Medicinal Qualities of Mustard Oil and Its Role in Human Health against Chronic Diseases: A Review

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ABSTRACT

Fats in its saturated and unsaturated form play an important role in our daily diet. Its overconsumption in either form can be lethal to our body. For example excess of cholesterol, saturated and tram’s fat can lead to chronic diseases such as cancer, heart attack, diabetes. Looking into the chemical composition of mustard oil with other edible vegetable oil, this review highlights the health benefits of mustard oil for its medicinal utility like anticarcinogenic property which prevents cancers formation in body, reduces body temperature, antifungal and antibacterial property to treat skin diseases, good appetizer and body toner Further, reduces the adhesive impulses in blood platelets which is helpful to minimize the risk of a heart failure, prevent children’s from asthma, allergic cold, and asthmatic eczema, protect eyes and throat irritation and strengthen our RBC by decreases cholesterol and improves RBC membrane structure. Above all, it also adds aroma and flavor increasing the palatability of food thereby increase the oil economy.

Keywords: Chronic diseases and economy, Diet advocacy, Human health, Mustard oil, Quality.

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INTRODUCTION

Fats and Oil

Fats serve as the storage form of energy and also as a means of insulating internal organs. It’s chemical composition is well known to have composed of the glycerol backbone and bound to it are triesters of fatty acids. Depending upon the fatty acids bound to the backbone, fats properties alter. Thus fats are solid at room temperature while oil is liquid at room temperature (Anthea,1993). Besides other properties of fats, it is a good source of fat-soluble vitamins such as vitamin A, E, K, D, serving as a major agent to provide vitamins, nutrients, and antioxidants which help keep our body healthy. Fats and oils also improve texture, taste, and palatability of the food and also provides a good source of higher calories density to diet (9 Kcal energy/g) as compared to protein (4 Kcal energy/g) (Singh, B 2006).

Fats can be obtained from various sources either from animals, fish or oilseed crops. Out of the various fatty acids required by our body is the polyunsaturated fatty acid (PUFA). Their importance is due to the inability of the human body to synthesize them making them the most essential fatty acids. ploy unsaturated fatty acids (PUFA) consists of linolenic (ω-3), linoleic (ω-6). Apart from the PUFA, the nutritionist has turned their interest into monounsaturated fatty acids (MUFA) too which consists of oleic acid (ω-9). The health benefits of these fatty acids have revolutionized the medical science as these all are helpful to protect the nervous system, reproductive organs, immune system and cardiac system to construct and maintain corpuses, for obtain optimum nutrition to cells and to eliminate waste products harmful waste products. PUFA products are prostaglandins, which coordinate body functions such as normal heartbeat, normal blood pressure, and blood coagulation, improve fertility, conception, and immunity to fight against harmful microorganisms. The absence of these fundamental fats in our daily diet may lead to spread the many chronic diseases among humans as heart failure, cancer, diabetic hazards, asthma, insanity, speed up of aging, obesity, arthritis and Alzheimer’s (Simpoulos, 2002).

RECOMMENDATION ON FAT CONSUMPTION IN WORLD

Optimal intake of fat/ oil for an adult in India, is 30 % of the total calories intake, thereby out of 2000 calories of diet about 600 calories of 60–65 gm of fat/day is required to maintain good health (Kumar, and Chauhan, J.S. 2010). The advocacy of American Heart Institute that the intake of total calories from fat should be least as 25–35 percent, from saturated fatty acid (SFA) less than 10 percent, from MUFA should be in the range of 10-15 percent and from PUFA 10 percent of total calories. In India, the intake of everyday fat is 48 g /day/ person

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and in the world the average 78 g/day person/ (Choudhary and Sangha, 2013). The optimum range of PUFA and SFA is 0.8 to 1.0 and the ratio of ω-6/ω-3 is 5–10 that is required in the daily diet for good health (WHO/FAO 2003). However, the ratio of ω-6/ω-3 is said to vary depending upon the type of disease (WHO 2005).

### Total Fat Recommended for Indians

With increased urbanization, the modern lifestyle of individuals with respect to dietary intake pattern is changing day by day due to the availability of varieties of food products with higher fat consistency. This is the major cause of the occurrence of many diseases, which create a serious health problem among Indians. Keeping this consideration in mind FAO/WHO recommended the 18–20 percent fat to be the intake for energy. ICMR (1981) also recommended the same amount. People from low socioeconomic status among their total calories 1300–1500 their intake of 8 percent from fat only, whereas the percentage of intake calories from fat among higher socioeconomic status is about 32 percent, which shows high intake of fat. Based on FAO/WHO/ICMR guidelines total energy intake from fat should be 20 percent including visible and nonvisible fat.

### Which Oil is Healthy

The basic health recommendations given in (Table 1) indicates that the optimum range of SFA/ MUFA/ PUFA and ω-6/ ω-3 should be present in our diet fat with natural antioxidants. Fatty acid composition of oil determines its quality. With increased health awareness among the consumers, edible oil having a higher proportion of unsaturated fatty acid is hyper cholesteremic in nature (Mathur and Sharma, 1993). The consumption of edible oils is based on the interest of a particular community. Like for example mustard oil, palm oil, and soybean oil are three major edible oils consumed in north-eastern, northern and eastern regions of India. Among these three oils, the consumption of mustard oil is highly desirable because of its pungency (Choudhary and Sangha, 2013). The mustard oil has the best components of MUFA and PUFA, which are good for health and SFA at nontoxic levels. In general mustard oil is considered being safe for human consumption. The internationally accepted quality norms shows that, saturated fat should be <7 %, whereas oleic acid content should be high and the ratio of SFA:MUFA:PUFA should be in the range of 1:1–3, PUFA:SFA ratio should be between 0.8 and 1.0 and the range of ω-6 and ω-3 should lie between 5 and 10 (Kale, 2007; WHO/FAO, 2003). Absence of trans fats in the oil adds to the value of mustard oil. We know the trans fat has the unfavorable effects on health because it leads to increase low-density lipoprotein and levels of cholesterol, which is the major cause of occurrence of cardiac diseases (Stender and Dyeberg, 2003). Natural antioxidants including tocopherols should be present to prevent the oxidation of the oil. Oil and seed meal should be free or at non-toxic levels of anti-nutritional constituents including erucic acid <2% in edible oil and glucosinolate <30 µgm defatted seed meal (Thacker, 1990). The suggested range in the diet is less than 4:1 by the Institute of Medical Science. WHO recommended the range of SFA: MUFA: PUFA should be 1:1.5:1 and the range of ω-6, ω-3 should be 5:4 and most consider the excellent range to be approximate to 1:1. These are beneficial for health and should be included in balanced diet as compared to SFA Comparison of different edible oil (Table 2), it clear that mustard oil is the top healthy edible oil with SFAs as the lowest in the mustard oil and highest in palm oil, MUFA is highest in mustard oil and lowest in safflower oil and mustard oil also contain the appropriate ratio of ω-6/ω-3 (1:2:1) which is closer to the recommended range (Mathur and Sharma, 1993). Being the safest and healthy oil in this review we emphasize other medicinal qualities of mustard oil and their role in human health against chronic diseases”.

### Mustard Oil

In India, about 67% of the population consumes, three edible oils mustard oil, palm oil and soybean oil in north, north-east and east regions, out of which mustard oil is locally accepted as its pungency adds to the taste (Choudhary and Sangha, 2013). After palm and soybean, mustard is the major oilseed crop in the world. In the production of edible oil, it contributes 12% at world level and 80 % in the country. Rajasthan is the leading state in India leading in the area and production of mustard which contributes more than 50%. Other mustard growing states are Haryana, Uttar Pradesh, Madhya Pradesh and Gujarat (Choudhary and Sangha, 2013). There are two common types of mustard oils are available in the market as Kachhi Ghani and Pakki Ghani, which are mainly used for cooking purpose in India. With consideration of its health advantages as a major source of MUFA. (Pacharia, N.C. 2007).

#### Table 1: Advocacy for the consumption of dietary fats

| Recommended by | Energy intakes from fat | PUFA | ω-6 | ω-3 | ω-6/ω-3 |
|----------------|-------------------------|------|-----|-----|---------|
| WHO (1990)    | 15–30                   | 3–7, ≤ 10 | –   | –   | 5–10    |
| FAO (1994)    | 15–35                   | –    | 4–10| –   | 5–10    |
| USA (1989)    | <30                     | 7    | 1–2 | –   | 4–10    |
| Japan (1995)  | 20–25                   | 7–8  | –   | –   | 4       |
| Canada (1990) | 30                      | ≥3.5 | ≥3  | ≥0.5| 4–10    |

(Source: Sugano and Hirahara, 2000)
**Nutritive Value of Mustard Oil Based on Above Studies**

- Mustard oil has 1.88 gm of protein and 0.44 mg zinc for growth and development of the body.
- It comprises about 38.92 mg calcium, helpful for bones health.
- 100 gm of mustard oil contains 1.08 mg dietary fibers, which helps to stimulate the digestive functions in our body.
- Calories: 100 gm mustard oil contains about 884 calories which are a source of energy. It contains about 12 gm saturated fat, 9.96 mg selenium for liver and muscular health, 22.28 mg magnesium which is essential as a cofactor for oxidative phosphorylation.
- Mustard oil contains 3% vitamin A, which is helpful for the normal vision of eyes, and 5% vitamin C which serves as a coenzyme for metabolic functions.
- 34 mg vitamin E present in mustard oil which, is a strong antioxidant, helps to reduce the oxidation effect of fat.

- It contains 1120 mg sodium and 151 mg potassium which helps to control the acid-base balance in our body.
- In mustard oil MUFA and PUFA are present in good amount, both play a vital role in heart safety among other oils having a high amount of saturated fat.
- Glucosinolate is the major antioxidant of mustard oil, which serves medicinal utility to reduce the bacterial and fungal effect.
- Mustard oil contains a favorable ratio of linolenic and linoleic acids with a high level of oleic acid. This ratio is safe from other edible oils.
- The high amount of alpha-linolenic acid present in mustard oil helps to control the high cholesterol level and heart disease.

**Health Benefits of Mustard Oil**

**Stimulant:** This oil plays an important role in the catalyst in our digestive system. It contains linoleic acid which leads semipermeable in arteries to control sweating during summers. The formation of different juices for digestion of food depends on a healthy diet. The stimulation also requires for the excretory system to regulate normal body functions (Niya, 2008 and Saba, 2015).

**Reduces the risk of cancer and maintain normal body temperature:** This oil contains the substance of phytonutrients as glucosinolate, which serves antibiotic, fungicidal and anti-carcinogenic properties, which reduces the effect of chronic diseases. These phytonutrients protect against colorectal and gastrointestinal cancers. Dietary glucosinolate plays an important role in reducing the effect of cancer. The studies portraits that the absence of trans fat in this oil has a positive association with low incidences of cancer and help to maintain the normal temperature of the human body because trans form has a higher melting point as compared to cis form. The amount of fatty acids present in oil has a direct bearing on human health as normal human body temperature is 37°C. In the human body the absorption pattern of cis and trans fatty acids are similar, however, cis fatty acids are preferred.
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Table 4: Range of different fatty acids in mustard oil

| S. no. | Different fats             | Degree of range | References                   |
|--------|----------------------------|-----------------|------------------------------|
| 1.     | SFA                        | <7%             | Warner et al.1997            |
| 2.     | Oleic                      | Upto 70%        | Warner et al.1997            |
| 3.     | Linoleic                   | 23–37%          | Warner et al.1997            |
| 4.     | Linolenic                  | <3%             | Warner et al.1997            |
| 5.     | SFA:MUFA:PUFA              | 1:1–3:1         | Mawlong et al. 2015          |
| 6.     | Linolenic/Linolenic acid (ω-6/ω-3) | 5–10          | Mawlong et al. 2015          |
| 7.     | TFA                        | Absent          | Mawlong et al. 2015          |
| 8.     | Palmitic                   | 1–3             | Kumar and Chauhan 2010       |
| 9.     | Stearic                    | 1–3             | Kumar and Chauhan 2010       |
| 10.    | Eicosenoic                 | 4–15            | Kumar and Chauhan 2010       |
| 11.    | Glucosinolate              | <30 umol/g      | Thaker 1990                  |
| 12.    | Erucic acid                | <2%             | Thaker 1990                  |

over trans incorporation into plasma triglycerides. (Bakker et al. 1997, Sambaiah and Lokesh 1999 and Vig et al. 2009, Zock PL, Katan MB (1998)).

Appetizer: The good foodstuff is a catalyst of hunger by creating juices as an appetizer. Mustard oil helps in digestion by stimulating digestive juices to create a feeling of hunger (Niya 2008 Saba, 2015).

Antibacterial or antifungal: Glucosinolate <30 µmol/g is available in mustard oil which accounts antibiotic, fungicidal and cancer prevention qualities, which serves the therapeutic functions for human health. Ally Isothiocyanate serves as an antifungal agent, which protect food from fungal growth and reduces the infection. These antibacterial and antifungal properties of the mustard oil help to treat skin diseases and helps Internally, to fight the contagion occurrence in our internal organs (Thaker 1990, George Mateljan 2001, Niya 2008 and Saba, 2015).

Therapeutic: The composition of mustard oil is based on our body requirement. This oil having <7% saturated fat, high amounts of monounsaturated fatty acids ranges from 3.6-32.2%. It also contains a considerable amount of linoleic (18:2) and linolenic acids (18:3). These acids having some nutritional qualities at a higher concentration that makes this oil highly susceptible to oxidation. The optimum range of ω-3 and ω-6 fatty acids, vitamin E, which serves nutritive value to boost our immune system (Sheppaed et al. 1993, Mead, 1977, Levy and Blum 2007 and Chauhan and Kumar, 2011).

Strengthen red blood cells: Dietary intake of fats plays an important role in the nutritional and metabolic process. Mustard oil is the major source of all fats required for our body to perform diverse biological functions as components of plasma, cell lipids, and cell membrane because this oil decreases cholesterol and improves membrane structure of red blood cell (RBC) (Jimenez et al 2007).

Good for a heart health: This oil is healthier than olive oil with the absence of trans-fatty acids, least amount of SFA, a huge amount of MUFA and PUFA, which is the best amount of ω-3/ω-6, oleic fatty acid, linoleic acid, alpha-linolenic acid, and erucic acid to increase the heart health. The alpha-linolenic acid helps to reduce the all adhesive impulses in blood platelets which is helpful to minimize the risk of heart failure. Most of the researches on different edible oils and their utility indicate that mustard oil is the best to protect cardiac diseases. The researches further show that the 70 % chances of heart disease have dropped by the consumption of this oil as a cooking of food. This oil also having more nutritional superiority as compared to olive oil (Mishra and Manchanda, 2012). Mustard and rapeseed oils—due to their favorable LA/ALA ratio, low SFA, and high MUFA content along with their relative stability during cooking—can be a preferred choice, particularly mustard oil in its unrefined (cold-pressed) form. In fact, epidemiologic studies among Indians do suggest that mustard oil consumption can reduce the risk of CHD (Manchanda and Passi, 2016)

Reduces diabetic hazards: Some researches indicate that the presence of trans fat is the major cause of insulin failure and high oxidation of fat. The use of high amount trans fat increases the blood sugar level which increases the chance of diabetic hazards, but the absence of trans fat can raise the insulin levels in our blood, which is helpful to control the blood sugar level and reduces the chances of diabetes but, the elaidic acid and vitamin E very protective measure for insulin. The amount of vitamin E in the α-tocopherols present in this oil have beneficial effects to control diabetic hazards (Sheppaed et al. 1993 and Bray et al. 2002).

Antiallergic: It is over think that the use of this oil reflects the health of children’s by preventing them from asthma, allergic cold, and asthmatic eczema, as the absence of trans-fat and a huge amount of monounsaturated and polyunsaturated fatty acids, which plays a good role for children’s health. The researches indicate that the major cause of asthma and allergies among children’s is the high absorption trans fat, while there was not any association between the intake of monounsaturated and polyunsaturated fatty acids, which indicates that, the trans fatty acids are harmful to child health. So the mustard oil is good to prevent skin diseases among children’s (Weilland et al.1999).

Throat and eye-protective: When fat and oil are heated on high-temperature decomposition occur and finally a point is reached where fat is broken down to glycerol and free fatty acids and
produce azureous smoke. This point is called the smoke point. Oils having higher acid value results in excessive smoking and unsatisfactory level which create irritation in throat and eyes. The sunflower and safflower oil had high acid value varying from 1.0–25.0% and 0.15–10.0% respectively. However, rapeseed mustard oil showed the low value which protects eyes and throat irritation (Krishnamurthy and Rao (2009).

As preservative: Vitamin E (tocopherols) acts as a preservative against oxidative rancidity of vegetable oils. The fungus growth can be reduced effectively by vitamin E. Mustard oil make a thick layer on pickle which resists the entry of microorganism and play a preservative role to conserve food and to enhance the taste. It also preserves flavor in chutney and canned vegetables (Singh, B 2006 and Uzum et al. 2006).

Antioxidants: Mustard oil contains a high quantity of carotenoids. The diverse function of carotenoids such as anti-aging have been reported and plays an important role for normal vision, good health of epithelial tissues and skin, promote physical development (Midorikawa et al. 200, Singh, B. 2006).

Used for cooking and flavorings agent: Most of the Indian household used mustard oil for cooking and seasoning of food respectively. This oil is healthier than olive oil with the absence of trans-fatty acids, least amount of SFA, a huge amount of MUFA and PUFA, which is the best source of ω-3/ω-6. This oil having great power for a tolerance of high temperatures. Due to this property, it can be used for frying of food. As per its qualities, it is indicated as well as suggested that this oil is most nutritious and health effective with a typical odor and taste to the food items (Kalyani,2008, Mishra and Manchanda 2012 and Choudhary and Sangha 2013).

Economic oil: This oil is available in all types as Kachhi Ghani, Pakki Ghani, and refined form. Its cost is least as compared to another cooking oil used in our country. So, it is used in every south and north region for cooking of different types of dishes (Gupta, P and Verma, U 2000).

Conclusion
Recommendation of mustard oil for consumption purpose particularly due to the presence of low saturated fat, high oleic acid, a balanced ratio of SFA/MUFA/PUFA and antioxidants, and absence of trans-fat and minimum antinutritional factors are generally different from those of industrial requirements. The recommended ratio of polysaturated fatty acids (PUFA)/saturated fatty acids (SFA) is 0.8–1.0 that require in daily diet and the range of linoleic acid (ω-6)/alpha linolenic acid (ω -3) is 5–10 as the range of SFA:MUFA:PUFA should be 1:1.5:1 and 5:4 range for ω-6/ω-3 should be for good health. These are beneficial for health and should be included in a balanced diet as compared to SFAs. Nutritional quality of mustard oil determined by its fatty acid constituents, protein content and respective amino acids concentration, dietary fibers, antioxidants and various factors including glucosinolate, phytic acid, sinapine, etc, plays a medicinal role. So, there is a need to switch on the mustard oil in our diet.

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