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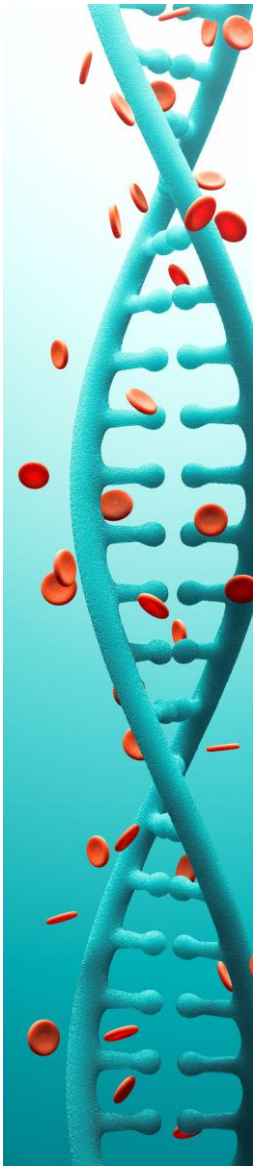

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AIMS AND OBJECTIVES OF IJEHS:

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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ASSESSMENT OF GROUNDWATER QUALITY FOR DRINKING PURPOSE IN RAJAUND BLOCK, KAITHAL DISTRICT, HARYANA

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Abstract
Assessment of water quality is important for planning and monitoring of water various purposes like drinking, irrigation and industrial uses. In the present era of developmental activities assessment of water quality is more important to avoid many health problems. The present study is carried out in Rajaund block in Kaithal district of Haryana with an objective to assess groundwater quality for drinking purpose. The geo-coordinates of the study area are latitudes 29.51^0 N to 29.69^0 N and longitudes 76.35^0 E to 76.58^0 E and covers an area of 285.25 sq. km. 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 (IS 10500:2012) drinking water standards to know groundwater quality for drinking purpose. In the study area pH ranges 6.5 to 8, alkalinity 210 mg/l to 550 mg/l, hardness 50 mg/l to 650 mg/l, chloride 60 mg/l to 490 mg/l, TDS 540 mg/l to 1776 mg/l, fluoride 1.5 mg/l to 5 mg/l, iron nil in all eight groundwater samples, ammonia nil to 5 mg/l, nitrite 0.5 mg/l to 1 mg/l, nitrate 75 mg/l to 150 mg/l, phosphate nil in all 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, Rajaund, Kaithal, Haryana.

INTRODUCTION

Water plays vital role in maintaining health of living beings. Good quality drinking water avoids many health problems like fluorosis. In the present time availability of good quality water is become scarce due to anthropogenic pollution. The need of the hour is to monitor the drinking water quality for minimizing poor water quality borne health problems. Many workers (Barber et al. (1996), Asadi et al. (2007), Babiker et al.(2007), Arumugam and Elangovan (2009), Balakrishnan et al. (2011), Deshpande and Aher (2012), Singh and Kumar (2014),Krishnaraj et al. (2015), Choudhary et al. (2016), Vijaya Lalitha et al. (2016), Lalitha et al. (2017), Molekoa et al. (2019)) had done work on assessment of groundwater quality for drinking purpose in many areas.

STUDY AREA

Rajaund block is located in Kaithal district of Haryana state (Fig.1). The geo-coordinates of the study area are latitudes 29.51^0 N to 29.69^0 N and longitudes 76.35^0 E to 76.58^0 E and covers an area of 285.25 sq. km.In the study are geologically alluvium and geomorphologically alluvial plain are present.

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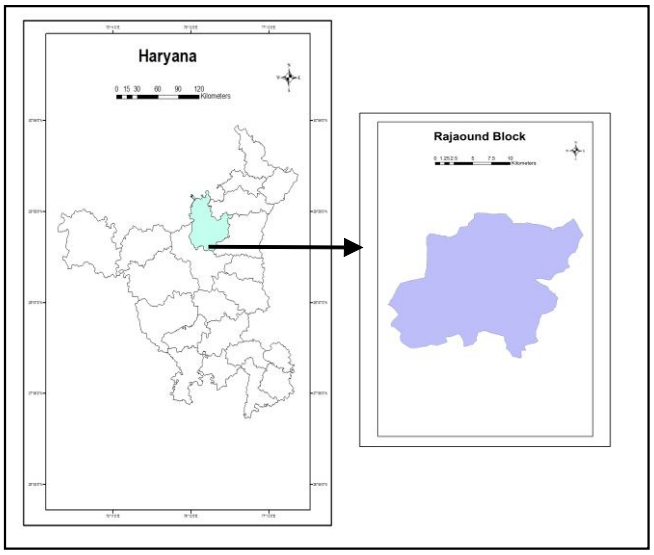

Fig.1: Location map of the study area.

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 (Table 1). Result of chemical analysis of groundwater samples were entered in excel software and prepared bar graph for each chemical parameter. Results of groundwater samples analysis were compared with BIS drinking water standards (IS 10500:2012) (Table 2) to know groundwater quality for drinking purpose.

Table 1: Results of groundwater samples analysis in the study area.

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)	Phos-phate (mg/l)	Residual Chlorine (mg/l)
1	Kithana (I)	29.54	76.39	TW	8	400	370	490	1512	5	0	5	1.0	150	0	0.2
2	Kithana (ii)	29.56	76.39	TW	6.5	340	50	60	540	3	0	0	1.0	100	0	0.2
3	Jakhauli	29.66	76.44	TW	8	480	540	420	1725	5	0	1	1.0	100	0	0.2
4	Dudana (I)	29.53	76.48	TW	8	530	650	300	1776	3	0	1	0.5	75	0	0.2
5	Dudana (ii)	29.53	76.48	TW	8	550	400	200	1380	3	0	0.5	0.5	100	0	0
6	Rohera	29.56	76.42	TW	7.5	280	120	140	648	3	0	0	1.0	100	0	0
7	Rajound	29.58	76.49	TW	8	380	90	80	660	1.5	0	1	1.0	100	0	0.2
8	Kukarkanda	29.63	76.52	TW	7	210	400	450	1272	3	0	1	0.5	100	0	0

Table 2: Drinking water standards (BIS: 10500:2012).

Sl. No.	Parameters	Potable		Non potable
			Desirable	Permissible
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)	<0.1	-	>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 8 (Table 1, Fig.2). As per BIS 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 eight groundwater samples (Kithana (i), Kithana (ii),Jakhauli, Dudana (i),Dudana (ii), Rohera, Rajaound, Kukarkanda).

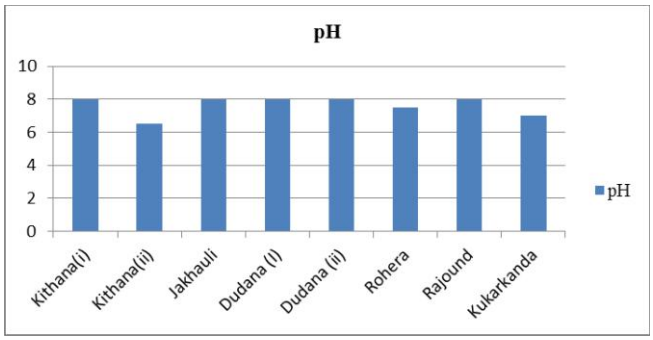

Fig. 2: pH in groundwater samples.

ii. Alkalinity

In the study area alkalinity ranges 210 mg/l to 550 mg/l (Table 1, Fig.3). As per BIS 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. Alkalinity is permissible in all eight groundwater samples (Kithana (i), Kithana (ii),Jakhauli, Dudana (i),Dudana (ii), Rohera, Rajaound, Kukarkanda).

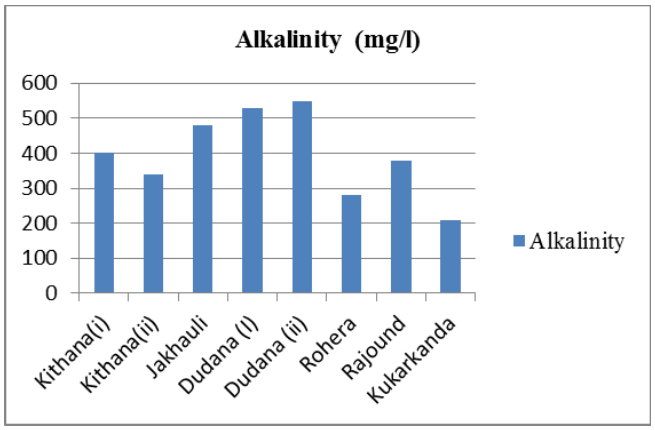

Fig.3: Alkalinity in groundwater samples .

iii. Hardness

In the study area hardness ranges 50 mg/l to 650 mg/l (Table 1, Fig.4). As per BIS 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 three groundwater samples (Kithana (ii), Rohera, Rajound, permissible in four groundwater samples (Kithana (i), Jakhauli, Dudana (ii), Kukarkanda) and non-potable in one groundwater sample (Dudana (i) (650 mg/l)).

iv. Chloride

In the study area chloride ranges 60 mg/l to 490 mg/l (Table 1, Fig.5). As per BIS 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. Chloride is desirable in four groundwater samples (Kithana (ii),Dudana (ii),Rohera, Rajound) and permissible in four groundwater samples (Kithana (i), Jakhauli, Dudana (I), Kukarkanda).

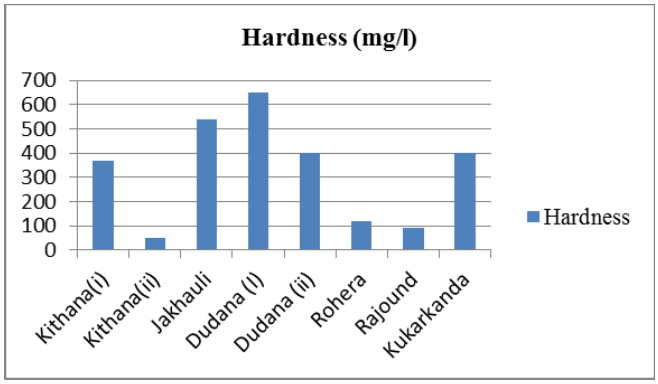

Fig.4: Hardness in groundwater samples.

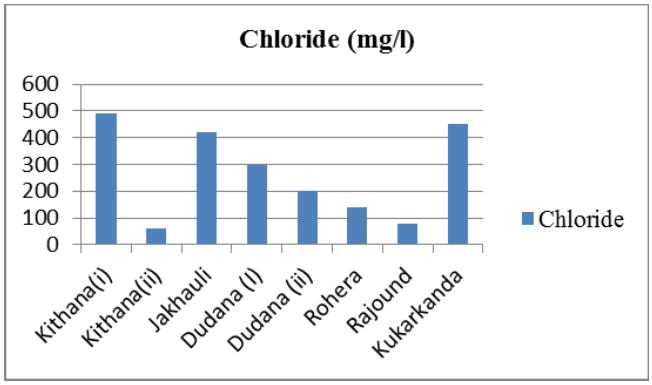

Fig. 5: Chloride in groundwater samples.

v. Total Dissolved Solids

In the study area TDS ranges 540 mg/l to 1776 mg/l (Table 1, Fig.6). As per BIS drinking water standards TDS is desirable if less than 500 mg/l, permissible between 500mg/l-2000 mg/l and non-potable if more than 2000 mg/l (Table 2). TDS is permissible in all eight groundwater samples (Kithana (i), Kithana (ii), Jakhauli, Dudana (i), Dudana (ii), Rohera, Rajound, Kukarkanda).

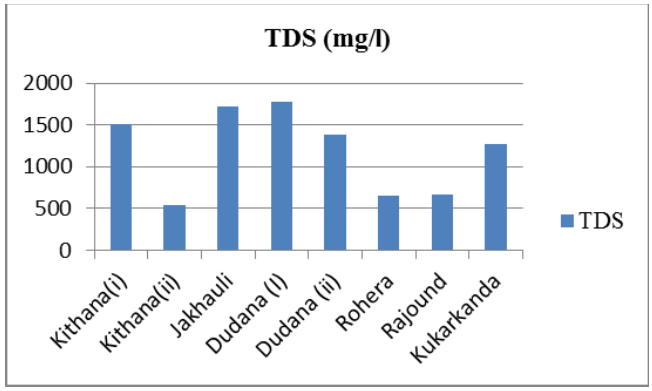

Fig. 6: TDS in groundwater samples.

vi. Fluoride

In the study area fluoride ranges 1.5 mg/l to 5 mg/l (Table 1, Fig.7). As per BIS drinking water standards fluoride is desirable if less than 1.0 mg/l, permissible between 1.0mg/l -

1.5 mg/l and non-potable if more than 1.5 mg/l (Table 2). Fluoride is permissible in one groundwater sample (Rajound) and non-potable in seven groundwater samples (Kithana (i) (5 mg/l), Kithana (ii) (3 mg/l), Jakhauli (5 mg/l), Dudana (i) (3 mg/l), Rohera (3 mg/l), Kukarkanda (3 mg/l)).

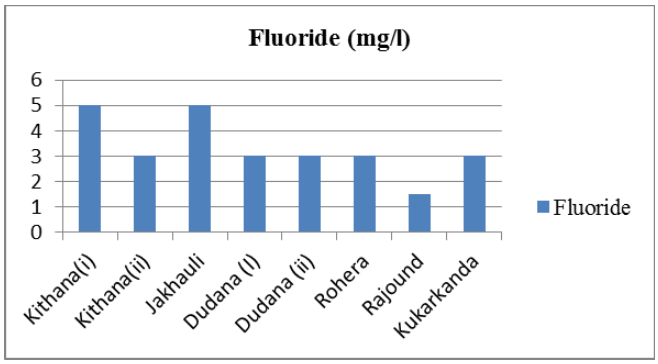

Fig. 7: Fluoride in groundwater samples.

vii. Iron

In the study area iron is nil in all the eight groundwater samples (Table 1, Fig.8). As per BIS 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 eight groundwater samples (Kithana (i), Kithana (ii),Jakhauli, Dudana (i),Dudana (ii), Rohera, Rajaound, Kukarkanda).

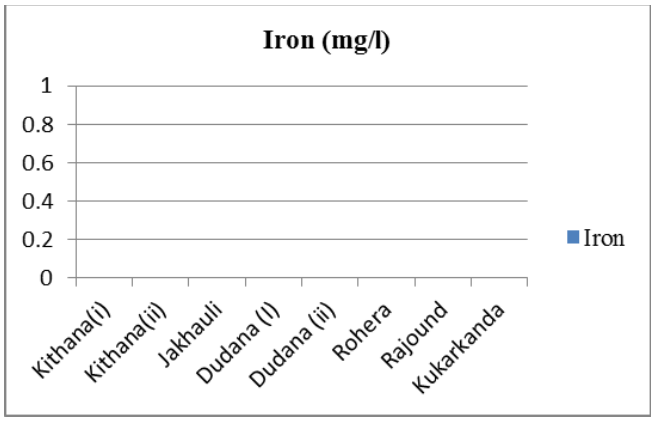

Fig. 8: Iron in groundwater samples.

viii. Ammonia

In the study area ammonia ranges nil to 5 mg/l (Table 1, Fig.9). As per BIS 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 three groundwater samples (Kithana (i), Dudana (ii), Rohera) and non-potable in five groundwater samples (Kithana (i) (5 mg/l), Jakhauli (1mg/l), Dudana (i) (1 mg/l), Rajound (1 mg/l), Kukarkanda (1 mg/l)).

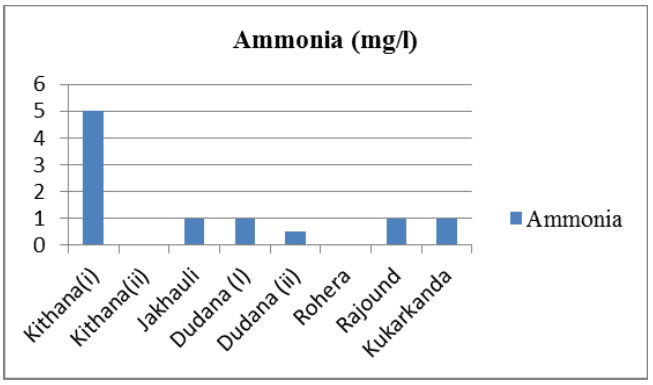

Fig. 9: Ammonia in groundwater samples.

ix. Nitrite

In the study area nitrite ranges 0.5 mg/l to 1 mg/l (Table 1, Fig.10). As per BIS drinking water standards nitrite is desirable if less than 1.0 mg/l and non-potable if more than 1.0 mg/l.Nitrite is desirable in all eight groundwater samples (Kithana (i), Kithana (ii),Jakhauli, Dudana (i),Dudana (ii), Rohera, Rajaound, Kukarkanda).

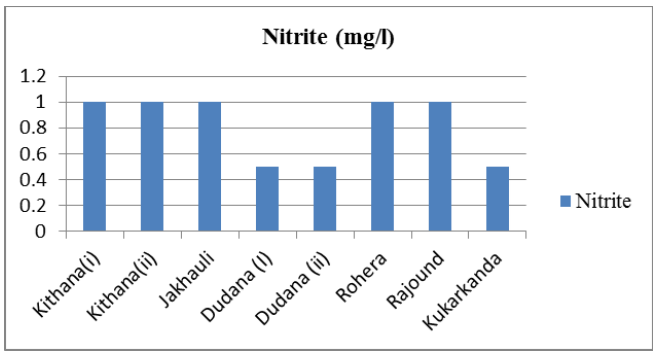

Fig.10: Nitrite in groundwater samples.

x. Nitrate

In the study area nitrate ranges 75 mg/l to 150 mg/l (Table 1, Fig.11). As per BIS drinking water standards nitrate is desirable if less than 45 mg/l and non-potable if more than 45 mg/l (Table 2). Nitrate is non-potable in all eight groundwater samples (Kithana (i) (150 mg/l), Kithana (ii) (100 mg/l),Jakhauli (100 mg/l), Dudana (i) (100 mg/l),Dudana (ii) (100 mg/l), Rohera (100 mg/l), Rajaound (100 mg/l), Kukarkanda (100 mg/l)).

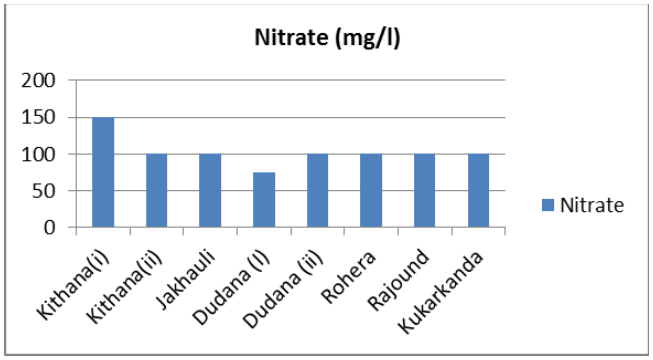

Fig. 11: Nitrate in groundwater samples.

xi. Phosphate

In the study area phosphate is nil in all the eight groundwater samples (Table 1, Fig.12). As per BIS drinking water 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 eight groundwater samples (Kithana (i), Kithana (ii),Jakhauli, Dudana (i),Dudana (ii), Rohera, Rajaound, Kukarkanda).

xii. Residual Chlorine

In the study area residual chlorine ranges nil to 0.2 mg/l (Table 1, Fig.13). As per BIS drinking water standards residual chlorine is desirable if less than 0.2 mg/l, permissible between 0.2-1.0 mg/l and non-potable if more than 1.0 mg/l

(Table 2). Residual chlorine is desirable in three groundwater samples (Dudana (ii), Rohera, Kukarkanda) and permissible in five groundwater samples (Kithana (i), Kithana (ii), Jakhauli, Dudana (i), Rajound).

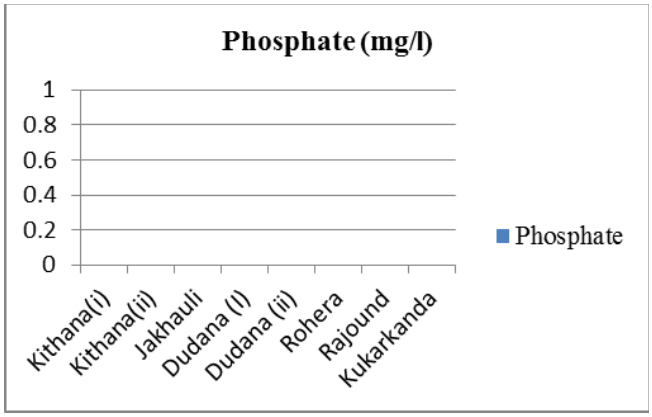

Fig.12: Phosphate in groundwater samples.

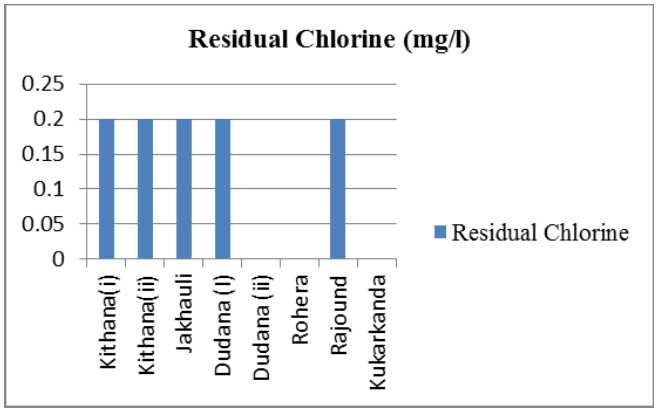

Fig.13: Residual Chlorine in groundwater samples.

CONCLUSIONS

In the study area pH, iron, nitrite and phosphate are desirable in all eight groundwater samples. Alkalinity and TDS are permissible in all eight groundwater samples. Hardness is desirable in three groundwater samples, permissible in four groundwater samples and non-potable in one groundwater sample. Chloride is desirable in four groundwater samples and permissible in four groundwater samples. Fluoride is permissible in one groundwater sample and non-potable in seven groundwater samples. Ammonia is desirable in three groundwater samples and non-potable in five groundwater samples. Nitrate is non-potable in all eight groundwater samples. Residual Chlorine is desirable in three groundwater samples and permissible in five 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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CORONAVIRUS (COVID 19) PANDEMIC: EMERGING CHALLENGES AND STRATEGIES FOR WASTE MANAGEMENT IN INDIAN SCENARIO

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Abstract
Generation and management of a huge quantity of waste and associated contamination risk during and post Coronavirus (COVID 19) pandemic is a potential global environmental problem. Like other countries of the world, India is also facing the challenges of proper segregation and disposal of the (COVID 19) waste generated from the last few months. Coronavirus (COVID19) waste like face masks, Personal protection equipment, sanitizer container, gloves, common packaging plastic waste generated from the hospital, household, restaurant and E-commercial sector, etc. are mostly made up of plastic and are associated with potential contamination risk. The world is already facing the problem of disposal and management of plastic pollution before the pandemic, COVID waste has posed an extra burden on the environment. Further, people who are engaged in the handling and disposal of COVID 19 waste could spread infection as they are working without proper personal protection equipment. Various government agencies in the world like WHO and CPCB in India have prepared the guideline for the management of COVID 19 waste i.e., biomedical, solid, and plastic generated during the pandemic. This paper highlights the urgent need for treatment of COVID 19 waste in fast track manner to avoid the transmission of the virus. The study highlights the Generation of COVID Waste during Pandemic, Rules and Guideline for waste management in India, Impact of COVID-19 waste on environment, and strategies for COVID Waste Management in Indian scenario.

Keywords
Covid-19, Waste, Management, Treatment, Pandemic, Guideline, Management.

1. INTRODUCTION

The pandemic known as Coronavirus also well known as Severe Acute respiratory syndrome coronavirus woke the world in late December 2019 [1] .Later on 11th February 2020 an International Committee on Taxonomy of Viruses declared coronavirus (SARS-CoV-2) as the name of the new infection [2]. COVID-19 outbreak as pandemic was exposed by WHO on March 2020 [3]. Developing countries like India are still fighting against the SARS-CoV-2 to survive by taking precaution like face masks, sanitizer, gloves, personal protective equipment, etc, which was later disposed off as waste. Waste is a serious environmental concern especially in developing countries and municipalities of both urban and rural areas put their best effort to successfully manage the large quantity. The problem of waste management has become a serious concern during COVID 19 pandemic as new items of waste have started generating which are mostly non-biodegradable in nature. The pandemic has hindered the process of waste generation, making problems among decision-makers and workers working in sanitation [4]. Many types of waste including disposable face masks, gloves, and other personal protective equipment as well as the huge quantity of general solid waste of similar nature are produced during the pandemic[5]. With total lockdown, people started demanding food and groceries for home delivery services, because eating places around the world were closed finally led to excessive use and production of common packaging plastic waste like LDPE, HDPE etc[6]
As a result of the coronavirus pandemic there were reduction in the recycling activities of plastic, handling and

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management have become a big question for the management business of waste[7,8] Huge production of infected face mask are source of environmental concerns because incineration and reclamation release harmful gases [9]. Abruptly rise in plastic waste due to the Coronavirus pandemic calls up for the critical need for plastic reduction policies and implementation at ground level without waiting and also to advances in innovation for sustainable solutions and to develop dynamic and reactive waste management systems instantly [10]. Therefore, to reduce the secondary effect on health and the environment authorities have counsel to treat waste management of biomedical, municipal solid waste or general waste, and other harmful waste as an important and necessary peoples service[5].

The pandemic Covid-19 has also immobilized the food network which is seen facing countless problems and caused alarm by countrywide lockdowns in many nations has resulted in the obstructive gathering of meal and other foodstuffs significant to break food waste creation active[11]. As a result of the emerging COVID-19, food manufacture and utilization systems have undergone notable changes, the food chain through a Material Flow Analysis, results reveal that first week of the COVID-19 lockdown [12]. The fast increase in waste quantity is probable to disturb systems that are planned for balanced conditions [13].

One of the grave problems during pandemic as far as waste is concerned is tremendous increase in plastic waste. If it is not managed properly it ended their life in the ocean which results in chocking of aquatic fauna and if incinerated there is emission of toxic gases in the environment. Simultaneously, there is a possibility of transmission of the virus through the handling of COVID waste generated from the hospital, home isolation, quarantine, as virus life span is varied on different articles such metal, clothes, plastic etc. The cases are also increasing because of improper handling of COVID waste by waste pickers and rag pickers in the community. Till date, no study has been done on the transmission of the virus through waste in India. In this paper we have highlighted the generation of COVID Waste during Pandemic, rule and guideline for waste management in India, Impact of COVID-19 waste on environment, and Strategies for management of COVID waste in Indian scenario. In this paper we have dwelled upon the generation of COVID Waste during coronavirus pandemic, rules and guideline for waste management in India, environmental impact of COVID-19 waste and emerging issues and strategies for Management of COVID Waste in Indian scenario.

2. CORONAVIRUS Pandemic (Covid-19) Situation in India

The first case of positive coronavirus in India was announced on 30th January a student from Kerala returned from China[14]. In India as the number of positive cases of corona has increased on twenty forth of March 2020 Prime minister declared a total lockdown of twenty one days for the whole country, which was again extended for nineteen days on fourteen of April 2020 in II phase followed till Phase IV. Various restrictions were imposed on various anthropogenic activities other common transportation activities. In addition to these directorial plan such as reduction on social gathering events, limitation on travel, corona suspects isolations and treatment were also imposed. However, the COVID-19 has created a crisis like condition for all and it would have a negative effect economy also [15] .

The coronavirus has seriously impacted the second most populous country in the world. In India on September 14, 2020 there were 986598 active cases with 79722 death cases and further increasing new cases along with 3780107 discharged or recovered from the disease. More than 70% cases due to co-morbidities [16].As far as vaccine trials for coronavirus in India are concerned, as per to the Indian Council of Medical Research), Bharat Biotech and Serum Institute of India engaged in vaccine manufacture and DNA vaccine of Zydus Cadila have completed phase one and will begin phase two clinical trials, Oxford vaccine got approval for phase 2 and 3 clinical trials which are being manufactured by Serum Institute of India [17] . Fig. one shows the Continues decline in Active cases in India from July to December, 2020.

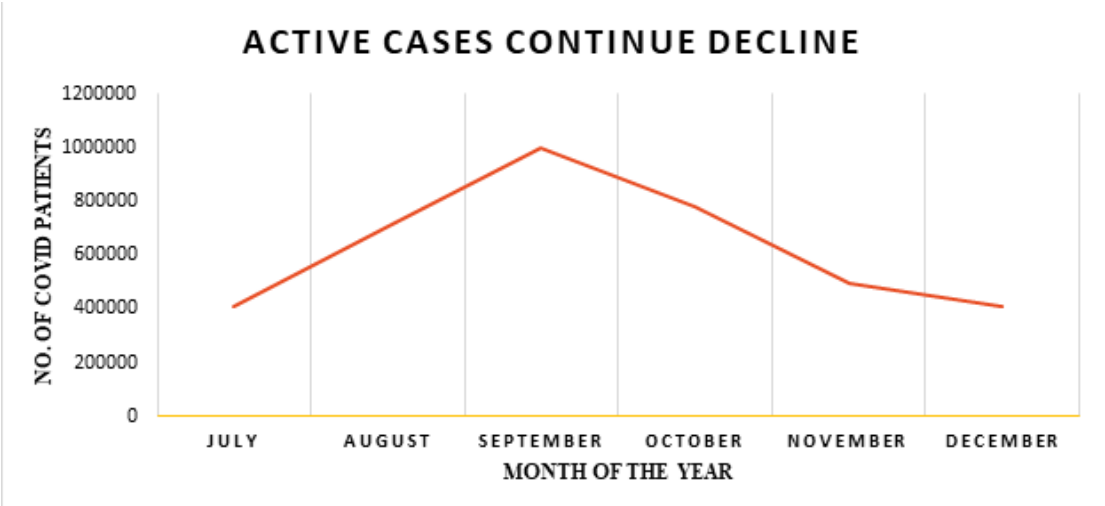


Fig 1: Showing the Continues decline in Active cases in India from July to December, 2020. *Source*:-pib.gov.in, 2020.

In India there was much decline in Covid case in Jan to mid-March but after amid of March month 2021 second wave of Covid started and highest number of Covid cases was on April 09 that was 144,829 found in India and India is 3rd leading country based on the USA and Brazil cases18. Some state of India such as Kerala, West Bengal, Tamil Nadu, Andhra Pradesh, Maharashtra, Delhi, Karnataka, and Uttar Pradesh in which higher number of Covid cases were found. Table 1 illustrates about the status of various medical facilities, availability of vaccines etc. between the first wave of Covid and second wave in India [19].

Table 1: Comparison between Covid First Wave and Second Wave in India.

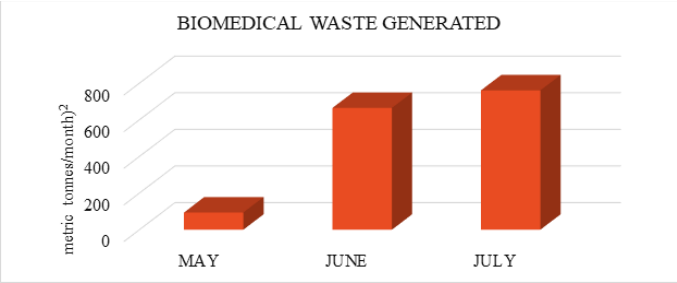
	First wave of Covid	**Second wave of Covid**
Causative organism	Severe Acute Respiratory Syndrome –Coronavirus-2 (SAR-CoV-2)	Variant of first wave Coronavirus
Symptoms	Respiratory	Respiratory, Gastrointestinal, Join pain etc.
Presentations	More severe	Less intense
Age profiles of patients	Older peoples	Youngers
Comorbidities	Observed more in cormorbidties	Less
Availability of medicines	Shortage of medicines	Medicines are available from various pharmacies and hospitals
Health care staff/worker	Less trained and also fear of infection as they were not vaccinated at that time.	Trained and less risk of infection as they were vaccinated
No. of beds	Limited no. of beds were available	Enhanced the availability of beds in hospitals
Personal Protection Equipments (PPE's)	Shortage of PPE's	Millions of PPE's (personal protection equipment) manufactured.
Age profile of the patients	Old age	Younger
Vaccines availability	No vaccines were available	Three approved vaccine are available
Beds having ventilators	Less	High
Death rate	Higher	Lower
Plasma therapy	Less	High
Positivity case rate	Lower	Much higher
Mechanical ventilations facilities	Less facilities of mechanical ventilations.	More

Source: Jain *et al.* 2021

In the second wave young people and children are infected in addition to older people [18]. Most of the symptoms observed are dry cough, breathing problem, joint pain, headache, Gastrointestinal or adding etc.

3. Generation of Covid 19 Waste During Pandemic

Waste was already a serious environmental issue before the pandemic as far as India is concerned, but the pandemic and post-pandemic waste generation have imposed huge concern for safe disposal and management of waste. In developing countries, waste recycling is managed by both authorized and private sectors during pandemic [20]. The best management practices plan put into effect for waste handling and cleanliness is important and should be given careful thinking toward workers exposure [2].



Source: EPCA, 2020

Fig 2: Showing the generation of biomedical waste during the month of May, June and July from NCR State.

Table 2: Generation and Disposal of Biomedical Waste During Covid-19.

S. No	Name of State	No. of covid waste generator month of May) Ton/Day	Covid-19 Biomedical Waste In June) Ton/Day)	Covid-19 Biomedical waste In June) Ton/Day	Covid-19 Biomedical Waste	No. of CBWTF involved	Capacity of Incinerator for 16 hours operation in tons/day
1	Delhi	15	25.18	372.47	349.006	2	74
2	Up	45	14.5	137	247.32	4	9.4
3	Haryana	160	54.1	155.89	162.3	7	55.2
4	Rajasthan	11	Data Not Available	Data Not Available	3.27	1	2.4

(*Source*: EPCA report 2020)

According to (EPCA) Environment Pollution Control Authority report, 2020 As compared to May month Delhi produced fourteen times more biomedical waste because of Covid 19 in July. In addition, Environment pollution control authority (EPCA), 2020 as shown in fig. two and table two report mentioned that in National Capital Region (NCR) six district namely as Baghpat, Meerut, Muzaffarnagar, Gautam Buddha Nagar, Hapur, Ghaziabad of Uttar Pradesh in combined generated one hundred and thirty seven tonnes daily in month of June and 14.5 tonnes per day in month of May and which was increase to total of 247.32 tonnes COVID-19 hospital waste per day in the month of July. On other side, Gurgaon, Panipat, Karnal, Sonipat, and Faridabad, etc. thirteen (13) districts of Haryana in NCR, sum up generated 54.1 tonnes per day ,155.89 tonnes per day and 162.23 tonnes COVID-19 hospital waste daily in May, June and July month [21].

According to (MPCB) Maharashtra pollution control board state biomedical production has been increased from a mean of 62,000kg/ day before Covid and over 90,000 kg daily in lockdown [22] . Coronavirus focal point Wuhan witness a six times rise in hospital Waste during the maximum of its pandemic [23] . In India metro cities (Gurugram) of India is one of the most affected and in Ahmedabad city, the normal hospital waste generated around 550–600 kg/day and now during the first phase of lockdown which was increased to 1000 kg/day which will again rise up to 3000 daily as very fast use of face masks and collection of waste from quarantine places. It showed that biomedical waste has risen 40 times in the last couple of months [24]. Now, India has finite potential to handle hospital waste, around one hundred and ninety eight (CBMWTF) common bio-medical waste treatment facilities and two hundred and twenty five captive incinerators are working in the country [25]. It has been a major issues to the municipal official to control the unexpected increase in the generation of Biomedical Waste quantities from the COVID-19 upsurged. Various types of waste are brought out during covid-19 are discussed below:

3.1 Plastic waste: During Pandemic (Coronavirus) time most of the countries made it mandatory to use masks, gloves, protective gowns, etc. which minimizes the infection of virus [26.27, 28, 3] . Both masks and hand sanitizer producer has use of plastic-like polypropylene which is due to the microfibers' water repelling characteristic and also polyurethane and polyacrylonitrile for expensive protective cover[29] . On one side over need for Personal Protection Equipment result in the rapid production of plastic wastes [8, 30, 31, 32, 33] . Unfortunately, suitable disposal place for Personal Protection Equipment has not been gained due to a number of reasons [34]. Various polymers and metallic compounds are used for the manufacture of personal protection equipment. Besides all recycling is the best method for treatment of Personal Protection Equipment, such activities are not easily realized due to problems in proper segregation [35].

The energy and environmental footprints of plastic product systems have rapidly in response to the rush in the COVID-19 number cases globally. The idea of Plastic Waste Footprint (PWF) is suggested to trap the environmental footprint of a plastic material's entire life cycle. Due to increasing concerns of cleanliness, specifically from materials used for personal protection and health protection purposes the usage of single use plastic is set to come back [36] . A rush in single-use plastic utilization found that people are demanding food at a rate more than twice as high as last year as a group surveyed over 2000 participants in early April, indicating most probably due to social distancing measures. [26]

3.2 Solid waste: The situation tackle by the waste management zones during the covid-19 has been a big source of concern during this emergency. Further, in absence of public involvement and support, blending virus infected on hospital waste with the general solid waste stream show notable impact on health and safety matter to waste handler and workers [37,38] . Suggested alternatives proposal for Municipal Solid Waste management and indicate the upcoming opportunity of work to gain post pandemics in sustainable waste management

3.3 Biomedical waste: Generation of hospital waste is increase during coronavirus emergencies rapidly, as well as the discard of infected disposable masks and personal protection equipment has disturbed the current waste management systems. As health care has expanded to temporary isolation centers facilities like camps, home-care etc. following guidelines or rules related to waste segregation and storage. Disposal of general solid waste from the hospital

are managed according to solid waste management rule[39] . In India guidelines issued for the management of hospital waste during pandemic also the disposal of general solid waste generated from both medical facilities and households covid patient should follow solid waste management rule 2016 [40] .

3.4 Food waste: Ability to make healthy food production and supply systems are key to fighting hunger and fight against diseases challenges wherever they appear in humans, animals, plants or the environment [41].The Pandemic Coronavirus Disease is a global issue which is already influencing the food and agriculture sector [42]. A guidelines has been issued by United State Environmental Protection Agency for solution for food waste management in a sustainable way during pandemic COVID-19 public health crisis, in addition guidelines also direct food waste management at different levels i.e. households, institutions and businesses[43] .

In India, diversity of agriculture and horticulture product i.e., seasonal crops, vegetables and fruits were ripened or mature and wheat, paddy and barley crops were got ready for harvesting. Due to the sudden lockdown in the country, maximum of the food product was wasted, in addition, the government of India (GOI) also cooperate in the management of perishable products and supplies disbursal of food items to affected people. Most importantly, food delivery through technology applications support the government to reach the specific and remote individuals received food management and reduced the food loss [38].

However, in many place there is a probability of rise in meal waste from the supply chains such as edible food items getting stuck on the road due to lockdown, shortage of labour in the depot for handling the food stuff, in future localized strong supply chains to counter such circumstances during pandemics [34].

4. RULE AND GUIDELINE FOR WASTE MANAGEMENT IN INDIA

In India there are separate rule for each type of waste i.e Solid waste, Biomedical waste, Plastic waste, C&D waste (Construction and Demolition), Hazardous waste and E-waste under (EPA) environmental protection act 1986. And these rule are amended according to need of improvement by invite suggestion from public .All these rule are amended in year 2016. Which are appended on CPCB websites. Here we discussed on different waste management Rule 2016.

4.1 Biomedical waste management rule in India:- The handling and management of Biomedical waste rule come in 1998 in which waste were categories into ten categories on the basis of waste item generated in health institution during diagnosis, treatment etc. Later in 2016 this rule was amended and named as Biomedical waste management rule 2016 where term handling was omitted in this rule there were four categories on the basis color of bins and treatment required i.e., Red, Blue, Yellow and White in which waste item were dump. Black bin which are also in health institution for dispose of food waste are considered under general waste not in biomedical waste. Fig. three shows type of colors bin use for segregation of biomedical waste in hospital of India are yellow bin are for segregation of soiled waste, blue bin is for glass waste like vials etc., red bin is for segregation of Plastic waste like glucose bottles etc. and white puncture proof container for sharps like needle and blade etc.

Fig 3: Showing different color code bin use for segregation of Biomedical waste in hospital.

In 2020, due to break of pandemic like Coronavirus government agencies has given a new guideline for management of biomedical waste these were World health organization, International solid waste association, Occupational safety and health administration, Centers for disease control and prevention. Such guideline main purpose was for overall safety protection and welfare of sanitary worker and waste collector while stockpile COVID-19 waste. In India Central pollution control board given new guideline with revised version time to time according to need of public well-being [44].

4.2 Guideline for handling of Covid waste i.e., Biomedical and Solid waste: -In India CPCB has given a guideline for waste generated during from Covid patients and which were revised time to time and 4th revised was on 17 July 2020 and appended on CPCB central pollution control board website Delhi. This guideline in addition with Biomedical waste management rule 2016 is applicable ULBs and CBWTF i.e Urban local bodies, Common biomedical waste treatment and disposal facilities), Laboratories, quarantine centres, and Isolation wards. The 1st guideline for handling of biomedical waste on 22 April 2020, 2nd revised guideline on 30 April 2020 and 3rd revision guideline in June and last guideline i.e 4threvised guideline on 17 July 2020 is for guide segregation of biomedical waste and solid waste generated by Covid patient during treatment and also mention disposal of personal protection equipment. According to guidelines, proper label and yellow bins with double layer and leakage proof should place in isolation wards for management of hospital waste generated by Covid patients. So, it could be easy for waste collector to direct transfer to CBWTF (Common biomedical waste treatment and disposal facilities) to handle the waste. All the plastic waste such as PPEs (personal protection equipment) are dump into red bag and wet waste should put in compostable bags. Other waste like non-plastic or semi-plastic, tissues and toiletries, of covid patient segregated in yellow bag[45].

4.3 Solid waste management in isolation ward: -Earlier solid waste management rule was name as municipal solid waste management and handling rule 2000 which only cover area under municipal but in 2016 this rule has been amended and term municipal has omitted and new named solid waste management rule 2016 which covered area extension of municipal like religious place, airport, harbor, defense area etc.[43] . During pandemic (Covid -19) revised guideline-4 of CPCB (central pollution control board) mentioned that general solid waste generated by Covid patient in isolation ward should collect and manage according to SWM rule 2016. In order to reduced waste generation, plastic items must be used for serving food are should be manage with disinfected as per given guidelines by Central Pollution Control Board. The wet and dry solid waste bags should kept carefully in non- leak- bags, disinfected with chemical such as sodium hypo-chlorite solution and finally give to waste picker authorized i.e., Urban Local Bodies on daily basis. General solid waste should not be kept in Yellow colored bags [46].

4.4 Biomedical and solid waste management in Camp, Home-Care, Quarantine center facilities. According to guideline revised-4 issued by CPCB state that biomedical waste generated by Covid patient should be segregated in yellow bag or bins finally handover to authorized Urban Local Bodies, Waste collector or Common Biomedical Waste Treatment Facilities. Solid waste or general waste generated by Covid -19 patient or quarantine persons generated from patients quarantine in different facilities such as camps and home quarantine should be segregated and collected in bags, properly sealed and gave to waste collector authorized by Urban Local Bodies for final disposal. Also ensure not to let of mixed of general waste with covid waste generated from quarantine center [37] . Fig. four shows flow chart for management of Covid waste generated by patients.

In Delhi The two municipalities bodies i.e. SDMC and NDMC i.e South and North Delhi Municipal Corporation accountable for transported Covid waste produced by covid positive patients undergoing home care isolation and finally transport to (Wte) waste-to-energy plants such as Timarpur-Okhla waste treatment plant, Narela-Bawana and Ghazipur. Environment Pollution Control Authority (EPCA) Suggested waste can send to (CBWTF) common biomedical waste treatment facilities, because present (WtEs) Waste to energy plant are designed to incinerate municipal solid waste. For treatment of biomedical waste incineration having double chamber and guideline for storage and emission control are needed [18].

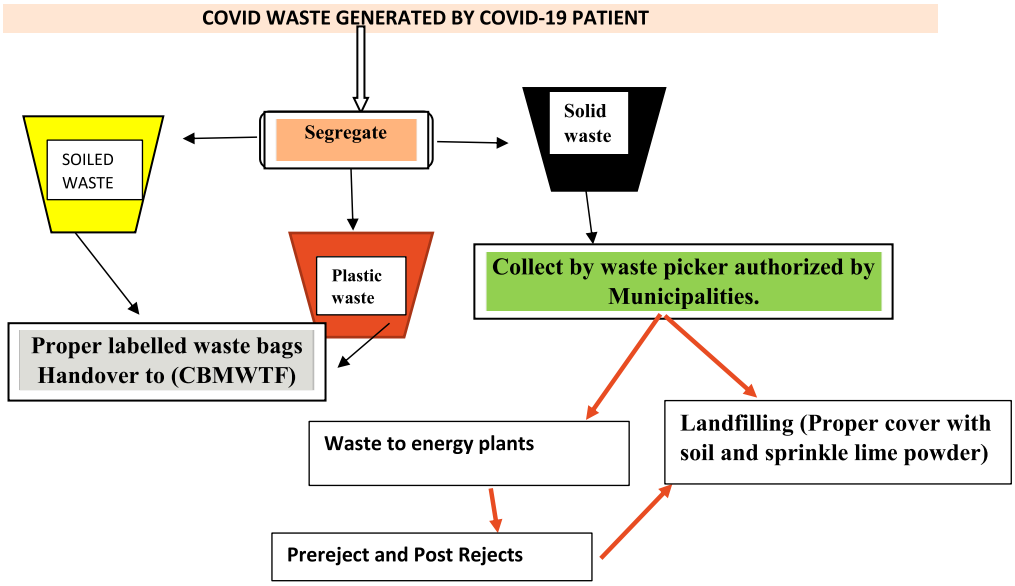


Fig 4: Showing flowchart for management of waste generated by a Covid patient in India.

5. ENVIRONMENTAL IMPACT OF COVID-19 WASTE

Before Covid -19 pandemics, waste has been one of the main environmental issue and discussion took place at various platform and aware the peoples about negative impact of unplanned disposal of waste in environment. Currently, at time of pandemic people maintain social distancing by avoiding entertainment and recreation areas which result in decreased in waste in people place and cities [47] **.**Due to stay-at-home guideline by government, many people have enhanced their single-use packaging for delivered food item from food corner. Many municipalities had their recycling activities of local waste because of the risk of transmission of virus in recycling [48]**.**

Likewise economic impact, GHG emissions and the nutritional content (+11%), (+10%), (−8%) complete the multifaceted impact form that the COVID-19 epidemic had on FLW production and management [27]**.** On the other hands domestic waste, food delivery boxes have notoriously increased in quantity. Some nations have ceased their recycling to minimize virus infection happened and protect labours [44]. Recently National Green Tribunal (NGT) directed the (CPCB) central pollution to recover fee from E-commerce like Amazon and Flipkart as they used excessive plastic packaging for their sale product and may violate the environmental norm. Amazon, Flipkart and other e retailers used plastic packaging beyond the size of the product inside the packet which later break into microplastic and become a major threat to aquatic and terrestrial environment [49] .

Biomedical waste represents a potential threat as many disposable items, such as gloves, facial masks, and shoes, are not easily degraded in nature and we can face its collection in our environment which can be again harmful to all environmental components[50]**.** COVID-19 epidemic increases the menace of plastic pollution which was already worsened the terrestrial and aquatic environment both[26] .Chemicals like Hydroxychloroquine and chloroquine are some of the drugs that have been used to treat COVID-19 which are persistent, bioaccumulative, and harmful to aquatic life and act as pollutants[51,52,53]**.**Many diagnostic laboratories usually use disposable supplies, produce huge quantities of plastics and chemicals that degrade soil and water[54]. Maximum of personal protective materials, such as masks and containers, made up of plastic [55]**.**

In the public places object that are placed close to containment area to control people enter mostly manufactured of methacrylate (source of plastic material, Resistance) which later ending their products durability and dumped in landfill. It has been also reported disposable mask and gloves also found in coastal area and seafloor Asian countries [56] . Animal of both terrestrial and aquatic were entangled or eaten this waste as food and finally end their life [57,58] **.**

General waste containing viable coronavirus are probably produced at the residential level from COVID-19 positive person may be cause of infection for people involve in waste collection [2] . In that regard,[59] report that proliferation of the SARS-CoV-2 may be rise by lack of proper handling and management of waste especially in developing countries having insufficient waste management rule. It has been reported in Nepal that lot of people are asymptomatic, may effect in infection to ragpickers of solid waste and collector and then reinfection back to the groups, In addition few of the product from waste are purchased by poor people, and again increase the cause of infection[60]. Likewise In Nigeria, Poorly disposal of solid wastes in dumpsites which are collected for recyclable and mistaken eaten by animal as their food and result in increased risk of infection in the community[61] **.**On other the hand in developed countries over generation of plastic mask and gloves from residential areas showed threat of transmission and degrade the environment[2,62]. Severe Respiratory Syndrome-Coronavirus-2 which was settle more imbalance on copper and cardboard than plastic and stainless steel and also known to stable on mask and gloves generated from households. Much of the information on Severe Respiratory Syndrome-Coronavirus -2 persistence on solid surfaces is work out from preceding coronavirus studies [63]**.** Two very toxic carcinogenic gases—Dioxin and Furan large number of people living around these incinerators and might end up having cancer and other diseases in the years to come (tribune) Covid waste new kind of pollutant which add up on current existing environmental issues **[26].**

PPE (Personal protective equipment) play a vital role during pandemic crises which need to be changed three or four time in a days for health worker which are gradually rise in quantities and threat to the environment. According to the CPCB (Central Pollution Control Board) report said that 30 per cent of waste still not treated and incinerator treat only 70 per cent of this waste. Even PPEs, Mask, Gloves have been found dumped outside the hospitals or even on the roads. Also waste segregation have not occurred at source of generation and waste collector have to segregate it, which may risk of infection as they reside in overpopulated place[64]**.**Many waste collector was got infected because of mishandling of biomedical waste and healthcare workers and public were also suffered as waste was not properly managed[65] .

6. Strategies and Technology for Covid Waste Management

People of different countries already fighting against single-use plastics which is non biodegradables, Currently the world is facing a new challenge in disposing masks, gloves and personal protective equipment amid the COVID-19 crisis. It is time for government needs to act quickly respond, install toxic gas absorbing filters and take all necessary steps for safe disposal of the huge amounts of biomedical waste being generated. It is imperative for the country to step up efforts to sensitize regarding proper handling of biomedical waste to protect the environment and reduce the threat of Covid-19[66]**.** For food packaging breadbox is highly safer than polythene bag in terms of sterility, and that food corner should offer discount to customers that bring their own food

vessel. The best solution would be to make healthy food at home [26] **.** Environment Pollution Control Authority EPCA has suggested to the SC (Supreme Court) that all municipalities and SPCB (State Pollution Control Boards) be rule to use the mobile applications started by the CPCB (Central Pollution Control Board) name as COVID19BMW to follow biomedical waste management[19] .Some of the sanitize plan at national used for hospital liquid waste sterilize during corona for biomedical waste and some common disinfection are incineration, chemical and physical disinfection were used in hospital [67]**.**

Incorporation of the different proposals for (SWM) solid waste management improve the present systems and execute new e management systems for solid waste and can minimize the environmental impacts from(GHG's) greenhouse gas emission[68]**.**Best management waste practices should be apply to avoid the workers vulnerable to potentially contaminated waste[2]**.** According to [69] Mask which is made of various compounds and difficult to be recycled, suggests an environmentally at the same time gaining the generation of useful fuels from the face mask it is done by method such as Carbon dioxide-assisted thermo-chemical process was performed and these conversion of discarded face mask and Carbon dioxide could be an eco-friendly way to reduce Covid waste and production of energy.

In India discarded (PPE) personal protection equipment should be shredded and transport to plastic waste recyclers which are authorized by state pollution control board, or may be used plastic waste in generation of energy i.e., Waste to Energy (WtEs) plant and into refuse derived fuel (RDF) or for road construction [37] **.** Treatment of biomedical waste can be done by autoclaving technique called as hydrothermal carbonization (mostly non-infectious plastic fraction) carbonization [70]**.** In china biomedical waste treated by adopting of these technologies depend on budget and flexibility, to assess potentiality, value and correlated degradation of environment [64]**.**

According to central pollution control board plastic waste which are generated from residential households must first store in paper bag for at least for seventy-two hours then discard of the similar as dry general solid waste [37]**.** Personal protection equipment (PPE) which get rid of from materialistic set up, shopping malls, institutions, offices, etc. must put waste in segregated form in different bin for 3 days, afterwards do cutting and finally discard in general solid waste [42] **.** Some Practices which may include if collection of infected household would have delaying waste collection later than (72 h) then direct transportation of waste to waste to energy or dumpsites without waste segregation at MRF (Material Recovery Facilities) [2]**.** [71] Claims that the technologies like (WtEs) waste to energy are hardly employ in developing nation concentrate on waste type, treatment may demand high level plant arrangement, and major capital costs.

CONCLUSIONS

The Pandemic coronavirus affect all the countries of the world in term of life, environment and economy but peoples try to cope up with serious situation and support their Government in tackling the situation. As number of cases increasing is directly related to increasing in biomedical waste such as PPE, mask, glove and other plastic waste etc. which required at time of treatment and risk for transmission is also there as people may contact with covid-19 positive patient. Rule and guideline are also made by government agencies to manage the waste generate from hospital and temporary isolation or quarantine place for patient there are need of awareness on segregation waste from household to not to mix biomedical with general waste but still there lack of implementation of guideline at ground level. Most of countries including India still fighting against pandemic and various vaccine has been developed by different countries researcher and in second wave three vaccine are approved in India and which were in different phase of human trial during first wave but in second wave vaccination against covid has been started for two age group i.e. 45+ and 18+.In future, people may tackle the third wave in better way as presently there are enough facilities and also people experienced already first and second wave of covid . It is duty of government to provide health and food security for waste collector and rag picker at time of these pandemic situation as they put their life at risk while handling of waste. For treatment of waste there are need to improvement in technology at waste to energy plant and also enhance the intake capacity of waste at plant .It would be better if maximum waste can be recycle and find out value added product from these waste in ecofriendly way than incineration .

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AMAZING HEALTH BENEFIT OF FENUGREEK (*trigonella foenum-graecum* LINN.)

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Abstract
Fenugreek is known for its medicinal qualities such as antidiabetic, anticarcinogenic, hypocholesterolemic, antioxidant, and immunological activities. Beside its medicinal value, it is also used as a part of various food product developments as food stabilizer, adhesive, and emulsifying agent. More importantly it is used for the development of healthy and nutritious extruded and bakery product. The main chemical components of fenugreek are fibers, lavonoids, polysaccharides, saponins, fixed oils and some identified alkaloids. Mature seeds mainly contain amino acid, fatty acid, vitamins, saponins and a large quantity of folic acid. It alsocontains disogenin, gitogenin, neogitogenin, homorientin saponaretin, neogigogenin, and trigogenin. The endosperm of the seed is rich with galactomannan. The young seeds mainly contain carbohydrates. In this review paper, the potential of fenugreek for disease prevention and health improvement has been emphasized.

Keywords
Diabetes; Fenugreek Lactone, Dietary fibres, Nutraceutical, Hypoglycemic, Gum extrudate.

INTRODUCTION

Fenugreek (*Trigonella foenum*-graecum) is a leguminous, herbaceous, rainfed crop included among the seed spices is about 30-60 cm tall, leaflets are about 2-2.5 cm long, flowers are1-2 cm long, axillary, sessile and cultivated throughout the country and has been used as a spice throughout the world to enhance the sensory quality of foods. Fenugreek, a short-living, self-pollinating crop, is a native to Indian subcontinent and the Eastern Mediterranean region. It belongs to Fabaceae family and is used extensively in various parts of the world as herb, food, spice, and traditional medicine. It is an annual herb with white flowers and hard, yellowish brown and angular seeds, known from ancient times, for nutritional value beside of it medicinal attributes. Fenugreek seeds are rich source of gum, fiber, alkaloid, flavonoids, saponin and volatile content. Due to its high content of fiber, fenugreek could be used as food stabilizer, adhesive and emulsifying agent to change food texture for some special purposes. The present article is aimed to review the potential applications of fenugreek as a functional food and nutraceutical. This novel legume source provides soluble fiber along with other glucose-, cholesterol-, and triglyceride-lowering compounds. [1-3] This seed spice is employed for medicinal purpose in many traditional systems as antibacterial, gastric stimulant, against anorexia, antidiabetic agent and as a galactogogue. In recent decades, several health beneficial physiological attributes of fenugreek seeds have been seen in animal studies as well as human trials. Not only therapeutic, Fenugreek also used as spices worldwide. The leaves are used as green leafy vegetables in the diet. Fenugreek seeds are bitter in taste and have been in use for over 2500 years. In different languages it has different names, as Fenugrec (French), Methi (Hindi), Bockshorklee (German), Fienogreco (Italian), Pazhitnik (Russian), Alholva (Spanish), Koroha (Japanese), Hulba (Arabian), Halba (Malaya), and K'u –Tou (China). India is the major producer of Fenugreek and its main consumers are culinary and medicinal users. In the indigenous system, it is effective

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against anorexia, and as gastric stimulant. Fenugreek having antidiabetic, antifertility, anticancer, antimicrobial, antiparasitic, lactation stimulant, hypocholesterolemic influence, antioxidant potency, digestive stimulant action, and hepatoprotective effect. [4-6]Among these beneficial physiological effects, the antidiabetic and hypocholesterolemic property of fenugreek, both of which are mainly attributable to the intrinsic dietary fiber constituent, possess promising nutraceutical value, have been discussed in this comprehensive review paper.

Fig. 1: Phytochemistry and Pharmacology.

Plant-derived natural products have long-standing utility toward treating degenerative diseases. Fenugreek is considered as one of the oldest medicinal plants and its health-promoting effects have been cited in Ayurveda and traditional Chinese medicine. In recent decades, several health beneficial physiological attributes of fenugreek seeds have been seen in animal studies as well as human trials. These include antidiabetic effect, hypocholesterolemic influence, antioxidant potency, digestive stimulant action, and hepatoprotective effect. The investigations into the chemical composition and pharmacological actions have seen a renaissance in recent years. Extensive preclinical and clinical research have outlined the pharmaceutical uses of fenugreek as antidiabetic, antihyperlipidemic, antiobesity, anticancer, anti-inflammatory, antioxidant, antifungal, antibacterial, galactogogue and for miscellaneous pharmacological effects, including improving women's health. The pharmacological actions of fenugreek are attributed to diverse array of phytoconstituents. [5-8]The phytochemical analysis reveals the presence of steroids, alkaloids, saponins, polyphenols, flavonoids, lipids, carbohydrates, amino acids, and hydrocarbons. It is also used for conditions that affect heart health such as "hardening of the arteries" (atherosclerosis) and for high blood levels of certain fats including cholesterol and triglycerides. Fenugreek is used for kidney ailments, a vitamin deficiency disease called beriberi, mouth ulcers, boils, bronchitis, infection of the tissues beneath the surface of the skin (cellulitis), tuberculosis, chronic coughs, chapped lips, baldness, cancer, Parkinson's disease, and exercise performance . Fenugreek has been associated with increased testosterone levels and enhanced sexual function in middle age men with androgen deficiency symptoms, as well as with a reduced severity of both menopausal symptoms and dysmenorrhea, including menstrual pain, fatigue, headache, nausea, and lack of energy. These hormone-regulating actions, equally beneficial for both men and women, are attributed to a high content of phytoestrogens (stearic acid, palmitic acid, and beta-sitosterol) and steroidal saponins (diosgenin, tigogenin, neotigogenin, and yamogenin). The presence of phytomenadione (a vitamin K derivative that aids coagulation), as well as alkaloids, aminoacids (such as lysine), also contributes to the galactagogue, hypoglycemic, and hormone balancing properties of fenugreek. Additionally, fenugreek's omega-3 fatty acids and dietary fiber, as well as a water-soluble polysaccharide called galactomannan (Fig. 2), are thought to contribute with the beneficial effects of fenugreek on metabolic functions. Galactomannan has been shown to help regulate digestive enzymes, also inhibiting the absorption of glucose in the gastrointestinal tract. Fenugreek seeds contain no essential oil and their characteristic scent and flavor are due to the presence of fenugreek lactone (sotolone Fig. 3), an extremely powerful odorant agent. [6-9]

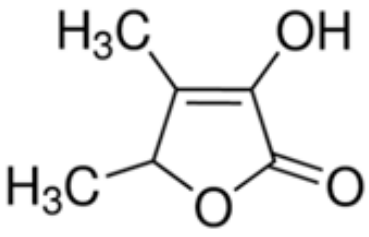


Fig. 2: Galactomannan structure

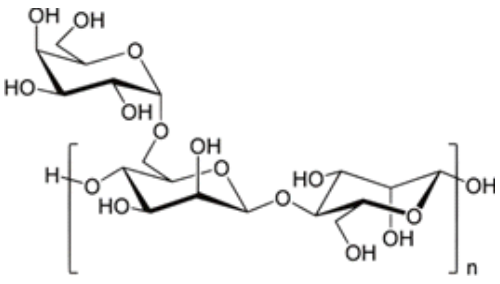


Fig. 3: Structure of Fenugreek Lactone

Fenugreek contains a number of chemical constituents including steroidal sapogenins. Diosgenin component has been found in the oily embryo of fenugreek. There are two furastanol glycosides, F-ring opened precursors of diosgenin that have been reported in fenugreek also as hederagin glycosides. Alkaloids such as trigocoumarin, nicotinic acid, trimethyl coumarin and trigonelline are present in stem. The mucilage is a standing out constituent of the seeds. There is about 28% mucilage; a volatile oil; 2 alkaloids such as trigonelline and Choline, 5% of a stronger-smelling, bitter

fixed oil, 22% proteins and a yellow coloring substance are present in stem. Fenugreek contains 23–26% protein, 6–7% fat and 58% carbohydrates of which about 25% is dietary fiber. Fenugreek is also a rich source of iron, containing 33 mg/100 g dry weight. [10-14].

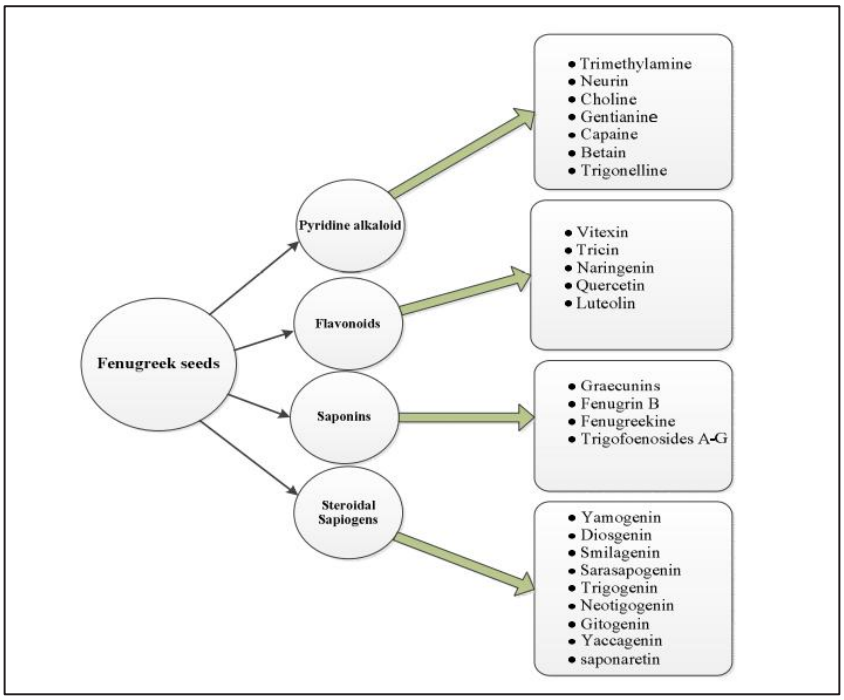


Fig. 4: Chemical constituents in fenugreek seeds.

The leaves contain seven saponins, known as graecunins. These compounds are glycosides of diosgenin. Leaves contain about 86.1% moisture, 4.4% protein, 0.9% fat, 1.5% minerals, 1.1% fiber, and 6% carbohydrates. The mineral and vitamins present in leaves include calcium, zinc iron, phosphorous, riboflavin, carotene, thiamine, niacin and vitamin C. It has been found that fresh leaves of fenugreek contain ascorbic acid of about 220.97 mg per 100 g of leaves and β-carotene is present about 19 mg/100 g. On the other side, it was reported that 84.94% and 83.79% ascorbic acid were reduced in sun and oven-dried fenugreek leaves respectively. Fresh leaves are used as vegetables in the diets. It was found that there was a better retention of nutrients in the leaves of fenugreek. Fenugreek is known for its pleasantly bitter, slightly sweet seeds. The seeds are available in any form whether whole or ground form is used to flavor many foods mostly curry powders, teas and spice blend. Fenugreek seed has a central hard and yellow embryo which is surrounded by a corneous and comparatively large layer of white and semi-transparent endosperm. The chemical composition of fenugreek (such as seeds, husk and cotyledons) showed that endosperm had the highest (4.63 g/100 g) saponin and (43.8 g/100 g) protein content. As against this, husk contains higher total polyphenols. The seeds of fenugreek contain about 0.1–0.9% of diosgenin and are extracted commercially. The plant tissue cultures from seeds of fenugreek when grown under optimal conditions have been found to produce as much as 2% diosgenin with smaller amounts of trigogenin and gitongenin. [12-16] Seeds also contain the saponin (fenugrin B). Fenugreek seeds have been found to contain several coumarin compounds as well as a number of alkaloids (e.g., trigonelline, gentianine, carpaine). The large amount of trigonelline is degraded to nicotinic acid and related pyridines during roasting. The major bioactive compounds in fenugreek seeds are believed to be polyphenol compounds, such as rhaponticin and isovitexin. Small amount of volatile oils and fixed oil has been found in fenugreek seeds have found the odor active compounds based on the fenugreek aroma detection with the help of Gas Chromatograph and these includes the olfactometry diacetyl, 1-Octene-3-one, sotolon, acetic acid; 3-Isobutyl-2-methoxypyrazine, butanoic acid, isovaleric acid, 3-isopropyl-2-methoxypyrazine, caproic acid, eugenol, 3-Amino-4,5-dimethyl-3, linalool, (Z)-1,5-Octadiene-3-one, 4-dihydro-2(5H)-Furanone with characteristic aroma of buttery like, roasty/earthy, metallic, pungent, paprika like, sweaty/rancid, flowery, musty, spicy respectively. Out of all these volatile compounds, sotolon was reported to be found most predominantly in (5s)-enantiomeric form (95%) in fenugreek. A study was conducted on sweat of human after fenugreek ingestion and it has been concluded that compounds responsible for the strong maple-syrup odor present in sweat after fenugreek ingestion are due to the following components including the following: pinene; 3-octen-2-one, 2,5-dimethylpyrazine, β-; camphor; terpinen-4-ol; 4-isopropyl-benzaldehyde; neryl acetate and β-caryophyllene but it was observed that 2,5-dimethylpyrazine to be a major component responsible for sweat odor contributing compound. [15-18]

Table 1: Odorous chemical constituents occurring in aroma extract of fenugreek seeds.

Odorous compound	Aroma quality
1-Octen-3-one	Mushroom-like
(*Z*)-1,5-Octadiene-3-one	Metallic
3-Isopropyl-2-methoxy pyrazine	Roasty, earthy
Acetic acid	Acidic, pungent
3-Isobuty-2-methoxy pyrazine	Roasty, paprika-like
Linalool	Flowery
Butanoic acid	Sweaty, rancid
Isovaleric acid	Sweaty, rancid
Caproic acid	Musty
Eugenol	Spicy
3-Amino-4,5-dimethyl 3, 4-dihydro-2-(5*H*) furanone	Seasoning-like
Stolon	Seasoning-like

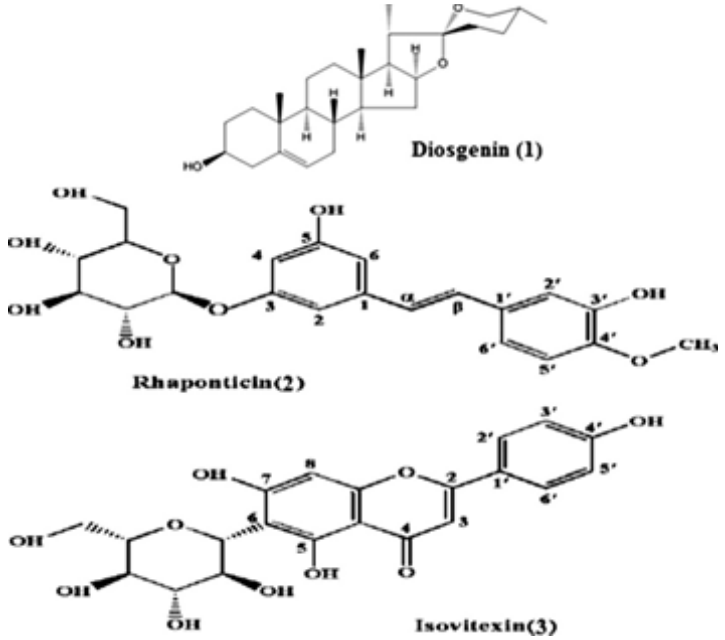


Fig. 5: Chemical structures of (1) Diosgenin (2) rhaponticin and (3) isovitexin (Volatile contents)

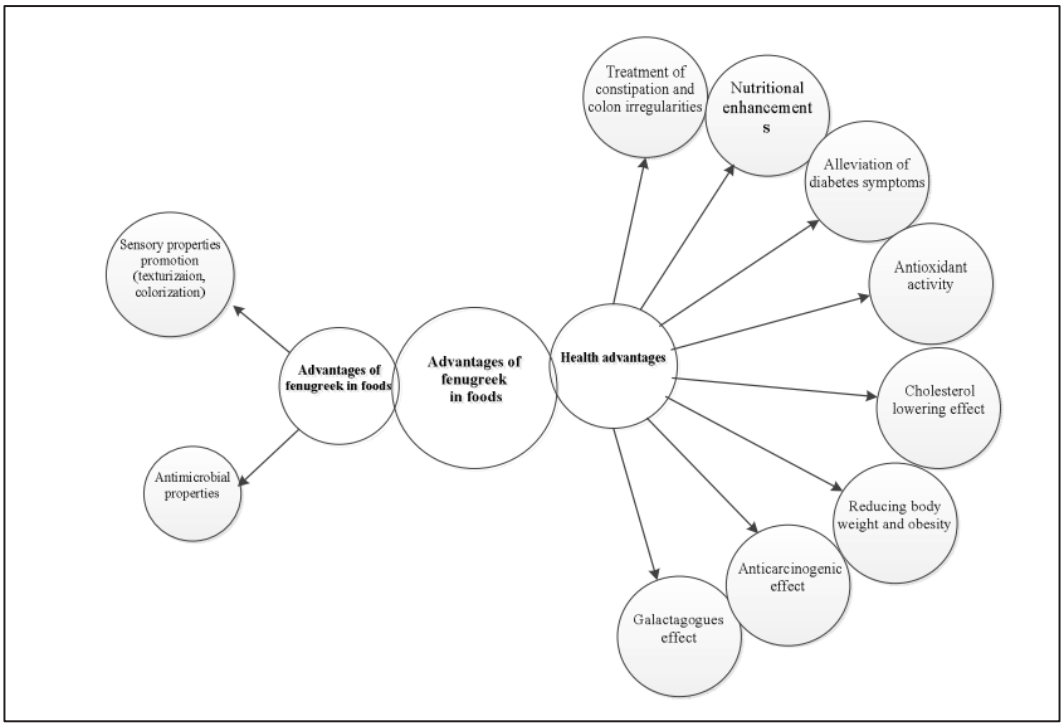
Use of Fenugreek in Day to day life

Methi seeds are a great remedy for diabetics. Methi helps in controlling the blood sugar level. The amino acid compounds in fenugreek seeds increase insulin secretion in the pancreas which helps in lowering the blood sugar level in the body. Consumption of fenugreek helps in treating kidney stones. Methi seeds help in improving kidney health. Drinking methi water will keep you full for long. Methi is packed with fiber which gives you a feeling of fullness. This helps you manage your weight. When you feel full, you don't eat many calories and also prevents you from bingeing on unhealthy snacks. It also prevents bloating. Fenugreek seeds have nutrients that help in hair growth. Consuming fenugreek water will promote hair growth, improve hair volume and keep hair problems such as dandruff, roughness at bay. Fenugreek or methi water helps in flushing out the harmful toxins from your body and it helps in improving your bowel movement. It helps you fight against digestive problems. It prevents constipation, indigestion among other digestion problems. [17-20] Methi is immensely useful for your skin and hair too. Fenugreek is taken for digestive problems such as loss of appetite, upset stomach, constipation, inflammation of the stomach (gastritis). Fenugreek is also used for painful menstruation, polycystic ovary syndrome, and obesity. Some men use fenugreek for hernia, erectile dysfunction , male infertility, and other male problems. Both men and women use fenugreek to improve sexual interest. Fenugreek is used for a variety of purposes. Fenugreek seed extract is the principal flavoring ingredient of simulated maple syrup. It is also used as a tobacco-flavoring ingredient, hydrolyzed vegetable protein flavor, perfume base, and a source of steroid sapogenin in drug manufacturing industries. The leaves are commonly consumed as a vegetable. [18-22] Currently, there is not enough conclusive evidence to fully support the use of fenugreek for any medical purpose. However, people have been using fenugreek in varying forms for hundreds or potentially thousands of years to treat a very wide range of conditions, such as: digestive problems, including constipation, loss of appetite, and gastritis; breast milk production and flow; diabetes; low testosterone or

libido; painful menstruation; menopause; arthritis; high blood pressure; obesity; breathing problems; boils; low exercise ;performance; ulcers; open wounds; muscle pain; migraines and headaches; childbirth pains; Of all the reported health benefits of fenugreek, only a few have been substantially backed by scientific evidence. Among other benefits, some research suggests that fenugreek may: Quite a few studies in animals have shown that at least four compounds in fenugreek have antidiabetic properties. They primarily: reduce intestinal glucose absorption; delay gastric emptying; improve insulin sensitivity and action; reduce concentrations of lipid-binding protein. Fenugreek may help stimulate breast milk production and ease the flow. Practitioners of traditional Asian medicine have long recommended fenugreek for this purpose. Fenugreek may suppress the appetite and increase feelings of fullness, which could help reduce overeating and lead to weight loss. Fenugreek may help increase low testosterone and sperm levels. Fenugreek may help regulate cholesterol levels and improve blood pressure, which can reduce the risk of developing heart conditions and improve heart health. Fenugreek has long been used for pain relief in traditional systems of medicine. Researchers think that compounds called alkaloids in the herb help block sensory receptors that allow the brain to perceive pain. [19-23]

Traditional uses

The medicinal value of fenugreek seeds is mentioned in Ayurvedic texts as well as in Greek and Latin pharmacopoeia. The Ayurvedic texts praise this herb for its power as an aphrodisiac, but modern vaidyas seem to be using it more for digestive and respiratory problems stemming from an excess of kaph (phlegm) and vat (wind). In ancient Egypt, methi was used to ease childbirth and to increase milk flow, and modern Egyptian women are still using it today to relieve menstrual cramps, as well as making hilba tea out of it to ease other kinds of abdominal pain. The Chinese call it hu lu ba, and also use it for treating abdominal pain. Though this cool season crop is grown in most corners of the world, its uses and people's awareness of its value vary considerably.



In India, fresh methi ka saag (the stems and leaves of the plant) is very commonly cooked as a winter vegetable, and the seeds are used year-round as a flavoring agent for various dishes. The seeds are also eaten raw as sprouts and used medicinally. In Egypt and Ethiopia, methi is used in baking bread, and the Swiss use it for flavoring cheese. In the USA, it is mainly used to make spice blends for soups and stews. [22-24]The herb of fenugreek has been used for centuries as a cooking spice in European countries and it remains a popular ingredient in curry powders, pickles and spice mixtures in India Pakistan, Bangladesh and other Asian countries. Fenugreek has been used in the folk medicines for the treatment of cellulitis, boils, and tuberculosis. Fenugreek remained a key ingredient in a 19th century patent medicine for dysmenorrheal and postmenopausal symptoms. It also has been recommended for the promotion of lactation. The seeds of fenugreek have been used as an orally as insulin substitute for reduction in blood glucose, and the extracts from seed have been reported to lower blood glucose levels. The maple aroma and flavor of fenugreek have led to its use in imitation maple syrup. [23-25]

Fenugreek usage in bakery and extruded products

The interaction of fenugreek protein with the food constituents determines its ability to stabilize and emulsify the food constituents. The effect of fenugreek gum on solubility and emulsifying properties of soy protein isolate has been evaluated and reported that the emulsifying activity

of soy protein isolate with fenugreek gum was four times higher than that of soy protein isolate with fenugreek gum or fenugreek gum alone and the results were to those of bovine serum albumin. The emulsifying stability of soy protein isolate with fenugreek gum dispersions was respectively three times higher than that of soy protein isolate with fenugreek gum and bovine serum albumin. Emulsifying properties and solubility of soy protein isolate with fenugreek gum dispersions were also stable over wide ranges of high temperature, pH and ionic strength. Fenugreek contains higher dietary fiber content which acts as probiotic in functional food. The soluble fiber of fenugreek acts as an excellent substrate for fermentation done by the microorganisms in the large intestine. The dietary fiber of fenugreek has potential for widespread use in the food industry because its galactomannan composition has emulsifying and stabilizing properties. Flour supplemented with a percentage of 8% and 10% of fenugreek dietary fiber has been used in the production of baked goods such as bread, pizza, muffins, and cakes. This application of fenugreek to flour allows for the production of functional foods that may be widely acceptable to consumers observing western diets. [24-26]Fenugreek paste, locally termed as “Cemen” is a popular food in Turkey which is prepared from ground fenugreek seeds. Crushed fenugreek seed or coarse fenugreek powder is used to make ball for making clarified butter. Adding fenugreek fiber to refined flours helps to fortify with a balance of soluble and insoluble fiber. Flour fortified with 8–10% fenugreek fiber has been used to prepare bakery foods such as pizza, bread, muffins, and cakes with acceptable sensory properties. Fenugreek seed husk is a rich source of dietary fiber and several important minerals. This fiber-rich functional ingredient can be incorporated in the manufacture of high-fiber muffins. The fiber-rich muffins possessed good volume, soft texture and medium-fine grain with twice the amount of DF incorporated fenugreek in bread and demonstrated that fenugreek in food helps in reduction of blood sugar but due to its bitterness and strong odor its use is restricted. They did not find significant variation in color, texture, proximate composition, firmness, and flavor intensity between the wheat and fenugreek bread, but level of glucose and insulin was found to be lower in the fenugreek bread. Fenugreek's functional property of reducing insulin resistance was maintained in the bread. Therefore, it is evident from this study that fenugreek can be incorporated in baked products in acceptable limit which will reduce insulin resistance and treat diabetic patients as well. Fenugreek flour has been incorporated up to a 10% level in the formulation of biscuits without affecting their overall quality. The physical, sensory and nutritional characteristics generally revealed that biscuits containing 10% germinated fenugreek flour were the best among all the composite fenugreek flour biscuits. Hence, development and utilization of such functional foods will not only improve the nutritional status of the general population but also helps those suffering from degenerative diseases. In a study incorporation of fenugreek flour up to 10% level has been used in the formulation of biscuits. [25-27]Baking quality, color attributes and organoleptic evaluation revealed that wheat flour can be replaced using 10% Soaked Fenugreek and 20% Germinated Fenugreek flours to produce acceptable and high nutritional value biscuits. The study confirmed that fenugreek seed (raw, soaked and germinated) significantly reduced total lipids, serum total cholesterol, and LDL-cholesterol but non-significant changes in triglycerides and serum HDL-cholesterol were observed. It can be recommended that fenugreek may be used for lipid lowering purposes. Supplementation of basal diets with fenugreek leaves, seeds (dry and germinated) and wheat flour supplemented with germinated fenugreek powder at 5–10% levels increased the total proteins, fibers, iron, zinc, calcium, vitamin B2, carotene, vitamin E and vitamin C contents. These dietary supplements also improve the blood picture of anemic rats so they have nutritive and restorative properties. The daily use of fenugreek products as a dietary supplement is proved to be safe and healthy. Therefore, this study recommends that intake of fenugreek products may be beneficial for patients who suffer from iron deficiency anemia owing to their nutritive and restorative values. In the same way 10% germinated fenugreek seed flour has been incorporated into the wheat based biscuits formula resulted in improving their chemical and nutritional quality and additionally also complimented the deficiency of lysine, isoleucine, leucine, threonine and valine, and hence neutralizes the amino acid imbalance. Fenugreek seed flour and fenugreek leave powder have been used for the development of extruded snacks. In a study a mixture of about 1.78% fenugreek seed flour and 0.66% fenugreek leave powder with the base material was found to have high preference levels for parameters of physical, functional and color and could be extruded with acceptable quality characteristics. The effects of fenugreek flour and debittered fenugreek polysaccharide inclusion on the physical and sensory quality characteristics, and glycemic index (GI) of chickpea–rice based extruded products were studied. Due to the distinct bitter taste, inclusion of fenugreek flour was not acceptable at levels more than 2% in extruded chickpea based products. Addition of fenugreek polysaccharide resulted in slight reduction in radial expansion, while longitudinal expansion increased. Water absorption index increased while water solubility index decreased compared to the control. The mean scores of sensory evaluation indicated that all products containing fenugreek polysaccharide up to 15% were within the acceptable range. There were no significant differences between products containing 5–15% fenugreek polysaccharide in their color, flavor, texture and overall quality. Fenugreek, in the form of debittered polysaccharide could be incorporated up to a level of 15% in a chickpea–rice blend to develop snack products of acceptable physical and sensory properties with low GI. In another study fenugreek gum was extruded in a twin-screw extruder without an exit die to minimize a decrease in molecular weight of fenugreek gum during extrusion process. Both the steady and dynamic shear rheological tests revealed that extrusion process did not substantially influence the steady and dynamic shear properties of the gum. The power law model was applied to describe the flow behavior of the extruded gum solutions. The

extrusion modified fenugreek gum solutions exhibited a shear thinning flow behavior at 25 °C, and the values of consistency index and apparent viscosity increased with an increase in the gum concentration. The magnitudes of storage modulus and loss modulus for the extrusion modified fenugreek gum solutions increased with increasing frequency and with increasing gum concentration. Fenugreek gum (extruded and non-extruded) was substituted for wheat flour at 0%, 5% and 10% (w/w) and the rheological effects and bread making characteristics were determined. [22-26] Bread containing fenugreek gum (FG) at 5% and 10% showed volumes and texture comparable with control bread. Extruding FG also improved its solubility in bread. Fenugreek gum resulted in an increase in dough farinograph water absorption compared with the control, but extruding the gum caused an even greater increase in water absorption when compared with the non-extruded gum. The addition of FG to bread dough caused an increase in storage modulus (G′) and loss modulus (G″). Starch pasting using RVA showed an increase in peak viscosity, final viscosity, breakdown and setback in a dose-related response when compared with a control. Another study showed the addition of fenugreek gum (FG) to the extruded pea–rice snack products. In addition to fenugreek gum, two more gums (guar gum and locust bean gum) were added to it. When these three gums were added to the formulations at levels of up to 20%, good expansion of the products occurred. The WAI of the extrudates containing FG increased with increasing inclusion levels. In addition to the high contents of starch that serve to provide energy, these snacks are good sources of protein and dietary fiber, and are low in fat, qualifying them as low GI snack products. In particular, the reduction in GI was the greatest with fenugreek gum extrudates. [23-29]

DISCUSSION AND CONCLUSION

Fenugreek is the famous spices in human food. The seeds and green leaves of fenugreek are used in food as well as in medicinal application that is the old practice of human history. Fenugreek seeds are rich with vitamin E. Fresh Fenugreek leaves are beneficial for indigestion, flatulence and in sluggish liver treatment. Regular use of fresh Fenugreek leaves paste helps hair grow, preserves naturalcolor, keeps hair silky and also cures dandruff. Fenugreek Seeds made in gruel, are given to nursing mothers to increase the flow of milk and also reduce the amount of calcium oxalate in the kidney which causes kidney stones. In animal studies, Fenugreek appeared to lowering the chance of developing colon cancer by blocking the action of certain enzymes. Fenugreek is currently used as a source of the steroid diosgenin , one of its active constituent from which other steroids can be synthesized. Not only that Fenugreek has a broad range of pharmacological profile but also it has antidiabetic activity, antiplasmodic activity, hypolipidemic activity, immunological activity, antibacterialactivity, anthelmintic activity, anti-inflammatory, analgesic activity and antioxidant activity. These beneficial physiological effects including the antidiabetic and hypocholesterolemic effects of fenugreek are mainly attributable to the intrinsic dietary fiber constituent which have promising nutraceutical value. It has been used to increase the flavoring and color, and also modifies the texture of food materials. It is well known for its fiber, gum, other chemical constituents and volatile contents. Dietary fiber of fenugreek seed is about 25% which changes the texture of food. These days it is used as food stabilizer, adhesive and emulsifying agent due to its high fiber, protein and gum content. The protein of fenugreek is found to be more soluble at alkaline pH. Fenugreek is having beneficial influence on digestion and also has the ability to modify the food. Fenugreek has been found to have important bioactive compounds. From this review it was observed that fenugreek has been used as food stabilizer, food adhesive, food emulsifier and gum. Fenugreek has been used to produce various types of bakery products and extruded product. Based on these several health usefulness as discussed in review, based on various past reported scientific findings, fenugreek can be recommended and must be taken as a part of our daily diet as its liberal use is safe and various health benefits can be drawn from this natural herb. The above-mentioned studies on fenugreek suggest that the functional, nutritional and therapeutic characteristics of fenugreek can be exploited further in the development of healthy products. Wonderful functional and medicinal values of fenugreek are attributed to its chemical composition proteins, dietary fiber, mucilaginous soluble fiber, fixed fatty acids and essential oils, and steroidal saponins. Moreover, some minor components such as alkaloids (trigonolline, cholin, gentianine, carpaine, etc), free unnatural amino acids (4-hydroxyisoleucine), and individual spirostanols and furastanols like diosgenin, gitogenin and yamogenin have also been identified and determined as the main component for its various biological effects. Regarding the composition of fenugreek seeds, husk and cotyledons it has been reported that endosperm had the highest saponin and protein content, whereas husk had higher total polyphenols and total dietary fiber, comprising insoluble dietary fiber and soluble dietary fiber It has been shown that fenugreek has antidiabetic, anticancer, hypocholesterolemic, anti-inflammatory, antioxidant and chemopreventive activity due to its useful chemical constituents. Fenugreek has strong flavor and aroma. The plants leaves and seeds are widely consumed in Indo-Pak subcontinent as well as in other oriental countries as a spice in food preparations, and as an ingredient in traditional medicine. A wide range of uses were found for fenugreek in ancient times. Medicinally it was used for the treatment of wounds, abscesses, arthritis, bronchitis, ulcer and digestive problems. Traditional Chinese herbalists used it for kidney problems and conditions affecting the male reproductive tract. Fenugreek was, and remains, a food and a spice commonly eaten in many parts of the world. Among the spices, the Fenugreek is used as esoteric food adjacent to enhance the flavor and colour of the food and make it tasty and also used to modify the texture of food. The seeds and plants are basically hot and dry and also they are suppurative, aperient, and diuretic. They have some useful aspect in dropsy, chronic cough, enlargement of the liver and the spleen. The leaves of Fenugreek is useful for both internal and

external swellings and burns and also used to prevent the hair falling off. The seeds are considered as carminative, tonic and aphrodisiac. Fenugreek is used to ease child birth as well as it helps to increase the milk flow of mother. Egyptian women are still taking Fenugreek for menstrual pain and tourist use it as hilba tea to remove stomach problem. Not only that the plant is also recommended for use in dyspepsia with loss of appetite, in diarrhea of puerperal women, and in rheumatism. An infusion of seeds is given to small-pox patients as a cooling drink. Fenugreek seed contains various bioactive compounds like flavonoids (quercetin, rutin, vetexin), saponins (graecunins, fenugrin B, Fenugreekine), amino acids (isoleucine, 4-hydroxyisoleucine, histidine, leucine, lysine). As medicinal plant it shows its activityagainst allergies, appetite / loss of catarrh, bronchial, cholesterol, diabetic retinopathy, gas, gastric disorders, lung infections, mucus excessive, throat/sore, abscesses, anemia, asthma, boils, body odour, bronchitis, cancer, swollen eyes, fevers, gallbladder problems, heartburn, inflammation, sinus problems, ulcers, uterine problems etc. A study in India showed that Fenugreek seed is used to reduce the blood sugar and other harmful fats. The evidence to date suggests that fenugreek can be a potential natural health product for the prevention and treatment of type II diabetes. This novel legume source provides soluble fiber along with other glucose-, cholesterol-, and triglyceride-lowering compounds. It would be a significant contribution to the daily management and stabilization of blood glucose and lipid levels for non-insulin-dependent diabetics. Fenugreek has antioxidants and anti-inflammatory properties. Among the spices that are esoteric food adjuncts being used to enhance flavoring and color, fenugreek also modifies the texture of food. This seed spice is also employed for medicinal purpose in many traditional systems as antibacterial, gastric stimulant, against anorexia, antidiabetic agent and as a galactogogue. It is important to increase awareness of the public, dieticians, and other health professionals as to the unique properties of fenugreek and to recommend it for the prevention of hyperglycemia and hyperlipidemia.

Has been resurgence in the consumption and demand for medicinal plants. Medicinal plants are finding use as Pharmaceuticals, Neuraceuticles, Cosmetics and Food supplements.

Even as Tradicinal source of medicinal and they continue to play pivotal role. Fenugreek was used to ease childbirth and to increase milk flow. It is still taken by Egyptian women for menstrual pain and as hilba tea to ease stomach problems of tourists. Seed of fenugreek contain Flavonoids like quercetin, rutin, vetexin, saponins like Graecunins, fenugrin B, fenugreekine, Amino acidslike as Isoleucine, 4-Hydroxyisoleucine, Histidine, Leucine, lysine, Alkaloid- trigonellin,it also contain mucilage, sugars, an,. Medicinal Action and Uses of Fenugreek like Allergies, Appetite/loss of Catarrh/bronchial, Cholesterol/high, Diabetic Retinopathy, Gas, Gastric Disorders, Lung Infections, Mucus Excessive, Throat/sore, Abscesses, Anemia, Asthma, Boils, Body Odour , Bronchitis, cancer, Eyes/swollen, Fevers, Gallbladder Problems, Heartburn, Inflammation, Sinus Problems, Ulcers, Uterine Problems, Water Retention focused the investigator's attention on this plan.

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ENGROSSING DIETETIC RÉGIME OF PROPHYLACTIC FLAXSEEDS (*LINUM USITATISSIMUM* L.)

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Abstract
Preventing the occurrence of CVD with nutritional interventions is a therapeutic strategy that may warrant greater research attention. The increased use of omega ω-3 fatty acids is a powerful example of one such nutritional strategy that may produce significant cardiovascular benefits. Marine food products have provided the traditional dietary sources of ω-3 fatty acids. Flaxseed is an alternative to marine products. It is one of the richest sources of the plant-based ω-3 fatty acid, ALA. Based on the results of clinical trials, epidemiological investigations and experimental studies, ingestion of ALA has been suggested to have a positive impact on CVD. Because of its high ALA content, the use of flaxseed has been advocated to combat CVD. Amongst its other incredible nutrition facts, flax seeds are also packed with antioxidants. Lignans are unique fiber-related polyphenols that provide us with antioxidant benefits for anti-aging, hormone balance and cellular health. The purpose of the present review was to identify chemical constituents of flaxseeds and their exemplary therapeutic usage with special reference to ALA and, just as importantly, what is presently unknown.

Keywords
ALA, ω-3 fatty acid, Lignans, CVD, Phytoesterogens.

INTRODUCTION

Flaxseed, or linseed (*Linum usitatissimum* L.), comes from the flax plant, which is an annual herb. The ancient Egyptians used flaxseed as both food and medicine. The Latin name of flaxseed means “very useful”, and it has two basic varieties: brown and yellow or golden (also known as golden linseeds). The flax plant is a small, single-stemmed annual that grows to about 2 ft (0.6 m) tall and has grayish green leaves and sky-blue flowers. Historically, flax has been cultivated for thousands of years. Linen made from flax has been found in the tombs of Egyptian pharaohs and is referred to in the Bible and in Homer's Odyssey. The Roman naturalist Pliny wrote about the laxative and therapeutic powers of flax in the first century AD, and many authorities believe it has been used as a folk remedy since ancient times. Flax is believed to be native to Egypt, but its origins are questionable since it has been used widely around the world. It is cultivated in many places, including Europe, South America, Asia, and parts of the United States 1-3 Flaxseed is one of the most important oilseed crops for industrial as well as food, feed, and fiber purposes. [1-3] Almost every part of the flaxseed plant is utilized commercially, either directly or after processing. The stem yields good quality fiber having high strength and durability. The seed provides oil rich in omega-3, digestible proteins, and lignans. In addition to being one of the richest sources of α-linolenic acid oil and lignans, flaxseed is an essential source of high quality protein and soluble fiber and has considerable potential as a source of phenolic compounds. Flaxseed is emerging as an important functional food ingredient because of its rich contents of lignans, and fiber. Lignans appear to be anti-carcinogenic compounds. [4-5]The omega-3s and lignan phytoestrogens of flaxseed are in

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focus for their benefits for a wide range of health conditions and may possess chemo-protective properties in animals and humans.

Flax seeds come from flax which is a fiber crop that dates back to ancient Egypt. Flax seeds are thus, high in fiber. In addition to their fiber content they are a rich source of antioxidants as well as healthy fats. There are two kinds of flax seeds, golden and brown, that have very similar nutritional make ups. Flax seeds contain high concentrations of two essential polyunsaturated fatty acids— linoleic acid (x-6) and a-linolenic acid (x-3), which cannot be produced by the human body. Their oxidation occurs rapidly in the air. [3-6]

Fig. 1: Flaxseed plants.

Types of seeds

There are two main types of flaxseed: golden flaxseed and brown flaxseed. Their nutritional profiles are very similar and both contain the same number of short-chain omega-3 fatty acids. The ANA (American Nutrition Association) highlighted the importance of this "neglected food," stating that flaxseed is not only "an excellent source of two fatty acids that are essential for human health - linoleic acid and alpha-linolenic acid," but also, "an excellent source of fiber and a good source of minerals and vitamins.

Fig. 2: Golden flaxseed and brown flaxseed.

Flaxseed Nutrition Facts

One of the most extraordinary benefits of flax seeds is that they contain high levels of mucilage gum content. Mucilage is a gel-forming fiber that is water soluble and has incredible benefits on the intestinal tract. The mucilage can keep food in the stomach from emptying too quickly into the small intestine which can increase ient absorption. Also, flax is extremely high in both soluble and insoluble fiber which can support colon detoxification, fat loss and reduce sugar cravings. The ALA fats in flax seeds benefits the skin and hair by providing essential fats as well as b-vitamins which can help reduce dryness and flakiness. It can also improve symptoms of acne, rosacea, and eczema. This also applies to eye health as flax can reduce dry eye syndrome. The soluble fiber content of flax seeds trap fat and cholesterol in the digestive system so that it unable to be absorbed. [7-9]

Fig. 3: Various uses of flaxseeds in daily nutrition.

Soluble fiber also traps bile, which is made from cholesterol in the gallbladder. The bile is then excreted through the digestive system, forcing the body to make more, using up excess cholesterol in the blood and lowering cholesterol overall. Using flax is a great way to naturally replace gluten-containing grains which are inflammatory where flax is anti-inflammatory. [9-11] So, flax seeds are great for those who have Celiac disease or have a gluten-sensitivity. They may also be a good alternative to omega-3 fats in fish for people with a seafood allergy. Amongst its other incredible Nutrition facts, flax seeds are also packed with antioxidants. Lignans (- among all commonly eaten foods, researchers now rank flaxseeds as the no.1 source of lignans in human diets, containing about 7x as many lignans as the closest runner-up food (sesame seeds). They contain about 338x as many

lignans as sunflower seeds, 475x as many as cashew nuts, and 3,200x as many lignans as peanuts.) are unique fiber-related polyphenols that provide us with antioxidant benefits for anti-aging, hormone balance and cellular health24-26. Polyphenols support the growth of probiotics in the gut and may also help eliminate yeast and candida in the body. Lignans are also known for their anti-viral and antibacterial properties, therefore consuming flax regularly may help reduce the number or severity of colds and flus. Maybe the biggest flax seed benefits come from its ability to promote digestive health. The ALA in flax can help protect the lining of the digestive tract and maintain GI health. It has been shown to be beneficial for people suffering from Crohn's disease or other digestive ailments, as it can help reduce gut inflammation. Flax is also very high in soluble and insoluble fiber which can also improve digestive health and is one of the highest magnesium foodsin the world. Flax seed benefits have been proven time and time again and even including fighting breast, prostate, ovarian and colon cancer. [12-15] The three lignans found in flaxseeds can be converted by intestinal bacteria into enterolactone and enterodiol which naturally balance hormones which may be the reason flax seeds reduce the risk of breast cancer. The lignans in the flax have been shown to have benefits for menopausal women. It can be used as an alternative to hormone replacement therapy because lignans do have estrogenic properties. These properties may also help reduce the risk of osteoporosis. It can even help menstruating women by helping maintain cycle regularity. A study published in Nutrition Reviews has shown that approximately 20% of ALA can be converted into EPA, but only .5% of ALA is converted into DHA. Also, surprisingly gender may play a big role in conversion where young women had a 2.5-fold greater rate than men. Regardless of conversion, ALA is still considered a healthy fat and should be included in a balanced diet. [16-18] Flaxseeds or Alsi are not commonly included in our daily diet, but those tiny, brown seeds pack a lot of health benefits that you might not know about. Containing Omega-3 fatty acids (also known as 'good fat'), lignans (rich in antioxidants and estrogen content) and fiber, flaxseeds are great for your health, here's why.

Lignans present in flaxseed, are known to improve the blood sugar levels in type 2 diabetics. having flaxseed on a daily basis can help maintain your blood sugar levels over an extended period of time. Flaxseeds are great for your heart health. Not only do they help prevent the formation of plaque within your arteries, but they also prevent atherosclerosis (when the arteries become stiff and less elastic), reduce blood pressure, heart rate and beat oxidative stress (due to its antioxidant properties). Apart from that flaxseeds can help lower the levels of bad cholesterol (or LDL cholesterol) in check, protecting your heart. The high content of antioxidants and Omega 3 fatty acids protect against breast cancer, prostate cancer and colon cancer. The lignin content in flaxseed especially protects against tumours that are hormone sensitive eg. estrogen-sensitive breast tumours. [19-21] The omega 3 fatty acids, lignans and ALA (alpha-linolenic acid) present in flaxseeds are known to block the release of inflammatory agents and are especially beneficial for patients who suffer from diseases such as arthritis, and 'Parkinsons disease. Hot flashes is a problem that is commonly associated with menopausal women. If you suffer from this condition then flaxseeds can help. The antioxidant properties of flaxseeds help regularise the hormonal imbalnce responsible for hot flashes and a study found that women who had a spoon of flaxseeds regularly experienced a 57% drop in the intensity of hot flashes they experienced. [22-25] Flaxseed may also help to lower cholesterol, control high blood pressure, protect against heart disease, control constipation, heal haemorrhoids, prevent painful gallstones and dissolving existing ones, it promotes healthy hair and nails, treats acne, eczema, reduces cancer risk, treats menopausal symptoms, infertility and male impotence! Make sure to include any form of flax in your daily diet, it is a must for the gout sufferer. Flaxseed's oil is very high in Omega -3 fatty acids and levels vary from the types and colors of the flax seed, usually in a yellow or brownish color. Just one teaspoon contains about 2.5 grams, the equivalent of more than twice the amount most people get through their diets! Flaxseeds also provide you with calcium, magnesium and potassium, all of which are needed in any gout diet. Flaxseeds also have omega-6 fatty acids in the form of linoleic acid. Flaxseed oil only contains alpha-linolenic acid (Omega 3 oils), and not the fiber or lignan components. Flaxseed is also good for gout sufferers that can't eat any fish which is on the higher end in the purines scale since it may trigger gout attacks for them. [26-27] Fish oil or flax seed oil supplements are into existence for obtaining health benefits from omega 3 fatty acids. Omega 3 fatty acids are essential fatty acids as these cannot be synthesized in our body and must be obtained from food or supplements. Three types of omega-3 fatty acids are ALA (alpha- linolenic acid), EPA (eicosapentaenoic acid) and DHA (docosahexaenoic acid). Omega-3 supplements in the form of EPA and DHA are what offers many of the evidence based benefits when used in the body and can be supplemented with fish oil. Flax seed oil contains omega-3 in the form of ALA from which the body can make EPA and EPA is finally converted to DHA. But the ratio of conversion is not efficient. [28-30]

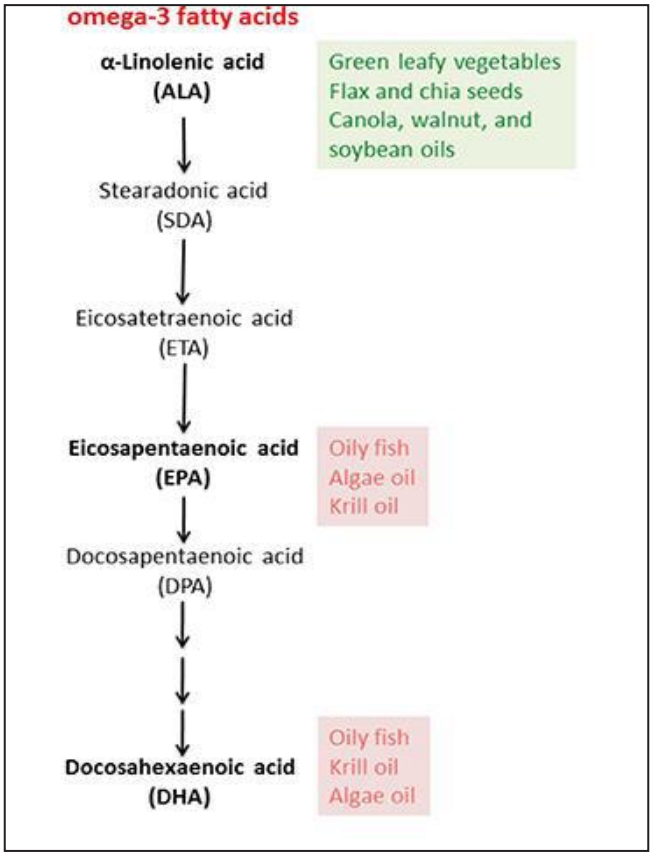
Fig. 4: Flaxseed oil.

Estimates of the rate of conversion range from 5% to 25%. Several factors further reduce the ability to convert ALA to EPA. For example with growing age this rate of conversion is diminished. ALA also competes metabolically with the other essential fatty acid omega-6. Too much of omega-6 in the diet leading to unbalanced fatty acid ratios also negatively affects the conversion. Looking at typical Indian diet excess of omega-6 through grains, cereals and cooking oil like sunflower oil is undeniable. Other factors like gender (conversion of ALA to EPA is limited in men and further transformation to DHA is very low.), medications, alcohol consumption, deficiency of certain micronutrients etc also affect the conversion rate. Thus, omega-3 fatty acid from flax seed cannot be considered substitute for omega-3 fatty acids from fish oil. [31-32] The best option for those who cannot have fish oil can be DHA rich algae oil. Fish consume algae and therefore are rich in DHA and EPA. Algae are the primary producers of DHA and EPA in the ecosystem, and several refined algal oils are rich sources of DHA. DHA is retroconverted to EPA following supplementation. Due to nontrivial retroconversion efficiency between omnivores and vegetarians, DHA supplementation represents an alternative to fish oil to increase blood and tissue levels of EPA, and DHA20-22.

Table 1: Nutritional value of flaxseed per 20 g (2 tbsp).

Energy - 54.7 kcal (DV = 3%)	Carbohydrates - 3.0 g (DV = 1%)
Sugars - 0.2 g	Dietary fiber - 2.8 g (DV = 11%)
Fat - 4.3 g (DV = 7%)	Saturated fat - 0.4 g (DV = 2%)
Monounsaturated fat - 0.8 g	Polyunsaturated fat - 2.9 g
Protein - 1.9 g (DV = 4%)	Thiamine (vit B1) - 0.2mg (DV = 11%)
Riboflavin 0.0mg	Niacin (vit. B3) - 0.3mg (DV = 2%)
Pantothenic acid (B5) - 0.1mg (DV = 1%)	Vitamin B6 - 0.0 mg
Folate - 8.9 mcg (DV = 2%)	Vitamin C - 0.1 mg (DV = 0%)
Calcium - 26.1mg (DV = 3%)	Iron - 0.6mg (DV = 3%)
Magnesium - 40.2 mg (DV = 10%)	Phosphorus - 65.8mg (DV = 7%)
Potassium - 83.3 mg (DV = 2%)	Zinc - 0.4mg (DV = 3%)

Source: USDA Database



Therapeutic Importance of Flaxseed Oil

Flaxseed oil is used medicinally. Linseed oil is the term usually used for the oil found in polishes, varnishes, and paints. Flaxseed oil is derived from the flax plant's crushed seeds, which resemble common sesame seeds but are darker. The amber oil is very rich in a type of fat called alpha-linolenic acid (ALA), an omega-3 fatty acid that is good for the heart and found in certain plants. High amounts of omega-3 fatty acids are found in fish and smaller amounts are found in green leafy vegetables, soy-derived foods, and nuts. Studies suggest that they can lower triglyceride levels and reduce blood pressure. Omega-3 fatty acids may also decrease the risk of heart attacks and strokes by preventing the formation of dangerous blood clots within arteries. In high dosages, the fatty acids may help to alleviate arthritis, though flaxseed products have not yet been shown to be effective for this purpose. In addition to omega-3 fatty acids, flaxseed products also contain potentially therapeutic chemicals called lignans. Lignans are believed to have antioxidant properties and may also act as phytoestrogens, very weak forms of estrogen found in fruits, vegetables, whole grains, and beans. Unlike human estrogen, phytoestrogens have dual properties: they can mimic the effects of the hormone in some parts of the body while blocking its effects in others. Many herbalists believe that phytoestrogens can be useful in the prevention or treatment of

a variety of diseases, including cancer , CVD, and osteoporosis . The estrogen-blocking effects of phytoestrogens may be particularly effective at combating certain cancers that depend on hormones, such as cancers of the breast or uterus. Women who consume large amounts of lignans appear to have lower rates of breast cancer . The fact that heart disease and certain cancers occur less frequently in Asian countries is sometimes attributed to a diet rich in plant foods containing phytoestrogens. [32-34]Flaxseed is sometimes referred to as a nutraceutical, a recently coined term that includes any food or food ingredient thought to confer health benefits, including preventing and treating disease. Several studies, some conducted in people, suggest that flaxseed products (or agents contained in them) may help to keep the heart and cardiovascular system healthy. Flaxseed products may lower cholesterollevels, help control blood pressure, and may reduce the buildup of plaque in arteries. Test tube and rat studies suggest that chemicals in flaxseed may help to prevent or shrink cancerous tumors. Due to its estrogen-like effects, some women use flaxseed oil to ease breast tenderness, alleviate symptoms of PMS (premenstrual syndrome), and help control menopausal symptoms. Flaxseed oil has also been recommended to treat skin conditions, inflammation, and arthritis. It is usually taken internally for all the purposes mentioned above. The oil may be used externally to help the healing of scalds and burns. More recently, flaxseed has been shown to be beneficial for people suffering from digestive disorders. It is now recommended as an "effective herbal agent" for treating IBS. [30-34]

Fig. 5: Flaxseeds and Flaxseeds Oil

Culinary asset

Finding creative ways to add flaxseeds to your meals can be a challenge. One popular technique is to incorporate ground flaxseeds into your muffin, cookie, or bread recipes. Recent research studies have shown that ground flax can be added to baked foods without sacrificing large amounts of alpha-linolenic acid (ALA), their showcase omega-3 fatty acid that accounts for over half of their total fat content. Oven temperatures of 300o F (150oC) - even over several hours of baking time - do not appear to substantially reduce the amount of ALA in baked products. This outcome has been demonstrated for breads, muffins and cookies. Even when flaxseeds are ground prior to incorporatation into breads and pastas, these preparation methods - involving grinding prior to heating - only appear to lower ALA levels by about 4-8%. Interestingly, bread enriched with ground flaxseed has also been shown to have a greater antioxidant capacity and a much lower GI(glycemic index) value (of ~ 51) than the same bread without the ground flaxseed addition. These research findings are great news for anyone who wants to include flaxseeds in baked dishes, in either whole or ground form. You could start off by having one tablespoon of ground flaxseed powder every morning on an empty stomach with a glass of warm water. Alternatively, you can even add it to your energy drink or fresh juice or include it in your meals by sprinkle one tablespoon of flaxseed powder on the dish you cook. Remember to not put the powder directly into hot oil, as the excess heat tends to deactivate the beneficial properties of flaxseed and may add a bitter taste to your food. Also do not have more than 2 tablespoons per day, as it can be detrimental to your health.

CONCLUSION

Flaxseeds are extremely good for one's health. They are a prime source of ω-3 fatty acids which makes them a must-have in one's diet especially if you are a vegetarian. Flax seeds also rich in Fe, Zn, Ca, Ca, K, Mg, protein, , folate, soluble fiber and even B. They are high in antioxidants which prevent free-radical damage by protecting healthy cells from getting damaged. Flax may be beneficial in suppressing the growth of breast and prostate cancers because when consumed, tumor cell proliferation goes down, cancer cell death increases, and c-erbB2 score is reduced. Combining flaxseed with dietary fat restriction may have an even greater effect on prostate cancer. Eating only 1 tbs of ground flaxseed a day may help prevent and reverse diabetes. Eating flaxseeds may also diminish skin sensitivity and improve skin barrier function and condition. Because lignans are activated by our gut bacteria, taking antibiotics may impair the production of the lignans. They also contain dietary fibre which is essential for regulating proper bowel movements. Fibre prevents constipation and also keeps you fuller for a longer time. So

people who are on a weight loss diet should eat flaxseeds regularly. When flaxseeds are compared with other commonly eaten foods in terms of their total polyphenol content (polyphenols are one very important group of antioxidants), flaxseeds rank 9th among 100 commonly eaten foods. Flaxseeds turn out to be significantly higher in polyphenol antioxidants than fruits like blueberries or vegetables like olives. The antioxidant benefits of flaxseeds have long been associated with prevention of cardiovascular diseases and have recently also been tied to decreased insulin resistance. Flaxseeds also help keep lifestyle diseases like diabetes, high BP, heart disease at bay.

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ETHNOPHARMACOLOGY AND TRADITIONAL ATTRIBUTES OF CLOVE (*SYZYGIUM AROMATICUM*)

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Abstract
Cloves are the sweet-smelling dried flower buds. Eugenol is the main bioactive compound of clove. With regard to the phenolic acids, gallicacid is the compound found in higher concentration. This essential oil mainly comprises eugenol, followed by β-caryophyllene, α-humulene, and eugenyl acetate as the main components. Other minor constituents including methyl amylketone, kaempferol, gallotannic acid, α-humulene, β-humulene, methyl salicylate, crategolic acid, andbenzaldehyde are responsible for the characteristic pleasant fragrance of clove. Cloves help reduce inflammation, thereby preventing heartburns and stomach spasms. Anecdotal evidence suggests that chewing cloves have an alkaline and carminativeeffect on the stomach and gastrointestinal tract, which doesn't allow gas formation. Furthermore, cloves prevent flatulence and bloating.

Keywords
Eugenol, Anti-microbial, Antidiabetic, Clove bud, Clove essential oil.

INTRODUCTION

Clove are the aromatic flower buds of a tree in the family Myrtaceae, Syzygium aromaticum. The name comes from the Latin word clavus. The name comes from the French “clou” meaning nail. Clove generally are dried flower buds from the clove tree. Clove were important in the earliest spice trade and are believed to be indigenous to the Moluccas, or Spice Islands, of Indonesia. The clove tree is frequently cultivated in coastal areas at maximum altitudes of 200 m above the sea level. The production of flower buds, which is the commercialized part of this tree, starts after 4 years of plantation. Cloves are harvested mainly in Indonesia, India, Madagascar, Zanzibar, and Sri Lanka. [1-2]They have a numbing effect on mouth tissues. The clove tree is an evergreen that grows to a height ranging from 8–12 m, having large leaves and sanguine flowers in numerous groups of terminal clusters. The flower buds are at first of a pale color and gradually become green, after which they enlarge into a bright red, when they are ready for collect. Cloves are harvested when 1.5–2 cm long, and consist of a long calyx, terminating in four spreading sepals, and four unopened petals which form a small ball in the center.[9]are collected in the maturation phase before flowering. Eugenol, the most important composition of Clove oil, has been accepted as food preservatives by China, US European Union, and other countries and regions. Majorly clove is consumed as a spice in Indian home kitchens. This plant contains active constituents that possess anti-fungal, anti-viral, anti-microbial, antidiabetic, anti- platelet, anaesthetic, anti-inflammatory, anti-oxidant, antithrombotic, pain-relieving, and insect repellent properties. This plant serves as the richest source of phenolic compounds such as eugenol, eugenol acetate, and gallic acid which is used in various applications like in agriculture, pharmaceutical, and in various food preservatives. This review includes the main studies reporting the biological activities of clove and eugenol. The antioxidant and antimicrobial activity of clove is higher than many fruits, vegetables and other spices and should deserve special attention Pharmacokinetics and toxicological studies were also mentioned. [3-5]

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Fig. 1: Clove plant, fresh and dried buds

Phytochemicals constituents of clove

Clove yields various kinds of volatile oil from leaves, stem, buds and the fruit. Stem oil differs extensively in yield and quality. The main extract of the oil is eugenol. Bud oil contains Eugenol (70–85%), eugenyl acetic acid (15%), and β-caryophyllene (5–12%), which together constitutes 99% of the oil. The constituents of the oil likewise incorporate methyl amyl ketone, methyl salicylate, α and β-humulene, benzaldehyde, β-ylangene, and chavicol. The fragrance of the clove is due to the presence of minor constituents like methyl amyl ketone, methylsalicylate. Stem oil also contains 76.4–84.8% eugenol and 1.5–8.0% eugenyl acetate. Both bud and stem oil contain 7.3–12.4% β- caryophyllene and 1.0–1.4% α- humulene. [6-8] There are 36 compounds extracted from the volatile oil of clove buds. Clove leaves yield 3.0–4.8% basic oil. Clove bud and leaf oil contain different classes of chemical extract, for example, monoterpenes, sesquiterpenes, aldehydes, and ketones. Clove stem contains 6% of oil. The stem oil consists of light yellow fluid containing 80.2% eugenol and 6.6% β-caryophyllene. It contains 2% of oil, which possesses 50–55 % eugenol. Non-Volatile Chemical constituents: Few non-volatiles oils have been isolated from clove, which include tannins, sterols, triterpenes, and flavonoids. Tannins: 10-13% of tannins components are present in non- volatile oil among which Eugenin and ellagitannin were separated from the plant. Eugenol glucoside gallate, a chromone C-glycoside, galloyl, and hexahydroxy diphenyl esters of 2, 4, 6-trihydroxy acetophenone- 3-glucopyranoside were extracted from leaves. The two ellagitannins, syzyginin A (1, 2, 3-tri-O-galloyl–4, 6-(S) - tergalloyl-βD- glucoside) and syzyginin B, were also obtained from the clove leaves. Cloves have about 2% of the triterpene and oleanolic acid. Maslinic acid and 2 α-hydroxyoleanolic acids were also extracted from clove buds. Sterols extracted from clove include sitosterol, stigmasterol, and campesterol.A chromone C-glucoside, isobiflorin (5, 7- dihydroxy-2-methoxychromone-8-C-β-D-glucopyranoside), and biflorin were isoated from the ethanolic extract of cloves. The seed of the clove possesses various ailments viz., apigenin 6-C-(β-D-xylopyranosyl-(1→2″)- β-Dgalactopyranoside)-7-O- β-D-glucopyranoside and apigenin-6-C-(β-D-xylopyranosyl-(1→ 2″)-β-Dgalactopyranoside)-7-O-β-D-(6-O-pcoumaryl glucopyranoside). [5-10]

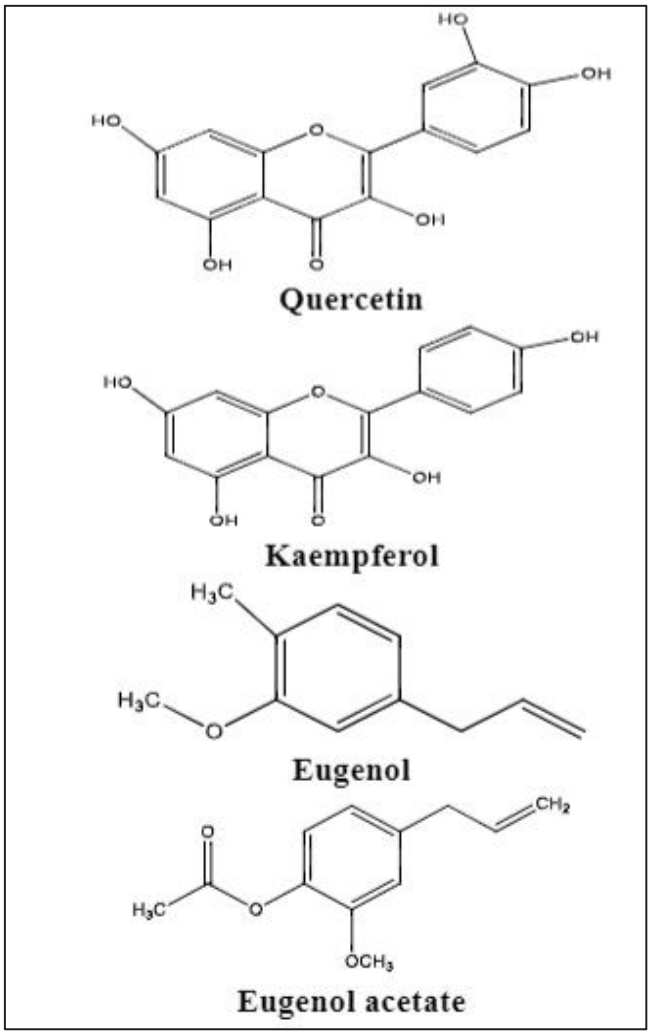

Fig. 2. Major chemical components of clove with their structures.

Ethnopharmacological relevance of Clove and its oil

Clove is known to possess antibacterial properties and is used in various dental creams, tooth pastes, mouth washes, and throat sprays to cleanse bacteria. It is also used to relive pain from sore gums and improves overall dental health. In dentistry, eugenol in combination with zinc oxide is used for provisional filling of cavities. Clove is an anodyne (an agent that soothes or relives pain) for dental emergencies. Cloves are aphrodisiac (an agent for arousing or increasing sexual desire or potency). Clove is used as an anti-inflammatory agent, due to its high content of flavonoids. Aroma therapists use pure clove oil to cure the symptoms of rheumatism and arthritis. Clove is used as a carminative, to increase hydrochloric acid in the stomach and to improve peristalsis.

[6-11]Apply the paste of clove powder in honey to treat spots. Paste of clove powder in water promotes faster healing of cut and bite. Cloves can efficiently cure many digestive problems. It is having medicinal qualities to cure flatulence, loose motions, indigestion and nausea. Cloves are useful in relieve the symptoms of diarrhea, gastric irritability and vomiting. Clove and clove oil boost the protected system by purifying the blood and help to fight against various diseases. Clove oil is effective in remedial Athlete's foot and nail fungus. Cloves are good expectorants that promote the free of mucous and secretions in the respiratory passage. The aromatic clove oil, when inhaled can help calm positive respiratory conditions like cold, cough, asthma, bronchitis, and sinusitis. It also helps in clearing the nasal tract. Cloves can successfully prevent the lung cancer as well as the skin cancer. Eugenol helps in minimizing the harmful effects of environmental wastes that can cause cancer of digestive system. Clove oil stimulate blood flow and circulation making it useful for the people having cold extremity. Cloves benefit the diabetic patients by controlling the blood glucose levels. Eugenol is powerful enough for preventing blood clots. Sucking of a clove bud reduce desire for alcohol. Muscular cramps are often relieved, when the oil of clove is applied as a poultice near the affected area. Cloves also help prevent the stop working in retina of the eye, which slows down macular collapse and aids vision in the old age. The underlying mechanism is through the prevention of the breakdown of docosahexaenoic acid, which preserves vision in elderly people. [11-13]Researchers found that sniffing the spicy aroma of cloves reduces drowsiness, irritability and headaches. One drop of clove oil applied to the roof of the mouth can instantly relieve many headaches. Clove enhances memory retention. It is recommended for relieving brain fog, lethargy and depressive state of mind. Research has shown that clove oil is an effective mosquito repellent. The most prominent use of clove oil in dental care. The germicidal properties of the oil make it very effective for relieve dental pain, tooth ache, sore gums and mouth ulcers. Clove oil contains the composite eugenol, which has been used in dentistry since numerous years. Gargles with diluted clove oil help in easing the throat. The character smell of clove oil helps removing bad breath. As a result, clove oil is added to numerous dental products and medications, including, mouth washes, and tooth pastes. Dentists also mix clove oil with zinc oxide and prepare a white filling material as a temporary alternative to root canal. Clove oil, it's still in dentistry today as antiseptic and pain reliever. According to a 2005 in vivo and in vitro study on immunosuppressed rat, the main compound in clove oil (eugenol) was found to be as effective in treating oral thrush. Clove contain eugenol is the most powerful of these, with antiseptic properties that have been shown to kill the Candida yeast cells. Eugenol is also an immune system stimulant, which means it helps to increase the body's disease fighting powers. Due to its antiseptic properties, clove oil is useful for wound, cuts, scabies, athlete's foot, fungal infections, bruises, prickly heat, scabies etc. It can also be used insect bites and stings. Clove oil is aphrodisiac in nature and hence serves as an outstanding stress reliever. It has a exciting effect on the mind and removes mental collapse and fatigue. When taken internally, in proper amounts, it refreshes the mind. Clove oil also induces the sleeps and is helpful to insomnias patients. It is useful for treating mental problems such as loss of memory, depression and anxiety. Clove oil has a cooling and anti - inflammatory effect, and in this manner clear the nasal passage. This expectorant is useful in various respiratory disorders including coughs, colds, bronchitis, asthma, sinusitis, and tuberculosis. [14-19]

Culinary and other uses

Clove is a valuable kitchen spice which can be used for studding onions, tomatoes, salads, herbal teas, and soups. It is also used to flavor meat products, cookies, chewing gums, spiced fruits, pickles, chocolates, soft drinks, puddings, sandwiches, pastries, and candies. Volatile oil is used to impart essence to perfumes soaps, toothpastes, and pharmaceuticals. In Indonesia, mixture of clove and tobacco in a ratio of 1:2 is used to make a special cigarette “Kretek”.Clove possesses antibacterial potential and is used in a variety of mouth washes, dental creams, throat sprays, and tooth pastes to kill pathogens. It is also used to relive sore gums. Mixture of eugenol (major bioactive constituent of clove) and zinc oxide is used for short-term filling of dental cavities. Clove oil has anti-inflammatory properties due to the presence of flavonoids. Pure clove oil is used in aromatherapy of arthritis and rheumatism. Paste of clove powder and honey is used to cure skin conditions. Paste of water and clove powder boosts healing process of bites and cuts. Clove is used to treat various digestive disorders including loose motion, flatulence, nausea, and dyspepsia. Clove oil improves body defense system and help to fight against invading microbes. It is also used to cure Onychomycosis and Athlete's foot disease. Inhalation of clove essential oil soothes various respiratory conditions such as asthma, cold, cough, sinusitis, and bronchitis. Cloves have anticancer potential and are used to cure skin and lung carcinoma. Clove is good for diabetic patients as it controls the blood level of glucose. Eugenol prevents the formation of blood clots. Topical application of clove oil relieves muscular cramps. Cloves also prevent the breakdown in eye's retina, which slows down muscles degeneration and assists vision in the old age. Sniffing of clove aroma reduces lethargy, restlessness, and headaches. Application of one drop of clove oil can soothe headache. Clove improves memory by relieving mental fog, drowsiness, and depression. Clove oil is mosquito repellent. Antioxidant potential of clove is higher than many other medicinal plants. One drop of clove oil is 400 times more potent than blueberries.

CONCLUSION

Clove (Syzygium aromaticum) is one of the most valuable spices that has been used for centuries as food preservative and for many medicinal purposes. This plant represents one

of the richest source of phenolic compounds such as eugenol, eugenol acetate and gallic acid and posses great potential for pharmaceutical, cosmetic, food and agricultural applications. Clove is a vital source of phenolic compounds such as flavonoids, hydroxycinamic acids, hydroxybenzoic acids, and hydroxyphenyl propenes. Eugenol is the chief bioactive constituent of clove. Clove consist of acetyl eugenol, beta-caryophyllene and vanillin; crategolic acid; tannins etc. Based on this above information it could be conclude that the clove is a very interesting and important plant which is used for the treatment of various medical conditions because it has various active constituent present in it but most important constituent that is eugenol have various pharmacological activity and for this all miraculous activity of this plant we can confirm that why this plants has been engaged for various centuries. With regard to the phenolic acids, gallic acid isfound in higher concentration. Other phenolic acids found in clove are caffeic,ferulic, elagic and salicylic acids. Flavonoids including kaempferol, quercetin and its derivates (glycosilated) are also found in trace amounts. Appreciable amounts of essential oil are present in aerial parts of clove. Good quality clove bud contains volatile oil which mainly comprises of eugenol, eugenyl acetate and beta-caryophyllene.

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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.

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To protect present and future generations from various environmental hazards.

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Our Activities
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