigestion. It

also inhibits the formation of gas and helps treat excessive flatulence. Fennel bulb exhibits strong anti-inflammatory properties. Whether you talk of inflammation that is internal or external, fennel bulb cures both. This magic food contains anethole. Anethole serves as a very strong anti-inflammatory flavonoid. It easily cures inflammation caused in humans without causing any side-effects. Fennel bulb offers natural cooling and neutralizing benefits. Thus, it is used to treat the problem of acidity in the duodenum. It makes intestines active and eases the process of absorption. Hence, the toxins get separated from useful minerals. The separated toxins are easily flushed out of the body. Hence, the normal pH level is restored which results in relief from acidity. Vitamin C is a natural immunity boosting vitamin for humans. Fennel bulb is highly rich in vitamin C. Hence; its regular intake strengthens the immune system. It keeps the body safe from minor infections naturally. It also increases the body's capacity to fight back major infections. This is because – stronger immune system means active WBCs. As soon as some infection enters the body, the WBCs engulf all the disease-causing bacteria and viruses and destroy them. Fennel bulb is a rich source of cineole. [35-37] Cineole is an active agent that potentially clears nasal blockages. Thus, it is a boon for people suffering from congestion, asthma, and bronchitis. Cineol efficiently clears and controls the formation and accumulation of phlegm in the chest and nasal passage. Hence, it eases respiration. Fennel bulb is a rich source of potassium. Potassium is an active component of cranial nerves. It is also an active compound that maintains the electrolytic balance of the brain. Moreover, potassium is also a memory charger. In short, fennel bulb ensures proper functioning of the human brain by regulating the levels of potassium. It sharpens the memory and improves focus and concentration. Fennel bulb can regulate hormonal changes in the human body. Its mild analgesic benefits work like a boon to control and cure menstrual pain in women. We all want to have healthy skin and hair but the mere thought of money and time involved in a beauty regime is enough to put us off. But what if I told you that you can stay beautiful with the help of a tiny thing called the fennel seed? Fennel seeds not only impart a special flavor to those gastronomic delights brewing in your kitchen, but can also be utilized for achieving a flawless skin and healthy hair. Yes, you got that right! Fennel seeds can be beneficial for your skin and hair. Fennel seeds are inexpensive and readily available. Loaded with minerals like iron, copper, selenium, potassium, magnesium, zinc and even vitamins like Vitamin C, Vitamin A, and Vitamin E, fennel seeds are also known to be a rich storehouse of dietary fibers, active compounds, and antioxidants. Fennel seeds offer amazing effects for the skin. Not only fennel seeds are antiseptic by nature, but also are loaded with antioxidants. As a result, they help prevent acne, cell damage, while keeping the skin toned. Using fennel seeds as a part of your skin care will help you delay the onset of lines, dark spots and wrinkles. When you consume fennel seeds in one form or the other, you get glowing and flawless skin in return. When consumed, fennel imparts a cooling effect to the skin. It soothes inflammation and skin irritation. Fennel tea, when consumed

on a daily basis, helps in improving the overall texture of the skin. It treats acne and makes your skin look youthful. Fennel seeds, when consumed daily, provide the body with minerals like iron, zinc, selenium and calcium. These minerals are effective in maintaining the oxygen balance, thus imparting healthy skin. [38-40]

FENNEL HOME REMEDIES

Saunf is an aromatic and sweet flavored seed acts as a mouth freshener and helps in removing bad breath, relief from toothache and gum problems. Eating saunf seeds provides relief from the common cold and cough problems. It is rich source of essential nutrients, fibers, anti-oxidants, vitamins and minerals which promotes courage and strength if consumed regularly. It is a powerful anti-oxidant as it contains some natural antioxidant compound called kaemferol and quercetin which helps in combating with harmful free radicals thus prevents from various degenerative diseases like cancer, aging, neurological diseases and etc. Regular intake of saunf helps in getting relief from the constipation and other digestive problems as it contains high level of dietary fibers which absorbs more water and makes stool soft and ease passage. Dietary fibers found in it helps in lowering the serum cholesterol level as it gets binded with bile salts and reduces its absorption in the colon. Its antioxidant nature protects colon and its mucus membrane from the cancer by inhibiting the growth and development of the cancerous cells. Fennel seed is rich source of essential oil compounds like limonene, anisic aldehyde, myrcene, pinene, fenchone, chavicol, anethole, cineole and etc which make it able to prevent from various health disorders. It is rich source of copper which is highly required by the body to produce red blood cells thus it protects from anemia and other problems caused due to decreased amount of hemoglobin.

It is rich source of zinc mineral which acts as a co-factor for many enzymes regulating the growth and development of body, sperm production, nucleic acid synthesis and etc. Fennel seed is rich source of potassium electrolyte which is very necessary for the balance of cells and body fluid as well as controlling heart rate and blood pressure. It is also a rich source of manganese mineral which is the important co-factor for various powerful antioxidant enzymes. Its antibacterial nature protects from the infection of various harmful bacteria including *Bacillus subtilis*, *Cladosporium cladosporioides*, *Aspergillus niger* and etc. It provides relief from the problems of stomach, intestine, colon, irritable bowel syndrome, spleen, kidney and etc. It helps in curing fever by increasing perspiration. Washing mouth with the warm saunf water is very helpful in removing bad breath.

Massaging the muscles on lower abdominal area with the mixture of saunf oil, whole fatty milk, geranium oil and clary sage oil helps in reducing menstrual pain, cramps and PMS disorders. It contains good level of phytoestrogens improving food digestion by soothing the irritable gastric glands. Fennel seed is a good blood purifier helps in purifying blood if a handful of raw saunf is eaten two times a day, morning and evening. It helps in curing heat stroke if saunf water (soaked

into water for whole night) is taken by adding a pinch of salt. It helps in promoting proper bowel movements if one teaspoon of the roasted saunf is taken after meals. It is diuretic in nature helps in removing toxic materials from the body as well as provides relief from the body swelling and joints pain during rheumatism and arthritis. It stimulates the secretion of digestive enzymes and juices as well as reduces inflammation of digestive tract thus promote more absorption of the essential nutrients from the food while passing through the alimentary canal. Regular intake of it helps in recovering digestive system functioning after getting long radiation or chemotherapy treatments. Saunf water acts as a vasodilator thus keeps mind and body stress free and calm by enhancing oxygenated blood flow to the brain and all through the body thus keeps away from depression, dementia and other memory loss problem.

Fennel seed is a most common mouth freshener used in the paan (betel leaf) to make it delicious and flavored to chew. Fennel seed is a natural home remedy to suppress appetite and go for weight maintenance. It has been used for years by the women during their fasting periods to reduce hunger. It is a fat digester and hunger suppressor thus helps in decreasing weight among obese and overweight people if saunf tea or saunf water is taken in the early morning with empty stomach. It helps in preventing from the eye disorders (optic nerves weakness, glaucoma and night blindness) and improving eye sight if carrot juice is taken with half tsf powdered saunf regularly. Regular consumption of saunf helps in maintaining clear vision. Fennel seed promotes blood vessels dilation in the eye by reducing the eye pressure thus prevents from glaucoma (caused due to increased eye pressure), retinopathy (vision loss in diabetics), vision impairment diseases and etc.

It is good source of all the minerals required for bone growth such as calcium, phosphorus, magnesium and etc thus helps in improving bone strength and development. Fennel seed naturally slows down process of bone destroying cells production in the body as well as reduces occurrence of age related bone problems like osteoporosis. Applying the mixture of saunf water (boil two tsf of saunf into a glass of water for at least one hour at low heat) and whey (or dahi water) to the face for 15 to 20 mins then wash, helps in getting fair look with smooth skin. Whether it is applied directly to the skin or eaten, helps in getting acne and spots free skin as it has antiseptic and antioxidant properties.

It slows down the aging process by preventing cell damage and reducing the effects of free radicals thus keeps skin flawless without wrinkles and fine lines. Applying fennel seed water to the skin helps in getting toned, flexible and soft skin as it hydrates the skin by enhancing blood circulation to the face. Regular use of fennel seeds tea (drinking or applying to hair) helps in getting strong and lengthy hair as it prevents unusual hair loss and premature hair graying.

It prevents from hair fall by providing relief from itchy scalp and dandruff. Saunf has emmenagogue property which helps in regulating the regular menstrual flow among women. Its

availability with essential phytoestrogens helps in curing menstrual disorders such as premenstrual syndrome, early menopause, unusual breast enlargement and etc. It prevents from the cardiovascular diseases, hormone or estrogen dependent cancer, menopausal disorders, hot flashes, dysmenorrhea (painful menstruation) and etc. Fennel seed keeps mind very calm and stress free by reducing the level of anxiety, depression, stimulating proper menstruation, lowering blood pressure, and etc. It helps in relieving morning sickness, weakness, fatigue and other symptoms during pregnancy. Regular use of fennel seeds helps in improving milk production among women on breast feeding or nursing mothers because of its galactagogue property. Drinking saunf water with little honey (boil saunf into water and add honey) helps in increasing the breast milk production.

It is aphrodisiac in nature helps in enhancing libido as well as maintaining sexual power in both men and women. It is a better home remedy to enhance breast at home than other surgical breast enlargement procedures. It is loaded with the natural hormones which involve in the developing and growing breast tissues to make breasts large and firm without any side effects. Saunf is used in manufacturing many creams and pills having estrogenic effects which are used by most of the women for years to get their enhanced breast. Its natural phytoestrogens availability prevents abnormal growth of the breast tissues thus protects from breast cancer. Fennel seeds availability with high amount of flavonoids helps in promoting the production of estrogen hormone which in turn promotes breast enlargement. Massaging breast with saunf oil for 10-15 mins each (100-300 circular rubs for each) once a day in the morning or before going to bed helps in enhancing breast size. This procedure needs time and dedication but result oriented. It is very beneficial for the newborn babies as it helps in relieving from the colic pain as well as improving digestion. Massaging joints with the fennel seed oil or saunf oil helps in relieving joints pain (caused due to arthritis) and cellulite. It also provides relieve from the respiratory problems like cough, bronchitis and etc.

It contains essential oil required for the health of liver thus protects from the liver disorders. Drinking jeera and saunf water on daily basis (boil jeera and saunf seeds powder into a glass of water till it remains half) helps in getting wrinkles and acne free skin as well as helps in good digestion by keeping acidity away. Eating one tsf of powdered mixture of saunf, almonds and mishri at every night before going to bed with a glass of warm milk for one and half months helps in improving eyesight by curing all the eye disorders. Avoid drinking water after having this mixture. Taking this mixture with milk also helps in enhancing the memory and concentration level by curing headache and eye pain. Fennel seeds tea is a natural detoxifier (when used regularly) helps in releasing body toxins by detoxifying the body as well as prevents from water retention in the body. It can be prepared at home by boiling one or two tsf saunf seeds or leaves into a cup of water till it remains half and add some sweetener (sugar, honey or jaggery) and milk according to the need and taste. Taking saunf tea on daily basis

helps in relieving gastrointestinal disorders including gas, acid reflux, bloating, loss of appetite, indigestion, acidity and etc. Generally it is used by the people during summer season as a home remedy to get relief from the summer heat. It improves digestion by curing intestinal worms problem among kids. It helps in regulating menses by easing menstrual spasms. Regular intake of saunf tea aids in proper digestion and assists in weight loss. It helps in keeping body fit and youth look. It helps in curing bloating, gas, indigestion and digestive tract inflammation which helps in decreasing belly fat and thus weight loss. Fennel leaves are used to reduce the effect of snake bite and neutralize the vegetable poison like mushroom etc. Inhaling the steam of boiled fennel leaves helps in treating respiratory infections of bronchitis and asthma. [35-44]

On account of its carminative properties, fennel is chiefly used medicinally with purgatives to allay their side effects and for this purpose forms one of the ingredients of the well known compound liquorice powder. Fennel water has properties similar to those of anise and dill water: mixed with sodium bicarbonate and syrup, these waters constitute the domestic 'gripe water', used to correct flatulence of infants. Fennel tea, also employed as a carminative, is made by pouring boiling water on a teaspoonful of bruised fennel seeds. In the Indian Subcontinent, fennel seeds are eaten raw, sometimes with some sweetener to improve eyesight. Extracts of fennel seeds have been shown in animal studies to have a potential use in the treatment of glaucoma, as a diuretic and a potential drug for the treatment of hypertension. It has been used as a galactagogue improving the milk supply of a breast feeding mother. This is suggested to be due to the presence of phytoestrogens present in fennel which promote growth of breast tissue.

NUTRITIONAL BENEFITS OF SAUNF/FENNEL SEEDS PER 100 G

(Source: USDA Nutrient Database)

Energy: 345 Kcal
 Carbohydrate: 52.29 g
 Protein: 15.80 g
 Fat: 14.87 g
 Dietary Fibers: 39.8 g
 Vitamins
 Thiamin (B1): 0.408 mg
 Riboflavin (B2): 0.353 mg
 Niacin (B3): 6.050 mg
 Pyridoxine (B6): 0.470 mg
 Vitamin A: 135 IU
 Vitamin C: 21 mg
 Electrolytes
 Sodium: 88 mg
 Potassium: 1694 mg
 Minerals
 Calcium: 1196 mg
 Copper: 1.067 mg
 Iron: 18.54 mg
 Magnesium: 385 mg
 Manganese: 6.533 mg
 Phosphorus: 487 mg
 Zinc: 3.70 mg

CONCLUSION

Foeniculum vulgare has shown that it is an important medicinal plant used in a wide range of ethnomedical treatments, especially for abdominal pains, antiemetic, aperitif, arthritis, cancer, colic in children, conjunctivitis, constipation, depurative, diarrhea, dieresis, emmenagogue, fever, flatulence, gastralgia, gastritis, insomnia, irritable colon, kidney ailments, as a laxative, leucorrhoea, liver pain, mouth ulcer, and stomachache. This plant has been in use for a long period of time without any documented serious adverse effects. Studies carried out in the past and present indicate that fennel possesses diverse health benefits and are an important constituent of food. Studies have shown that various extracts of fennel possess a range of pharmacological actions, such as antiaging, antiallergic, anticolitic, antihirsutism, anti-inflammatory, antimicrobial and antiviral, antimutagenic, antinociceptive, antipyretic, antispasmodic, antistress, antithrombotic, anxiolytic, apoptotic, cardiovascular, chemomodulatory action, cytoprotection and antitumor, cytotoxicity, diuretic, estrogenic properties, expectorant, galactogenic, gastrointestinal effect, hepatoprotective, human liver cytochrome P450 3A4 inhibitory, hypoglycemic, hypolipidemic, memory-enhancing property, nootropic, and oculohypotensive activity supporting its traditional use. The observed health benefits may be credited to the presence of the various phytochemicals like volatile compounds, flavonoids, phenolic compounds, fatty acids, and amino acids. Fennel also contains mineral and trace elements like aluminum, barium, calcium, cadmium, cobalt, chromium, copper, iron, magnesium, manganese, nickel, lead, strontium, and zinc; fat soluble vitamins such as vitamins A, E, and K; water soluble vitamins like ascorbic acid, thiamine, riboflavin, niacin, and pyridoxine; essential amino acids like leucine, isoleucine, phenylalanine, and tryptophane may contribute to the myriad health beneficial effects at least in part. Among several classes of chemical constituents identified in fennel, volatile components of fennel essential oil and phenolic compounds are assumed to be the main bioactive compounds responsible for the majority of its pharmacological effects. However, the vast traditional use and proven pharmacological activities of fennel indicate that an immense scope still exists for its chemical exploration.

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SAVE THE ENVIRONMENT (STE) was founded and registered on 19th November 1990. In 1992 with the collaboration of WWF (India), the organization started working to combat arsenic poisoning problem of water in the arsenic prone areas of West Bengal. Since then STE has been involved in various projects related to combat arsenic problem in India.

Our Vision

To protect present and future generations from various environmental hazards.

Our Mission

To create awareness and motivation among rural communities & provide cost effective, energy efficient & environment friendly technologies.

Our Activities

Conducting interactive sessions, workshops/ seminars, awareness programs, field operations through projects, science fairs, posters & quiz competitions.

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