Know Your Food

A manual to identify daily
food and food-like substances

By Swasth Yog Institute

Contents

Introduction

For many people, the food that they consume and the decisions that they make regarding it are not very well planned. They are not measured and strategized but based on what is convenient, cheap, and tasty. Moreover, if people are trying to adopt a healthier lifestyle, most of what they alter in their eating habits depends on what they already know, what someone told them, a high reliance on a popular but flawed measure of food quality – calories, and their existing beliefs and hypotheses regarding food products, especially when there exists extremely conflicting research related to the impact of different food items on our bodies. Additionally, as we live in the modern age, in the name of food, we often consume food-like substances which are responsible for the poor state of our health[1].

Luckily, through our association with the Swasth Yog Institute, as participants, as Anand Yog Coaches, as Doctors, we have already made significant changes in how we think about food and also in what we consume. And now, we have both the opportunity and the responsibility to be change centers, to influence those around us to make similar shifts. This manual is an attempt to support you in that process. It is divided into two sections. The first is a deep dive into six common food items (and mainly their food-like variants) we use at home – salt, sugar, oil, wheat, tea and coffee – and it sews together information and insights from both western science and Ayurvedic nutrition to understand their impact on our health and provide alternatives to existing consumption patterns. The second section takes a look at the food labels of some very commonly used packaged food products such as ketchup, juice, maggi, etc. and reveals not only the food-like substances present in these products but also their impact on our bodies.

The idea behind the manual is for us to backed with all the knowledge and understanding that is required to support our own consumption choices and influence other people's consumption choices as well in a manner that is scientific, relevant and based on the truth.

We have used several reliable sources for concepts centered on both western science – Harvard School of Public Health[2], NCBI[3], CDC[4], American Heart Association and Mayo Clinic – and Ayurvedic nutrition – From Obsessive Diets to Yogic Aahaar[5], Kripalu – Center for Yoga and Health[6] and Ayurvedic Nutrition by Vaidya Atreya Smith[7]. Sources and references have been incorporated within the document so that you can strengthen your understanding in areas of interest.

Happy Reading!

---

[1] Garima Gupta Kapila, *From Obsessive Diets to Yogic Aahaar*
[2] https://www.hsph.harvard.edu/nutritionsource/
[3] https://www.ncbi.nlm.nih.gov/
[4] https://www.cdc.gov/
[5] https://www.amazon.com/Obsessive-Diets-Yogic-Aahaar-nutrient-based/dp/1086069994
[6] https://kripalu.org/
[7] https://www.amazon.in/Ayurvedic-Nutrition-Vaidya-Atreya-Smith/dp/1450570682

Part I: Deep Dive into Regularly Used Food and Food-Like Substances

1. Salt

Executive Summary

Salt is sodium chloride – the white crystals left over when seawater evaporates[8]. While salt is needed to transmit nerve impulses, contract and relax muscle fibers (including those in the heart and blood vessels), and maintain a proper fluid balance, it is only needed until a certain amount.

According to CDC, one should not consume more than 2,300 milligrams (mg) of sodium per day[9]. Also, according to Mayo Clinic, one teaspoon of iodized salt (6g) – the form of salt that is most commonly consumed (or 'table salt') contains 2,325 milligrams (mg) of sodium. On average, in India people consume 11g of salt per day[10], resulting in a daily consumption of sodium 4,262 mg which is almost double of the recommended amount of daily sodium intake. This excess consumption of salt is what leads to several health-related issues. Its impact different systems of our body as highlighted below –

Cardiovascular System	The accumulation of sodium in the blood increases the volume of blood in the bloodstream which means more work for the heart and more pressure on blood vessels. Over time, the extra work and pressure can harden blood vessels, leading to high blood pressure, and a higher risk of heart attack, kidney diseases and stroke[11].
Immune System	In presence of high sodium levels, immune cells responsible for attacking bad bacteria tend to become inactive. Also, anti-inflammatory activity is suppressed, making our body more susceptible to infections[12].
Mental Health and Addiction to Salt	Once salt is consumed; sodium helps to activate the dopamine reward system. A lack of sodium may then prevent dopamine from being released. As a result, the brain sends messages to promote the salt craving which may become to an addiction in order to achieve the pleasure feeling[13].

Table 1 Salt-Impact on Health

However, there are many ways to monitor our sodium intake and not exceed the recommended daily amount, such as[14]:

- Alternative salt options: Using sea or rock salt instead of iodized salt due to its lower sodium levels
- Alternatives seasoning options: Using herbs and spices instead of adding table salt to the food, examples include black pepper, nutmeg, parsley, ginger, rosemary, thyme, tarragon, garlic, onion powder, oregano, dry mustard and chili
- Awareness: Reading food labels and choosing products with low salt addition
- Reduce processed food intake:
    - consuming fresh meats, fruits, and vegetables, instead of their canned substitutes.
    - using fresh, skinless poultry that isn't enhanced with sodium solution instead of fried or processed chicken
    - preparing your own meals and limit the salt in recipes and avoiding instant products
- Process: Adding salt in process of cooking to unlock its complete flavor rather than after the food is cooked

[8] https://www.health.harvard.edu/heart-health/take-it-with-a-grain-of-salt
[9] https://www.cdc.gov/salt/pdfs/sodium_dietary_guidelines.pdf
[10] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6412427/
[11] https://www.hsph.harvard.edu/nutritionsource/salt-and-sodium/
[12] https://www.ahajournals.org/doi/pdf/10.1161/HYPERTENSIONAHA.118.11128
[13] https://greatist.com/health/why-we-love-salt-and-how-break-sodium-addiction#1
[14] https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/sodium/how-to-track-your-sodium

1. Introduction

Salt is a mineral composed primarily of sodium chloride (NaCl), a chemical compound belonging to the larger class of salts; salt in its natural form as a crystalline mineral is known as rock salt or halite. Salt is present in vast quantities in seawater, where it is the main mineral constituent[15]. Salt is essential for human life and sodium (as a nutrient) is more generally needed in larger amounts by animals.

Why we need Salt

Sodium is an essential electrolyte that plays a vital role in our health and well-being and the human body cannot live without some sodium.

- First, it helps maintain the balance of water in and around our cells, helping create a proper fluid balance.
- Second, it is also important for proper muscle and nerve function as it is needed to transmit nerve impulses, and contract and relax muscle fibers (including those in the heart and blood vessels),
- Third, its second function supports it in maintaining stable blood pressure levels.

According to experts from Healthline, insufficient sodium in our blood is also known as Hyponatremia. It occurs when water and sodium are out of balance. In other words, there is either too much water or not enough sodium in our blood.

Moreover, saltiness is one of the basic human tastes. In Ayurveda, the salty taste is one of the six tastes (salty, sweet, sour, pungent, bitter, and astringent). Divya Alter, chef at Ayurvedic restaurant Divya's Kitchen in New York City says, "It helps us experience all the other tastes properly. Each taste has a mental and physical function in the body."[16] Salt is also one of the oldest and most ubiquitous food seasonings and salting is an important method of food preservation.

While there exist several kinds of salt. For the purpose of this document, we will delve into the most commonly used one – table salt – and try to break down its constituents and the possible consequences of its regular and often unmonitored consumption. Later in the document, we will also lay down alternatives options and habits that enable us to be more effective in monitoring our sodium intake and provide additional nutrition to our bodies.

[15] https://planeta.com/salt/
[16] https://www.yogajournal.com/lifestyle/the-best-type-of-salt-to-balance-your-dosha

2. Table Salt

Table salt, the type of salt that is most commonly consumed is the most processed version of salt, one that undergoes two essential processes that prevent clumping and makes it extremely refined.

First, the evaporation of sea water on high temperatures (185°C), after which it is processed by a multiple-effect vacuum evaporator with high pressure for purification. Here, calcium, magnesium and other minerals are lost due to the high temperature and pressure[17].

Second, iodizing the salt. Iodine is found in some foods such as seaweed, fish and dairy products. According to the Harvard School of Public Health, iodine is a trace mineral that was added to salt in 1924 to prevent goiter and hypothyroidism, medical conditions caused by iodine deficiency[18]. The adoption of table salt iodization, according to Mayo Clinic, was an inexpensive, universal, easy way to provide iodine as a supplement to everybody.

After these two processes, we get table salt. The nutrients present in one teaspoon (6g) of table salt are highlighted in the table below.

Nutrients	Iodized salt	% of daily recommended intake
Calories (kcal)	0	0%
Protein (g)	0	0%
Calcium (mg)	0	0%
Magnesium	0	0%
Potassium (mg)	0.5	0%
Phosphorus (mg)	0	0%
Sodium (mg)	2325	102%
Iodine (mcg)	71	47%

Table 2 Salt- Nutrients composition of table salt

According to CDC, one should not consume more than 2,300 milligrams (mg) of sodium per day[19]. Also, according to Mayo Clinic, a teaspoon of iodized salt contains 2,325 milligrams (mg) of sodium, which exceeds the recommended amount of sodium daily intake[20].

In India, the average intake of salt by a person is 11g, according to NCBI which makes our daily consumption of sodium 4,262 mg which comes out to be 187% of the daily recommended intake.

3. Some common foods with high amount of salt

According to American Heart Association, more than 70% of the sodium we consume comes from packaged, prepared and restaurant foods. The rest of the sodium in the diet occurs naturally in food or is added when we're cooking food or sitting down to eat. So even if one never uses the salt shaker, they are probably consuming too much sodium[21].

---

[17] https://ods.od.nih.gov/factsheets/Iodine-HealthProfessional/
[18] https://www.hsph.harvard.edu/nutritionsource/salt-and-sodium/
[19] https://www.cdc.gov/salt/pdfs/sodium_dietary_guidelines.pdf
[20] https://newsnetwork.mayoclinic.org/discussion/mayo-clinic-q-and-a-sea-salt-and-sufficient-iodine-intake/
[21] https://healthmetrics.heart.org/wp-content/uploads/2019/02/At-A-Glance-Heart-Disease-and-Stroke-Statistics-%E2%80%93-2019.pdf

This fact also implies that salt reduction can be accomplished by cutting out on packaged, prepared and restaurant foods, instead of compromising on the taste of home-cooked meals by reducing salt in the food. The table below highlights the high amount of salt/sodium content contained in some common food items[22].

Food Item	Amount of Sodium	Specification
Soy Sauce	1,024 mg	One tablespoon (15-ml) serving
Soup	800 mg	One cup of canned soup
Pizza	765 mg	One slice of pizza (40-gram slice)
Biscuits	528 to 840 (mg)	One biscuit made from packaged dough
Ketchup	321 mg	One fourth cup (62 grams) of tomato sauce

Table 3 Salt - Amount of sodium in processed food items

According to NCBI, current evidence suggests that the main source of dietary salt in India is from added salt during cooking. However, India is presently undergoing a rapid epidemiologic, demographic, and nutrition transition, and salt intake from pre-prepared packaged foods may be increasing as a result, as seen in other countries which have undergone a similar transition. This transition has and will lead to increased intake of salt over the coming years.

4. Impact of Processes and Nutrients

4a. Iodization

While the idea of adding iodine to salt was seen as a convenient way to provide iodine as a supplement universally to all, however, the process of iodization has two unintended consequences, listed below:

- In the process of manufacturing salt and creating fine and non-clumpy table salt, it loses its natural content of some minerals and nutrients such as potassium, magnesium, and calcium. This lack of minerals and nutrients can be seen in the table below, especially in comparison to less processed alternatives such as sea salt and rock salt –

Nutrients	Iodized salt	Sea Salt	Rock Salt
Calories (kcal)	0	0	0
Protein (g)	0	0	0
Calcium (mg)	0	0.4	3.6
Magnesium	0	0	1.8
Potassium (mg)	0.5	0.5	1.8
Phosphorus (mg)	0	0.2	0
Sodium (mg)	2325	2000	2040
Iodine (mcg)	71	0	0

Table 4 Salt - Nutrients in table salt v/s sea salt and rock salt

The micronutrients lost in the processing of salt are needed for several essential functions of the body. These include –

[22] https://www.healthline.com/nutrition/foods-high-in-sodium#The-bottom-line

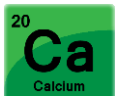
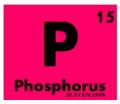
Micronutrients	Function
	It is essential for the development, growth, and maintenance of bone. It also plays an essential role in muscle contraction and blood clotting[23].
	Manages the interaction with neurological receptors in the nerve cells to transmit the sensory messages from the brain, which helps to keep the normal movement of muscles.
	Along with sodium, it regulates the water balance and the acid-base balance in the blood and tissues. However, consumption of too much sodium and not enough potassium causes high blood pressure[24].
	The main function of phosphorus is in the formation of bones and teeth. It plays an important role in how the body uses carbohydrates and fats. It is also needed for the body to make protein for the growth, maintenance, and repair of cells and tissues[25].

Table 5 Salt - Micronutrients and their roles

- The process of iodization increases the sodium content, sodium has many roles in regulating the body's fluid balance, preventing low blood pressure and maintaining the health of the heart, liver, and kidneys as discussed above. However, increased amounts of sodium can cause alterations in key processes of the body related to the cardiovascular and urinary system which have poor long-term consequences, discussed in detail below.

4b. Sodium

Iodized salt leads us to consume more sodium that the recommended amounts. This can have various short term and long-term consequences.

- **Cardiovascular System and kidney:** As sodium level increases in the blood, the kidney works on its excretion to keep the balance of fluids in the body. The accumulation of sodium in the blood makes the body hold onto water to dilute the sodium which increases both the amount of fluid surrounding cells and the volume of blood in the bloodstream. Increased blood volume means more work for the heart and more pressure on blood vessels. Over time, the extra work and pressure can harden blood vessels, leading to high blood pressure, heart attack, kidney diseases and stroke[26].

  Globally, according to WHO, cardiovascular diseases are the number one cause of death which represents 31% of total deaths every year[27]. Also, according the American Heart Association, on average in 2016 someone died of stroke every 3 minutes and 42 seconds[28]. Regarding high blood pressure, WHO stated that 12.8% of total deaths worldwide are caused by raised blood pressure[29]. Cardiovascular diseases (CVDs) are the leading cause of death in India, with high blood pressure responsible for almost one quarter of the 2.3 million CVD-related deaths per year[30].

[23] https://medlineplus.gov/ency/article/002412.htm
[24] https://hkpp.org/patients/potassium-health
[25] https://medlineplus.gov/ency/article/002424.htm
[26] https://www.hsph.harvard.edu/nutritionsource/salt-and-sodium/
[27] https://www.who.int/health-topics/cardiovascular-diseases/#tab=tab_1
[28] https://healthmetrics.heart.org/wp-content/uploads/2019/02/At-A-Glance-Heart-Disease-and-Stroke-Statistics-%E2%80%93-2019.pdf
[29] : https://www.who.int/news-room/fact-sheets/detail/hypertension
[30] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6412427/

- **Immune System:** The macrophages, which are immune cells that attack, eat and digest the bad bacteria, become inactive in the presence of high sodium level which makes the body more susceptible to infections. Also, high sodium level suppresses the anti-inflammatory activity by blocking their inflammatory receptors, which are responsible for fighting the bad bacteria that enters the body[31].

- **Mental health and addiction to salt:** Once salt is consumed; sodium helps to activate the dopamine reward system. Dopamine is a neurotransmitter that mediates pleasure in the brain which gives the feeling of pleasure and joy when it is released. A lack of sodium may trigger the activity of dopamine reward system which prevent the dopamine from being released. As a result, the brain sends messages to promote the salt craving which may become to an addiction in order to achieve the pleasure feeling[32].

Simplified: Salt sensitivity

Some people can effectively excrete high dietary salt intake without an increase in arterial blood pressure, and other people cannot excrete effectively without an increase in arterial blood pressure. Salt sensitivity of blood pressure refers to the blood pressure responses for changes in dietary salt intake to produce meaningful blood pressure increases or decreases. The mechanism that promote salt sensitivity is complex and ranges from genetic to environmental factors, such as age, gender, genetics and dietary habits.

To summarize, an increased intake which increases the amount of sodium in the bloodstream may

- alter the fluid balance by attracting the water molecules which could cause fluid retention and high blood pressure (hypertension) and
- reduce the ability of the kidneys to remove the water outside the body.

Long-term consumption of salt will result in heart diseases, kidney failure and strokes.

5. Healthy alternatives to salt consumption

Sea Salt

Sea salt, which is being produced through the natural evaporation of sea water, is a healthier alternative to iodized salt (or table salt.)

In the chart below, we can see a comparison in the nutrients of table salt and sea salt (6g of each), clearly highlighting how sea salt contains additional essential nutrients and lesser sodium. Sea salt is a great source of electrolytes like phosphorous, calcium and potassium which play an essential role in the functioning of our bodies. Also, since sea salt contains the appropriate amount of sodium daily need, it is safe to use with no side effects of fluid imbalance, kidney and heart functions. Because it is not highly refined and ground like table salt, it may appear coarser and darker with an uneven color, indicating the remaining impurities and nutrients[33].

[31] https://www.ahajournals.org/doi/pdf/10.1161/HYPERTENSIONAHA.118.11128
[32] https://greatist.com/health/why-we-love-salt-and-how-break-sodium-addiction#1
[33] https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/sodium/art-20045479

Nutrients	Iodized salt	Sea salt
Calories (kcal)	0	0
Protein (g)	0	0
Calcium (mg)	0 (0% of daily recommended intake)	0.4 (0.1% daily recommended intake)
Potassium (mg)	0.5 (0% of daily recommended intake)	0.5 (0% of daily recommended intake)
Phosphorus (mg)	0	0.2 (0.2% daily recommended intake)
Sodium (mg)	2325 (102% of daily recommended intake)	2000 (87% of daily recommended intake)

Table 6 Salt-Table salt v/s Sea salt

Rock salt

Rock salt is a refined version of the salt of rocks and is mined from underground rocks which form under the earth surface. It has sodium chloride as the most abundant component in its formation, but it also contains other minerals is very small quantities It has large crystal particles that make it hard to dissolve in water or food unlike sea salt which sourced from sea water and can be easily dissolved due to its small particles. The table below highlights the composition of rock salt in comparison to iodized salt. Here it can be seen that rock salt like sea salt, not only contains lesser amount of sodium but also higher amount of other essential nutrients, as compared to iodized salt.

Nutrients	Iodized salt	Rock Salt
Calories (kcal)	0	0
Protein (g)	0	0
Calcium (mg)	0 (0% of daily recommended intake)	3.6 (0.9% daily recommended intake)
Potassium (mg)	0.5 (0% of daily recommended intake)	1.8 (0% of daily recommended intake)
Magnesium (mg)	0 (0% of daily recommended intake)	1.8 (0% of daily recommended intake)
Sodium (mg)	2325 (102% of daily recommended intake)	2040 (89% of daily recommended intake)

Table 7 Salt-Table salt v/s rock salt

In addition, there are many natural healthy alternatives of salt in which they can be added to food with no health risks, such as lemon, herbs and spices such as nutmeg, chili, pepper, mint, basil, garlic and many others[34].

But one may argue that these alternatives do not contain iodine. According to Mayo Clinic, the recommended dietary allowance for iodine in adult men and women is 150 µg per day and while this can be obtained from about one-half to three-quarters of a teaspoon of iodized salt[35]. So, instead of depending on iodized salt for our iodine intake, we can instead consume alternatives like fish, seaweed, dairy products, fruits and vegetables in which their iodine content as shown in the table.

[34] https://www.bhf.org.uk/informationsupport/heart-matters-magazine/nutrition/herbs-and-spices
[35] https://newsnetwork.mayoclinic.org/discussion/mayo-clinic-q-and-a-sea-salt-and-sufficient-iodine-intake/

Food	Serving size	% of daily iodine recommended intake
Seaweed	5g	57%
Cod	3oz	66%
Baked potato	1 medium potato	40%
Milk	1 cup	37%
Tuna	6oz	22%
Cooked beans	½ cup	21%
Yoghurt	1 cup	50%

Table 8 Salt-Iodine amounts in common foods

Apart from the above mention food items - which fall under the category of 'excellent' sources of iodine - other ingredients that can load you up with iodine would include fruits like bananas, strawberries; veggies like green leafy vegetables, onions and sweet potatoes; grains, nuts, peanuts, barley, etc.[36].

6. Ayurveda Says

The benefits of rock salt

According to Ayurvedic experts, rock salt (*Saindhav Lavana*) is considered to have a cooling effect on the body, which is unusual given its taste. Hence, it is recommended by Acharya Charaka to be used every day in meals. Rock Salt is much better for health than using refined, chemical salts which are commonly available in a super market. This is also available as Himalayan salt, Himalayan Pink salt, or plain Rock Salt. Ayurveda tells us that using the right salt, in quantities that are appropriate for our prakriti, aids digestion. *Saindhava Lavana* improves digestion, aids metabolism, clears blocked channels, and aids nutrient absorption and hence is pitta channelizing.

However, if we use too much of even *Saindhava Lavana* we aggravate Pitta dosha. If we use iodized table salt, even in small amounts, we severely aggravate Pitta dosha. If we eat hotel food, which is often laced with high amounts of Monosodium Gutamate (MSG), we are even further aggravating Pitta. If we eat food preserved in Vinegar and commercial salt like pickles, pickled vegetables and even so-called healthy foods like Kimchi, we are adding Petrol to the Forest Fire[37].

The process of cooking

Moreover, according to Ayurveda, it is more helpful to add salt to the cooking process rather than adding salt at the table to already cooked food. Cooking salt is key to unlocking its flavor-enhancing abilities. While it is common to see salt shakers on dining tables, salting food after it has been cooked (even with mineral salt) is too harsh for the body. Salt is quite heating and eating it this way concentrates the effects and will cause pitta imbalance. In addition, salting your food after cooking numbs the taste buds. While cooking salt into food brings out the subtleties of the tastes in your meal, salting at the table does the opposite[38]. Thus, Ayurveda advocates clean, home cooking whenever possible to ensure good quality ingredients like unrefined salt that provides well-balanced minerals and electrolytes[39].

[36] https://food.ndtv.com/food-drinks/iodine-rich-foods-10-best-dietary-sources-1242496
[37] https://krya.in/2018/11/pitta-channelizing-dravyas-spices/
[38] https://www.halepule.com/blog/all-about-salt-an-ayurvedic-perspective
[39] http://positivelyayurvedic.com/2016/12/03/the-truth-about-salt/

2. Sugar

Executive Summary

Sugar is a class of carbohydrates that tastes sweet. It is also a quick and easy fuel for the body to use. Some types of sugar are lactose, glucose, fructose, and sucrose[40]. While sugars occur naturally in a wide variety of fruits, vegetables and dairy foods, they can also be produced commercially. Where natural sugars are not harmful to our bodies, excess use and consumption of sugars produced commercially is detrimental to our health and the environment because of the refining process they go through, explained below –

- First, the refining process removes essential nutrients from natural sugars such as potassium, calcium, iron and magnesium. Without these nutrients, the structure of sugar that is left detrimental to our health
- Second, the process adds certain components to sugar such as Sulphur which is a hazard for both the environment and our bodies

In India, according to the NCBI, the average consumption of sugar is 10 spoons per a day (40g)[41] which comes out to be 111% of the daily recommended intake. Consumption of excess of refined sugar has been linked to the following diseases –

Obesity, Cardiovascular diseases and Cancer	It leads to increase in accumulation of fat and may cause obesity (risk factor for cardiovascular diseases, hypertension and strokes[42]). It also causes the pancreas to produce increased insulin, causing damage to the heart and arteries over-time. Production of increased insulin also supports the growth of cancerous cells[43].
Diabetes	It leads to a rise in blood glucose level, leading to a buildup of liver fats and a decrease in insulin sensitivity which can cause blood sugar to be persistently high, potentially leading to type 2 diabetes[44].
Repressed Immune System	It has been found that that consumption of 100gm of sugar effectively suppresses the immune system for six to seven hours, opening the doorway to many other infections and diseases.
Addiction and other mental health issues	Excess consumption of refined sugar triggers a dopamine reward system which is then activated every time sugar is consumed, so when there is no sugar in the body, these chemicals do not get released, which may lead to depression[45].

Table 9 Sugar-Impact on Health

Keeping these facts about refined sugar in mind, we can exercise control on our diets by simple habits:

- Consume healthy alternatives:
  - In place of white sugar, use of jaggery, raw honey as a sweetener goes a long way for our health and leads to a similar taste profile
  - Consumption of alternative sweets such as fruits instead of cake, chocolates, *laddus*
- Reduction of processed food with added sugars by –
  - Always reading the ingredient list and avoiding foods with sugar (or syrup) as the first few ingredients or any artificial sweeteners
  - Visualizing the amount of sugar present – 4 grams of sugar = 1 teaspoon of sugar

[40] https://www.webmd.com/diabetes/qa/what-is-sugar
[41] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4389505/
[42] https://www.health.harvard.edu/heart-health/the-sweet-danger-of-sugar
[43] https://www.rogelcancercenter.org/living-with-cancer/mind-body-side-effects/nutrition/sugar-and-cancer-does-sugar-increase-cancer-risk
[44] https://www.medicalnewstoday.com/articles/317246#the-link-between-sugar-and-type-2-diabetes
[45] https://doi.org/10.1016/j.neubiorev.2007.04.019

1. Introduction

Sugar is a class of carbohydrates that tastes sweet. It is also a quick and easy fuel for the body to use. Some types of sugar are lactose, glucose, fructose, and sucrose[46]. While sugars occur naturally in a wide variety of fruits, vegetables and dairy foods, they can also be produced commercially. Within the food industry, sugar is produced commercially to be added to foods for the many technical functions they perform – contributing to foods' structure and texture, sweetening and flavor enhancement, providing a medium for the growth of yeast in baked goods, lengthening the shelf-life of canned products and preventing spoilage[47].

Where natural sugars are not harmful to our bodies and provide us nutrients as they come packaged within a fruit or vegetable with its own benefits, excess consumption of sugars produced commercially is detrimental to our health. Refined sugar that we buy from the market to use at home in food items such as sweets, desserts, tea and coffee and the one that is already found in processed products is extracted, purified, filtered and crystalized from the sweet juice present in sugarcane stalks or beet plants.[48]

Additionally, through slight adjustments in the process of cleaning, crystallizing and drying the sugar and varying the level of molasses, different sugar varieties are produced. Sugar color is primarily determined by the amount of molasses remaining on or added to the crystals, giving pleasurable flavors and altering moisture. Heating sugar also changes the color and flavor, there are many kinds of sugar in which they are different in the chemical structure and properties, such as brown sugar and white sugar[49].

For the purpose of this document, we will focus on refined white sugar and try to understand its properties and their impact on our health. Moreover, we will also look at certain healthier alternatives to white sugar.

2. Refined sugar

Sugar refining is the production of high-quality sugars from raw cane sugars. First, extraction of the sugar cane juice, then clarification of the juice which is purified by the addition of heat (99°C–104°C), and then it is evaporated to form syrup. After that, the syrup is sent to vacuum pans, where it is boiled to form white crystals and let them cool and dry to package them into bags as white sugar[50].

However, in India, sugar is refined using the Double Sulphitation method that involves the introduction of Sulphur Dioxide (SO2) at two stages. This is the most widely used and cheapest process of refining sugar as compared to other available processes.

---

[46] https://www.webmd.com/diabetes/qa/what-is-sugar
[47] https://foodinsight.org/background-on-carbohydrates-sugars/
[48] https://www.agfoundation.org/news/where-does-sugar-come-from
[49] https://www.sugar.org/sugar/types/
[50] https://www.britannica.com/science/sugar-chemical-compound/Crystallization#ref50461

Simplified: Double Sulphitation Method

Raw sugarcane juice has a low pH value of 4 or 5 which is slightly acidic in nature. At this level, sugar can get converted into other forms, like glucose and fructose in the process of refining, which is not desirable. To prevent this, the juice is heated to about 70 degree Celsius and little lime or calcium oxide is added to it, which takes the pH value to around 9.5. This mixture of juice and lime is then treated with SO2 to bring the pH value to the neutral level of 7. In the process, the calcium oxide reacts with Sulphur dioxide to produce Sulphites and sulphates of calcium, which helps in the clarification/purification of the sugarcane juice. The mud thus formed is removed by filtration as 'press mud'.

Sulphur dioxide is then used at a later stage, after the juice has been concentrated and is being crystallized. At this point, SO2 works as a bleaching agent and is responsible for ensuring that the end product, sugar, is white in color. Once the crystallization process is over, the soluble Sulphur compounds are drained out along with the molasses.

While this process may be more convenient and cheaper, there are two problems with it –

- First, a little bit of Sulphur remains within the final product, that is the sugar that we eat. This Sulphur exists in amounts higher than what is required by the body and is known to lead to a variety of respiratory diseases.
- Second, the molasses containing Sulphur which is removed from the end product, when used to produce ethanol and biogas from distillery waste, releases considerable amount of foul-smelling Hydrogen Sulphide (H2S) - a poisonous gas - which needs to be removed from biogas for its use as fuel and thus needs additional treatment plants and chemicals.

This fact is well-known and that is why many countries have banned this process involving Sulphur. This is also the reason why Indian sugar cannot be exported to markets in the United States and Europe[51].

After the processing of sugar and the conversion of natural sugar found in sugarcane to white refined sugar, we have a sugar which with no nutritional value and many detrimental properties. According to the USDA, one tablespoon of white sugar (4g) contains the following:

Content	Amount	% of daily recommended intake
Calories (kcal)	16	~
Protein (g)	0	0%
Fat (g)	0	0%
Carbohydrates (g)	4 (As sucrose)	1%

Table 10 Sugar-Nutritional Composition

The American Heart Association's recommendations for sugar intake, classified by gender have been stated below.

- **Men** should consume no more than 9 teaspoons (36 grams or 150 calories) of added sugar per day.
- **For women**, the number is lower: 6 teaspoons (25 grams or 100 calories) per day[52].

[51] https://indianexpress.com/article/technology/science/sweet-talk-is-white-sugar-minus-the-sulphur/
[52] https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/sugar/how-much-sugar-is-too-much

AHA research states that American adults consume an average of 77 grams of sugar per day, more than 3 times the recommended amount for women. In India, according to the NCBI, the average consumption of sugar is 10 spoons per a day (40g)[53] which comes out to be 111% of the daily recommended intake.

3. Common foods with high amount of sugar

As per the Harvard School of Public Health, while we sometimes add sugar to food ourselves, most added sugar comes from processed and prepared foods. Sugar-sweetened beverages and breakfast cereals are two of the most serious offenders. Other processed foods with high sugar levels include desserts and sweets. The table below highlights the high amount of sugar content contained in some common food items.

Food Item	Amount of refined sugar	Specification
Tea	6g	One cup of sweetened tea
Cupcake	19g	One cup cake (79g)
Soda soft drinks	20g	One bottle of soft drink (16oz)
Ketchup sauce	4g	1 tablespoon (15g)
Milkshake	40g	1 cup (6oz)
Canned tomato soup	24g	1 can (294 g)
Breakfast cereal	12g	34 g serving
Boondi Laddu	13g	1 piece (50g)

Table 11 - Amount of sugar in processed food items

4. The impact of refined sugar

When sugar is consumed, glucose level in the blood increases. Glucose stimulates the pancreas to release insulin, which then triggers uptake of glucose by cells in the body, causing blood glucose to return to base levels. Sugar metabolism is the process by which energy contained in the foods that we eat is made available as fuel for the body. The body's cells can use sugar directly for energy to keep the body function normally by using it as energy in many metabolic pathways, such as digestion, protein synthesis and store it as fat for future use[54].

When high amounts of refined sugar consumed, it can affect the body on short-term and long-term as described below:

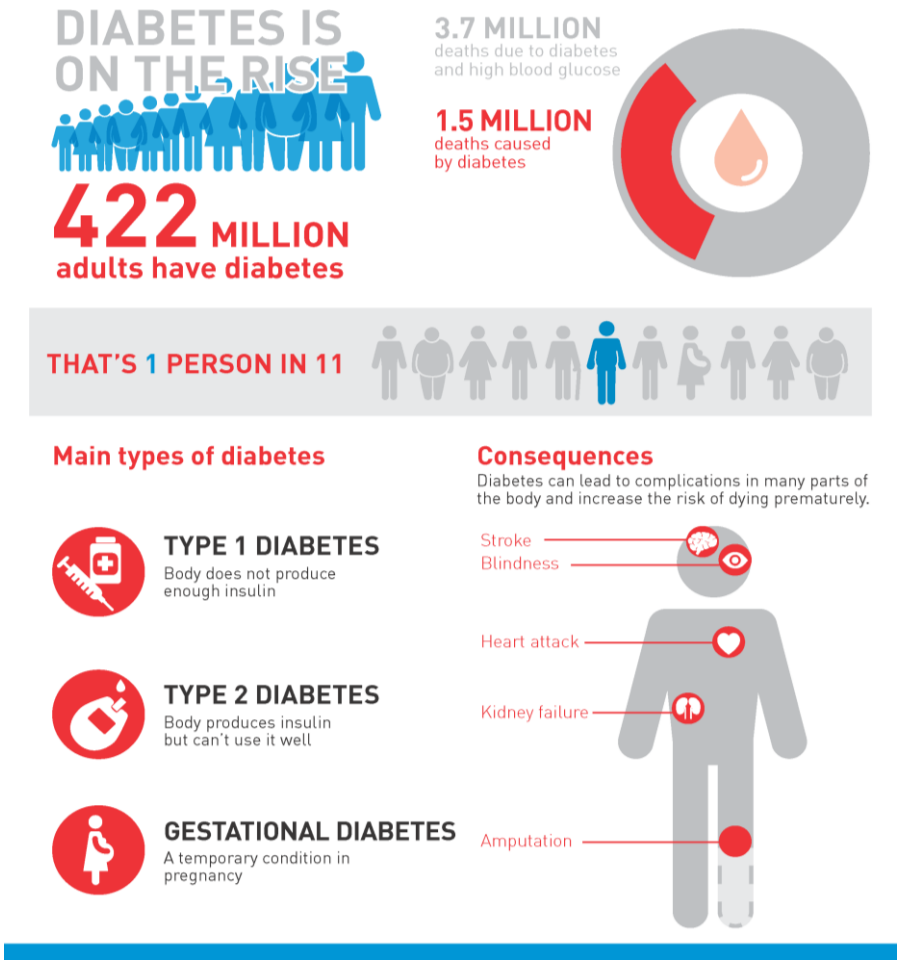
- **Obesity and cardiovascular diseases:** When excess refined sugar amount is consumed, the liver metabolizes it and converts it to fat, this can lead to a greater accumulation of fat in the body and may result into obesity which is a risk factor for cardiovascular diseases, hypertension and strokes[55]. Also, high refined sugar consumption causes the pancreas to produce insulin in order to maintain normal blood sugar, so too much sugar results in too much insulin production which makes the arteries inflamed and stresses the blood flow which can make damage to the heart and arteries over-time. Eventually, hypertension and heart diseases will develop.

[53] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4389505/
[54] https://sugarscience.ucsf.edu/sugar-metabolism.html#.Xw2nZ9PRDu0
[55] https://www.health.harvard.edu/heart-health/the-sweet-danger-of-sugar

According to WHO in 2016, 39% of adults aged 18 years and over (39% of men and 40% of women) were overweight and 13% of the world's adult population (11% of men and 15% of women) were obese in 2016. Also, most of the world's population live in countries where overweight and obesity kills more people than underweight[56].

- **Cancer:** When high amount of refined sugar is consumed, there is a great spike in blood sugar level. This spike results in an increased release of insulin-like growth factor (IGF), which helps cancer cells to grow. If blood glucose levels are better controlled, less IGF is released which likely will decrease cancer growth[57].

- **Diabetes:** When blood glucose level increases too fast due the great amount of refined sugar in the food, it leads to a buildup of liver fats and a decrease in insulin sensitivity. Insulin sensitivity shapes how effectively cells use glucose, removing it from the bloodstream. When it decreases, blood sugar can become persistently high, potentially leading to type 2 diabetes[58]. It is estimated that 415 million people are living with diabetes in the world, which means it is 1 in 11 of the world's adult population[59].



[56] https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight
[57] https://www.rogelcancercenter.org/living-with-cancer/mind-body-side-effects/nutrition/sugar-and-cancer-does-sugar-increase-cancer-risk
[58] https://www.medicalnewstoday.com/articles/317246#the-link-between-sugar-and-type-2-diabetes
[59] https://www.diabetes.co.uk/diabetes-prevalence.html

- **Addiction and other mental health issues:** Like drug dependence, sugar enhances the brain areas of pleasure and self-control. There are some chemicals released when sugar is consumed, which are responsible for mood boosting and the feeling of joy. This complex dopamine reward system includes some chemicals such as endorphins, endocannabinoids, oxytocin, and opioid-like chemicals. This system is activated every time sugar is consumed, so when there is no sugar in the body, these chemicals do not get released. This will lead to the addiction process of sugar, which means if there is no sugar in the system, there is no dopamine being released where some symptoms of depression may appear[60].

- **Tooth decay:** Tooth decay is mainly caused by high white sugar consumption, in which the sugar will allow some kinds of harmful bacteria to grow on the tooth. After eating foods that contain sugar, sugar molecules combine with saliva and bacteria present in the mouth, which leads to plaque on teeth[61].

- **Aging and acne:** Glycation is the process of collagen and elastin breaking down caused by sugar. They are proteins that provide skin with strength & firmness. When we consume high sugar, it causes signals within the skin to malfunction, preventing the skin from forming new collagen and elastin which causes aging and acne[62].

- **Repressed Immune System:** Besides being a driver behind other chronic health conditions like diabetes and heart disease, sugar consumption affects your body's ability to fight off viruses or other infections in the body. You know how your body needs certain cells to fight off infections? White blood cells, also known as "killer cells," are highly affected by sugar consumption. Sugar hinders the immune system since, according to a study done on fruit flies, the white blood cells are not able to do their job and destroy bad bacteria or viruses as well as when someone does not eat sugar[63]. It has been found that consumption of hundred grams of sugar effectively suppresses the immune system for six to seven hours.

Simplified: Stages of Sugar Addiction

The diagnostic criteria for addiction can be grouped into three stages:

- First – Bingeing which is defined as the multiple in-take of a high proportion of a substance at one time. This happens when sugar is being consumed frequently with high amount to reach the feeling of pleasure through the acute reinforcing effects of sugar.
- Second – Signs of withdrawal become apparent when the abused substance (sugar) is no longer available. In this stage, anxiety, mood swings and depression may appear due to the lack of dopamine. The third stage of addiction is craving, which occurs when motivation is enhanced such as temptations, and it characterized by the increased efforts to obtain the desired substance (sugar).
- Third – Finally, the frequent intake of sugar would result in less drug-like effects on the brain due to the frequent exposure to the substance (sugar), which means that people need to consume higher and higher levels of sugar in order to reach the same reward levels of dopamine and avoid mild states of depression.

[60] https://doi.org/10.1016/j.neubiorev.2007.04.019
[61] https://www.health.harvard.edu/heart-health/the-sweet-danger-of-sugar
[62] https://www.facethefuture.co.uk/blog/is-sugar-responsible-for-skin-ageing-acne/
[63] https://www.cnet.com/health/sugar-can-lower-your-immune-system/

5. Alternatives of refined sugar

There are many healthy alternatives of white sugar such as honey, fruits and fruit juices, natural maple syrup, dates or date paste, brown sugar and jaggery. These are healthy alternatives as they are found naturally from plants, with no chemical processing or manufacturing. They exist in their natural chemical structure where they can easily get metabolized inside the body, regulate the blood sugar level and release energy to regulate body biochemical functions[64].

Jaggery: a healthy alternative

Jaggery is a form of sweetener which is obtained from the boiling of raw sugarcane juice until the water content is evaporated and reaches a semi solid stage. Then it is poured over small molds or to a big tray and then shaped into big size balls. It is sometimes referred to as a 'non-centrifugal sugar', because it is not spun during processing to remove the nutritious molasses. As shown in the table, jaggery and white sugar differ in their content (in 4g) in various aspects, revealing jaggery to be a better alternative as a sweetener.

	Jaggery	**White sugar**
Calories (kcal)	15	16
Carbohydrates (g)	3.4	4
Protein (g)	0.01	0
Potassium (mg)	42	0
Calcium (mg)	4	0
Iron (mg)	0.5	0
Magnesium (mg)	3.2	0
Manganese (mg)	0.01	0

Table 12 Sugar- Refined Sugar v/s Jaggery

Because of the natural nutrients and minerals that jaggery retains, it has good nutritional value and helps in boosting immunity. It also activates digestive enzymes in the body, stimulating smooth bowel movement. High potassium and low sodium content in jaggery can help to maintain the acid balance in the body cells, which helps to regulate blood pressure. It also helps to relieve tension and takes care of asthma, as it has anti-allergy properties.

Artificial sweeteners: an unhealthy alternative

Artificial sweeteners – present in products like *sugarfree* and *coke zero*, offer the taste of sweetness without any calories and thus could seem like an effective alternative to sugar. However, when you look at their overall impact on our bodies, it is far from favorable. The American Heart Association (AHA) and American Diabetes Association (ADA) have given a cautious nod to the use of artificial sweeteners in place of sugar to combat obesity, metabolic syndrome, and diabetes, all risk factors for heart disease[65].

To understand why they are not a healthy alternative to sugar, it is essential to understand how the human body and brain respond to these sweeteners. According to Dr. David Ludwig, an obesity and weight-loss specialist at Harvard-affiliated Boston Children's Hospital, one concern is that people who use artificial sweeteners may replace the lost calories through other sources. However, he explains that a larger issue is that these products change the way we taste food. "Non-nutritive sweeteners are far more potent than table sugar. A miniscule amount produces a sweet taste comparable to that of sugar, without comparable calories. Overstimulation of sugar receptors from frequent use of these

[64] https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/artificial-sweeteners/art-20046936

[65] https://www.health.harvard.edu/blog/artificial-sweeteners-sugar-free-but-at-what-cost-201207165030

hyper-intense sweeteners may limit tolerance for more complex tastes," explains Dr. Ludwig. That means people who routinely use artificial sweeteners may start to find less intensely sweet foods, such as fruit, less appealing and unsweet foods, such as vegetables, downright unpalatable.

Animal studies suggest that artificial sweeteners may be addictive. In studies of rats who were exposed to cocaine, then given a choice between intravenous cocaine or oral saccharin[66], most chose saccharin. The table below lists some common artificial sweeteners and their level of sweetness compared to refined sugar.

Name of Sweetener	Sold as	X times sweeter than sugar
Aspartame.	NutraSweet, Equal, or Sugar Twin	200
Saccharin	Sweet'N'Low, Sweet Twin, or Necta Sweet	700
Sucralose	Splenda	600
Aspartame-acesulfame salt	Twinsweet	350

***T*able 13 Sugar-Common sweeteners**

Thus, use of artificial sweeteners can make you shun healthy, filling, and highly nutritious foods while consuming more artificially flavored foods with less nutritional value. Moreover, in the Multiethnic Study of Atherosclerosis, daily consumption of diet drinks was associated with a 36% greater risk for metabolic syndrome and a 67% increased risk for type 2 diabetes, the very diseases that artificial sweeteners claim to help prevent in the first place.

6. Ayurveda Says

Ayurvedic experts strongly believe in the detrimental impact of refined sugar. According to experts, refined sugar is absorbed very quickly into the blood stream and thus damages the normal enzyme function through its fast action. Therefore, the body's enzymes are disrupted by this direct action which then forces the liver, stomach and pancreas to balance the excessive amounts of blood sugar caused from the immediate digestion of the sugar. This causes energy fluctuations, which in time, disrupt the pancreas and water metabolism. Given the harm that refined sugar poses, experts in the field of Ayurveda provide certain insights and suggestions into the consumption of refined and other forms of sugar.

- Avoid refined sugar and use unprocessed substitutes – Especially for sugar addicts, ayurvedic experts suggest avoiding refined sugar completely until they have re-educated their metabolism to function well without it. Jaggery and raw honey can be used as substitutes for sweeteners.
- Heating sweeteners – Ayurveda discourages heating of any sweeteners (Honey and raw, non-refined sugar) as it damages the structure of the sweetener and makes them difficult to digest.

[66] A type of artificial sweetener

3. Oil

Executive Summary

Oils come from many different plants and their seeds, from fish and from nuts. They provide us with essential nutrients that facilitate important functions of our body – cardiovascular, digestive and hormonal. Additionally, oils are universally used for cooking and flavoring of foods. However, the refining of oil includes a set of processes such as – hexane-extraction, refining, bleaching and de-odorizing. Consumption of this refined oil poses a threat to our health because of two reasons –

- Loss of nutrients: While refining processes make the oil extraction efficient and the oil stable to be an industrial product, they damage the composition of the oil – increasing the amount of saturated and unsaturated fats in the oil and ridding it of its original nutritional components. Additionally, processed food contains hydrogenated oil which possesses an even higher amounts of fat including trans-fat.
- Inclination to overconsume**:** We tend to exceed the recommended consumption of saturated and unsaturated fats as only 1 teaspoon of refined oil contains 14g of fat.

Over-consumption of refined and hydrogenated oils can cause the following impact on our health –

 **Heart attack/ stroke**	Will lead to an increase in the level of 'bad cholesterol' in blood vessels, which may lead to rupture or tearing of the arteries and may result in a block of blood flow to the heart (heart attack), or to the brain (stroke)[67].
 **Diabetes**	May prevent your body cells to respond well to insulin disabling them from using glucose for energy. To compensate, the pancreas makes more insulin resulting in high blood sugar level, leading to diabetes[68].
 **Hypertension**	Cause a buildup of these fats in the body, particularly arteries and blood vessels which prevents the blood vessels from contracting and expanding normally, damaging the arteries, leading to high BP and hypertension[69].
 **Cancer**	Lead to the overproduction of circulating free fatty acids in the bloodstream which causes oxidative damage to the cells and consequently, the random multiplication of cells may result in cancer[70].

Table 14 Refined Oil: Impact on Health

However there exist several alternative products and habits that can prevent us from the harmful effects of oil consumption without compromising on its benefits –

- Use healthier alternatives such as cold-pressed oils that do not use extreme refining processes or addition of chemicals in their manufacturing process – coconut, sesame, mustard
- Focus on a holistic diet which emphasizes on consumption of fruits, vegetables, whole grains coupled with oils and limits red meat, sugary foods and beverages
- Avoid pre-processed foods as they contain the most deteriorated version of fat- trans-fat. Look for '0g trans-fat' and no hydrogenated oils on ingredient list and the nutrition facts label.

[67] https://www.mayoclinic.org/diseases-conditions/high-blood-cholesterol/in-depth/trans-fat/art-20046114
[68] https://www.webmd.com/diabetes/insulin-resistance-syndrome
[69] https://www.helloheart.com/blog/fda-bans-trans-fats-bp
[70] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6893649/

1. Introduction

Oils come from many different plants and their seeds, from fish and from nuts.

Why we need Oil

While oils are not a food group, they provide essential nutrients. Oils contain essential fatty acids (omega-3 and omega-6) which have anti-inflammatory properties that help to lower risk of heart disease, Alzheimer's, promotes vision and boost brain health. These essential oils are potent mediators of inflammation and vasoconstriction which help the blood vessels to dilate, keeping the blood normally circulating and prevent the formation of bad cholesterol plaques formation, which is the main cause of heart diseases[71]. According to Ayurveda, oils ensure building and strengthening of the body and tissues. Oils also provide lubrication in the digestive system and are building blocks for all hormone production in the body.

Also, oils are major source of vitamins, such as vitamin A, D, E and K. The specific roles of these vitamins have been briefly stated in the table below[72] –

Vitamin Type	Role
A	It manages eye health, cell division, and regulation of the immune system. Additionally, it keeps the membranes of different organs -skin, lungs, eyes- moist.
D	It plays a critical role in the body's use of calcium and phosphorous, helping to form and maintain healthy bones and protect against osteoporosis
E	It benefits the body by acting as an antioxidant and protecting vitamins, red blood cells and essential fatty acids from destruction
K	It is naturally produced by the bacteria in the intestines, and plays an essential role in normal blood clotting, promoting bone health, and helping to produce proteins

Table 15 Oil-Vitamins present in oils and their role

Additionally, we need oils as they support the process of cooking and adding flavor to the food. Some common cooking oils include: canola oil, corn oil, cottonseed oil, olive oil, safflower oil, coconut oil, soybean oil, and sunflower oil. While some oils such as walnut and sesame are used mainly as flavoring.

When oils are processed, they turn to new products called 'refined oil', a product that is very distinct from its original version and affects our health negatively. For the purpose of this document, we will delve into refined oil as it is the most commonly used form of oil and try to break down its constituents and the possible consequences of its regular consumption.

[71] https://ods.od.nih.gov/factsheets/Omega3FattyAcids-HealthProfessional/
[72] https://extension.colostate.edu/topic-areas/nutrition-food-safety-health/fat-soluble-vitamins-a-d-e-and-k-9-315/

2. Refined Oil

The oil we use in our homes is different from the crude oil that is extracted from plants, seeds, fish and nuts. It undergoes several processes that makes its flavor stable, increases its shelf-life and removes most of the natural flavoring, making it more attractive for the industrial food industry[73].

The most common extraction process uses hexane, a common industrial solvent and paint thinner, it is a petroleum product and is classified as a neuro-toxin by the center for disease control & prevention (CDC). Oil seeds are passed through Hexane, which extracts the 99% of the oil from the seeds. The resultant oil and hexane mixture is then evaporated and condensed to separate the oil and the hexane, claiming that all the hexane is removed from the mixture by the end of the distillation process. However, this process suffers from a high risk of hexane contamination. After extraction, three processes are used to refine oil.

- Refining: One of the refining methods is to add lye (caustic soda or alkali) to the edible oil, in order to remove the fatty waxes. This process produces cheap laundry soap as by-product and a sediment-free oil.
- Bleaching: The next step after is bleaching where the oil is passed through clays like Bentonite to remove different color and hues within the oil.
- De-odorizing: The refined and bleached oil is passed through a high temperature, steam distillation process to remove all odors, especially the bad odors accumulated during the earlier steps like addition of hexane, introduction of lye and usage of crude bentonite.

After this process, we have what is called refined oil – a colorless, odorless, tasteless oil that may contain traces of hexane and one which has almost none of the nutritional properties of the crude oil we aimed to extract. All the common brands of cooking oil available in the market today are only RBD oils.

The nutrients present in one teaspoon (14g) of refined oil[74] are highlighted in the table below:

Nutrients	**Refined Oil**
Calories (kcal)	126
Protein (g)	0
Carbohydrates	0
Fat (g)	• Fat: 14 • Saturated Fatty Acids: 1.54 • Monounsaturated Fatty Acids: 3.64 • Polyunsaturated Fatty Acids: 8.82 • Trans Fatty Acids: 0
Cholesterol (mg)	0
Vitamin E (m.g./IU)	5/5

Table 16 Oil- Nutritional composition of refined oil

According to the 2015 Dietary Guidelines for Americans, for a 2-000 calorie diet, the total amount of consumption of saturated and unsaturated fats a day should not exceed 16 to 22 grams[75]. But as can be seen in the table above, only 1 teaspoon of refined oil contains 14g of fat. From this we can infer that our daily intake of fat from refined oils exceeds the recommended amount.

[73] https://www.100daysofrealfood.com/problem-refined-oils/
[74] Constitution is used from one of the refined oil brands
[75] https://medlineplus.gov/ency/patientinstructions/000785.htm

Ayurveda Says: Why we refine and process oil

As per Ayurveda, the main problem with oil is that it oxygenates very quickly. This means that it starts to putrefy when exposed to heat and air. Normally with seeds or nuts the shell protects them from oxidation. However, once the oil is extracted from the seed or nut it begins to deteriorate. If the deteriorating oil is consumed then the deterioration continues in the body in the form of "free radicals" and the impairment of normal metabolic function. This fact was known by some ancient cultures because they tended to use forms of oils or fats that are "saturated". This means that they are more stable and do not oxygenate like the more liquid oils that are a mix of mono-unsaturated and polyunsaturated fats.

3. Some common foods with high amount of oil

Oils used in processed foods are formed through an industrial process that adds hydrogen to vegetable oil, which causes the oil to become solid at room temperature, makes it less likely to spoil and gives the food a desirable taste and texture.

Simplified: Process of Hydrogenation

The process of hydrogenation involves the use of hydrogen molecules to saturate organic compounds (vegetable oil) under high temperatures and pressures in the presence of a solid substance (Nickel). In this process, hydrogen gas reacts with liquid vegetable oil at elevated temperatures, then it is heated under high temperatures (160-300^{0}C) until the hydrogen gas get dispersed in the oil. The reaction is continued until the oil chemical properties are changed, and it becomes solid at room temperature[1]

Due to the heating and processing, the oil loses its content of many vitamins such as vitamins A, D, E and K, results in increased content of saturated and also results in trans fats.

The table below shows the amount of oil in some food items.

Food Item	Oil	Specification
French fried fries	17g	117g (Medium-sized potato)
Donuts	6g	1 medium-sized donut (60g)
Coffee creamer	1.4g	1 tablespoon (15g)
Frozen pizza	5g	1 slice (107g)
Microwave popcorn	14g	1 bag (87g)
Chhole Bhature	15g	2 bhatura + 1 serving of chhole

Table 17 Oil- Common foods with high amount of oil

4. Impact of processes and nutrients

Refined oil has unhealthy effects on the blood cholesterol levels, where cholesterol is defined as a waxy, fat-like substance that is found in all the cells in the body. It is made by the liver, and it is also found in some foods such as meat, dairy products and fat-containing foods. There are two types of cholesterol in which they are classified as lipoproteins, due to their combination of fat (lipid) and protein. First, high-density lipoprotein (HDL) which is also known as the ‘good’ cholesterol, because it helps remove the bad cholesterol from the bloodstream and keeps the blood circulating normally in the vessels. Higher levels of HDL cholesterol are associated with a lower risk of heart disease. Second

type of cholesterol is low-density lipoprotein (LDL) which is also called the 'bad cholesterol', because when LDL level increases in the blood, it may cause many harmful effects on the body. Short-term and long-term consequences of overconsumption of oil is shown below[76]:

- **Heart diseases and stroke:** Foods with high refined oil content increase the LDL level in the blood which will lead to the buildup of bad cholesterol in the blood vessels, which may make the arteries tear or rupture, then a blood clot may form and block blood flow to a part of the heart, causing a heart attack; or to a part of the brain, causing a stroke[77].

  According to WHO, an estimated 17.9 million people died from CVDs in 2016, representing 31% of all global deaths. Of these deaths, 85% are due to heart attack and stroke[78].

- **Diabetes:** High intake of saturated fat may promote insulin resistance, which means that our body cells don't respond well to insulin and thus can't use glucose for energy. To make up for it, the pancreas makes more and more insulin which results in high blood sugar level and lead to diabetes[79].

- **Hypertension:** Consuming foods high in trans fats causes a buildup of these fats in the body, particularly arteries and blood vessels. Excess fat in your arteries prevents the blood vessels from contracting and expanding normally, damaging the arteries, which leads to high blood pressure and hypertension as a long-term effect[80].

  In fact, it is estimated that the incidence of hypertension in India ranges from 20 to 40% in urban areas and 12 to 17% in rural areas of India, which means there is one between three adults who has high blood pressure[81].

- **Cancer:** High trans-fat consumption causes overproduction of circulating free fatty acids in the bloodstream which results in oxidative damage to the cells, including DNA, proteins, and lipid membranes. Consequently, oxidative stress makes the cells to multiply in random cycles, which results in cancer cells grow[82].

- **Decrease Immunity**: Eating food cooked in refined oils leads to production of free radicals that damage the tissues and cause temporary inflammation. This negatively impacts our immune system[83].

[76] https://www.mayoclinic.org/diseases-conditions/high-blood-cholesterol/in-depth/hdl-cholesterol/art-20046388
[77] https://www.mayoclinic.org/diseases-conditions/high-blood-cholesterol/in-depth/trans-fat/art-20046114
[78] https://www.who.int/news-room/fact-sheets/detail/cardiovascular-diseases-(cvds)
[79] https://www.webmd.com/diabetes/insulin-resistance-syndrome
[80] https://www.helloheart.com/blog/fda-bans-trans-fats-bp
[81] https://timesofindia.indiatimes.com/life-style/health-fitness/health-news/All-you-need-to-know-about-hypertension/articleshow/35617449.cms
[82] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6893649/
[83] https://goqii.com/blog/foods-that-weaken-the-immune-system/

5. Ayurveda Says

As per Ayurveda, oil is a necessary part of nutrition and is greatly misunderstood today because of the narrow biochemical view of its metabolic function. We have already discussed the benefits of oil and fat; however, we need to pay attention to how we consume this product. Ayurveda provides us with some interesting insights with respect to consumption of oils, as stated below –

- Preparation of the oil: Currently, we are faced with a product in the market that does not normally occur in nature and undergoes thorough refinement process that alters its original composition, ridding it of its nutrients and adding substances that are harmful to our health.

- Holistic Diet: The use of large amounts of vegetable oils coupled with a grain-and-vegetable-based diet seems to be very healthy. Yet, the same oil used with a modern industrialized diet has been shown to directly contribute to disease. Which is why Ayurveda pushes us to not only think about oil consumption independently, but also oil consumption within our holistic diet.

- Application of Heat: As per both Ayurvedic texts and western medicine, application of heat on oil during the process of cooking or frying creates the possibility for them to oxidize at a rapid pace, further deteriorating the composition of the oil. Biochemical scientists state that the oils high in polyunsaturated fats are the most prone to deteriorate in cooking and should not be used for frying.

- Cold-pressed alternatives: Ayurveda encourages the use of cold-pressed oils as an alternative. Most of the oils used in the industrialized world is already oxidized as it has been exposed to heat as high as 6000 F or more in processing. This kind of change in the oil accounts for all kinds of diseases like high cholesterol, arthritis, cancer and heart disease to name a few. Cold-pressed alternatives are created without the use extreme refining processes or the addition of chemicals, making them a healthier substitute.

6. Healthy alternatives

Cold press oils

Cold pressing refers to oils obtained through pressing fruit or seeds with a modern steel press without the use of any additional chemicals, heat or preservatives. Cold pressed oils retain healthy antioxidants that are otherwise damaged by the refining process. The pressing method requires high-quality equipment and machines to ensure the best way to retain all the natural nutrients and prevent them of being lost. Most cold pressed oils are rich in vitamin E, which has anti-inflammatory and healing properties. They are also rich sources of oleic acid that help boost the immune system. Cold pressed oils are cholesterol free, do not contain any trans-fats which make them extremely healthy alternatives of refined oils and suitable for cooking and eating[84].

[84] http://www.proteco.com.au/cold-pressing-explained/

Popularly known as '*kachchi ghaani*' in India, these also help us as the quantity of the oil we consume is automatically reduced due to the high thickness and viscosity of the variant. According to Ayurveda, some cold pressed oils are traditionally supplemented with palm sugar or jaggery, which heightens its flavor and also its nutritional value. Benefits of cold-pressed oils to your heart health and internal well-being are many, these oils can also be a healthier and safer source of nourishment. Cold-pressed oils are available for all different sources of oils such as coconut oil, sesame oil and mustard oil.

4. Whole Wheat

Executive Summary

Wheat is the most important staple crop in temperate zones and is in increasing demand in countries undergoing urbanization and industrialization. It is a major source of starch and energy and it provides substantial amounts of vitamins and minerals which are essential for health – selenium, manganese, phosphorus, copper, B-vitamin, folate. Wheat also contains protein, dietary fiber, and phytochemicals. It is recommended to eat minimum of 48g of whole wheat per day as they positively impact our health in the following ways -

Reduction in risk of heart disease	High amount of fiber helps to decrease 'bad cholesterol' and blood pressure, allowing for free movement of blood through blood vessels and decreasing buildup of plaque in the arteries[85].
Reduced Obesity	Fiber, which is an insoluble and indigestible form of carbohydrates give us the feeling of fullness because they cannot be broken down in the stomach, and are fermented in the gut to produce short-chain fatty acids which help to lower colonic pH, and may alter blood lipids[86]
Diabetes Prevention	Whole wheat has a low GI value (55 or less) and thus is more slowly digested, absorbed and metabolized, causing a lower and slower rise in blood glucose and preventing sudden peaks in blood sugar level. Therefore, it can regulate blood sugar level and insulin production to prevent diabetes[87].
Cancer Prevention	Usually, cancer cells start to grow when there are no enough antioxidants to fight them and high amounts of free radicals circulating in the blood[8]. Whole grains contain high amounts of antioxidants which can help to prevent the growth of cancer cells and decrease the free radicals damage.

Table 18 Whole Grains - Impact on Health

However, the processing of whole wheat and its conversion into refined wheat rids it of almost all its nutrients and minerals. It reduces calcium and vitamin E by 95% and halves the fiber component. All other essential minerals also reduced by at least 50%. Fortunately, there are plenty of healthy whole-grain options to choose from. Given below are some simple tips to encourage a diet much healthier than what refined wheat offers –

- Simple swaps: simple, affordable swaps from refined grains to intact whole grains and whole grain products for wheat, bread, pasta, oats
- Paying attention to ingredient list: look for products with high amount of whole grains, read the ingredients list and choose products that name a whole grain ingredient towards the top
- Paying attention to a holistic diet: Avoid pairing refined grains with high-fat animal products.
- Increase consumption of millets: Millet is a cereal grain that belongs to the grass family, it is a healthy substitute to rice and wheat largely due to its nutritional values and low glycemic index that makes it more suitable for diabetics and those allergic to gluten.
- Avoid whole grains if allergic to gluten: Some people who react differently to gluten should replace consumption of whole grains with alternatives like quinoa or millets.

[85] https://health.howstuffworks.com/diseases-conditions/cardiovascular/cholesterol/foods-that-lower-cholesterol9.htm
[86] https://www.cambridge.org/core/journals/proceedings-of-the-nutrition-society/article/why-whole-grains-are-protective-biological-mechanisms/25042F202584EDAE68C7CBBFCDBB5471
[87] https://www.gisymbol.com/about-glycemic-index/

1. Introduction

Wheat is the most important staple crop in temperate zones and is in increasing demand in countries undergoing urbanization and industrialization. A grass widely cultivated for its seed - a cereal grain which is a species of cereal grasses of the genus Triticum (family Poaceae), it is one of the oldest and most important species of the cereal crops. It is used to make bread, pasta and rice. Additionally, some wheat is used by industry for the production of starch, paste, malt, dextrose, gluten, alcohol, and other products[88]. Wheat can be cultivated over a wide range of soils and can be successfully grown over a wide range of climatic conditions and soils.

Why we need Wheat

According to the NCBI, wheat is a major source of starch and energy. And it also provides substantial amounts of vitamins and minerals which are essential or beneficial for health. These include selenium, manganese, phosphorus, copper and the B-vitamin, folate. Wheat also contains protein, dietary fiber, and phytochemicals. Of these, wheat is a particularly important source of dietary fiber.

Fiber is one of the most needed nutrients for the human body. While it does not supply minerals, vitamins or calories, it benefits your digestive system. Having a high fiber diet can reduce the risk of heart disease, lowers risk of type 2 diabetes, and reduces inflammation which associates with certain types of cancer.

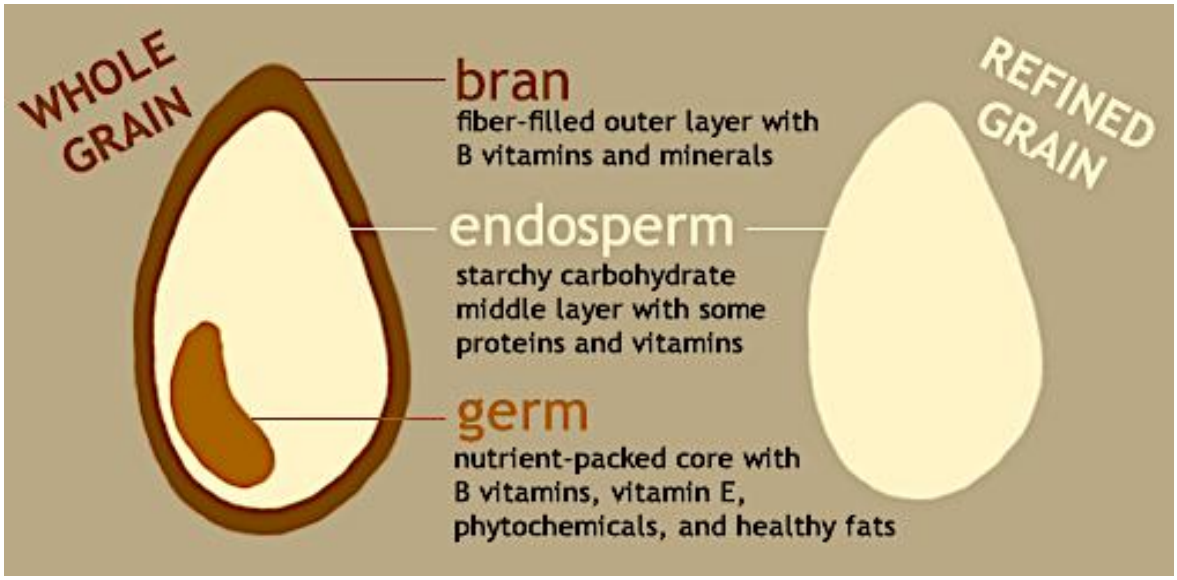
However, most wheat used for food requires processing, which extracts out these benefits of wheat. For the purpose of this document, we will be exploring the refining process of wheat and try to enlighten the benefits of whole wheat consumption instead of consumption of refined wheat.

2. Refined wheat v/s Whole wheat

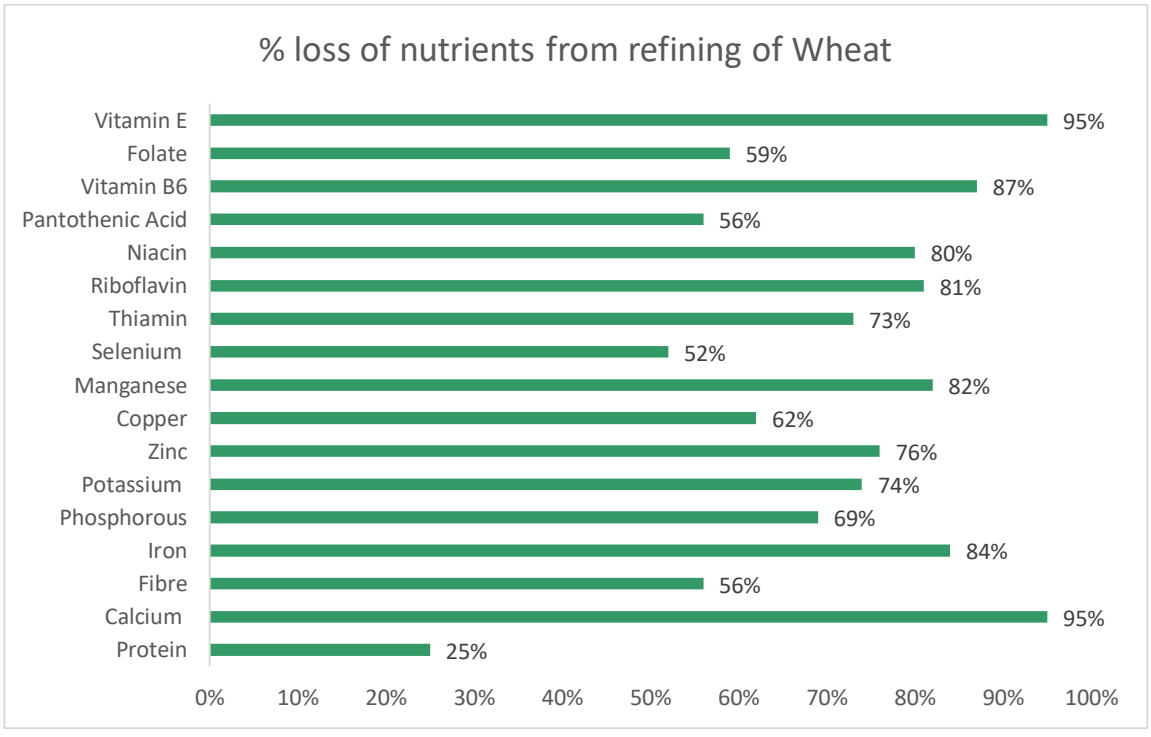
All natural whole grain seeds contain three parts – the bran, germ, and endosperm. Each section has some health-promoting nutrients.

- **The bran** is the fiber-rich outer layer that supplies B vitamins, iron, copper, zinc, magnesium, antioxidants, and phytochemicals which are natural chemical compounds in plants that have a role in disease prevention.
- **The germ** is the core of the seed where growth occurs; it is rich in healthy fats, vitamin E, B vitamins and antioxidants.
- **The endosperm** is the interior layer that holds carbohydrates, protein, and small amounts of some B vitamins and minerals[89].

[88] https://www.britannica.com/plant/wheat
[89] https://www.hsph.harvard.edu/nutritionsource/what-should-you-eat/whole-grains/



The invention of industrialized roller mills in the late 19th century changed the way we process grains. Milling strips away the bran and germ and leaves only the soft, easy to-digest endosperm. Without the fibrous bran, the grain is easier to chew. Additionally, removal of bran is aimed at producing a flour with a white rather than a brown color. The germ is removed because of its fat content as it contains polyunsaturated fats which have a tendency to oxidize and become rancid on storage, which can limit the shelf life of processed wheat products. The resulting highly processed grains are much lower in nutritional quality. According to Harvard School of Public Health's research, refining wheat creates fluffy flour that makes light, airy breads and pastries, but the process strips away more than half of wheat's B vitamins, 90 percent of the vitamin E, and virtually all of the fiber. Although some nutrients may be added back by fortification, other health-promoting components of whole grains such as phytochemicals cannot be replaced. According to John Robbins' research, the amount of nutrients lost when whole wheat is converted to refined wheat is unparallel. Also, the factory synthesized nutrients added back through fortification lack the life energy and body intelligence of naturally occurring nutrients and have been shown to create toxicity in the lives and other organs. The loss of individual nutrients has been highlighted in the chart below –



According to Ayurvedic experts, large food companies discovered that refining of flour removes all portions of wheat that contain nutrients when they first began to introduce white flour in the market. Many people began to be deficient from the lack of B vitamins that were normally found in whole-wheat flour. This prompted the government to require that white flour be "enriched" With vitamins and nutrients. The only reason wheat flour needs to be "enriched" is because it is now dead from the processing procedure that makes it last an almost indefinite time on the supermarket shelves. The nutrients content in 100g of whole wheat are shown in the table, as compared to the same proportion of refined wheat. As is evident, whole wheat contains a much larger proportion of essential nutrients and minerals as compared to refined wheat.

	Refined wheat	Whole wheat
Calories (kcal)	370	340
Protein (g)	6.8	11
Fat (g)	0.5	2
Carbohydrates (g)	81.7	75
Fiber (g)	2.8	7
Vitamin A (IU)	0	9
Vitamin E (mg)	0	1
Iron (mg)	1.6	3.9
Potassium (mg)	77	405
Phosphorus (mg)	71	346

Table 19 Wheat - Refined Wheat v/s Whole Wheat

According to the American Heart Association, whole grains should constitute at least half of the total grains in the diet, which means it is recommended to eat 3 to 5 servings or more of whole grains every day (total 48g of whole wheat). Also, daily fiber intake should be consumed at least 25g per day[90]. On average, Indian adults in urban areas consume 10g/day of whole grains, and Indian adults in rural areas consume 3.3g/day of whole grains which comes out to be only 20.8%, 6.9% of the daily recommended intake, respectively[91]. Increasing the consumption of whole grains is something that one should focus on in an attempt to have a better and wholesome diet.

3. Foods with high amount of whole wheat

The table below highlights the high amount of whole grains content contained in some common food items. Increasing the intake of such foods will provide one several health benefits highlighted in the next section.

Food Item	Amount of fiber	Specification
Whole grain bread	4g	One slice (45g)
Brown rice	5g	One cup cooked brown rice (195g)
Oatmeal	10.6g	100g of raw oatmeal
Barely	17g	100g of uncooked barely
Whole wheat pasta	6g	1 cup cooked pasta (200g)

Table 20 Wheat - Amount of fibre in different foods

[90] https://www.heart.org/en/healthy-living/healthy-eating/eat-smart/nutrition-basics/whole-grains-refined-grains-and-dietary-fiber

[91] http://www.ilsi-india.org/Conference_on_Whole_Grains_for_Promoting_Health/Intakes%20&%20Barriers%20To%20Consumption%20Of%20Whole%20Grains%20(Evidence%20From%20India),%20Dr.%20Sudha%20Vasudevan,%20Sr.%20Scientist%20and%20Head,%20MDRF,%20Chennai.pdf

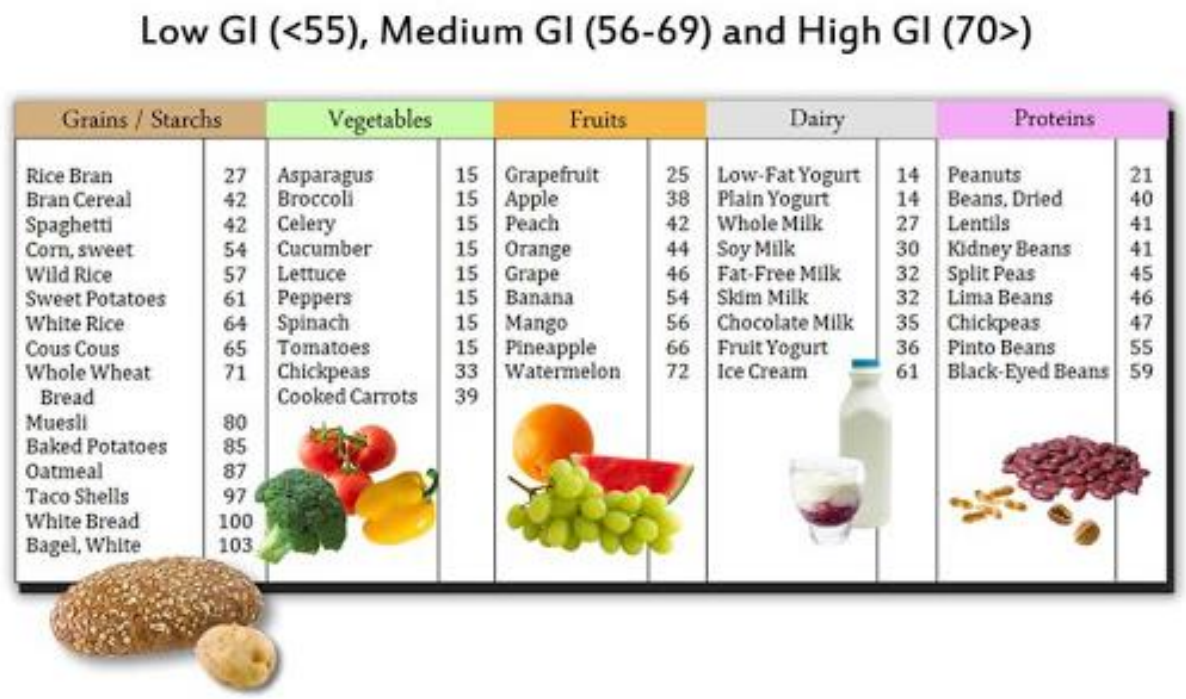
4. Health benefits of whole wheat

Whole wheat can be a rich source of various antioxidants, vitamins, minerals, and fiber. High consumption of whole wheat products may affect our health in a good way that can prevent many diseases, as highlighted below. Consumption of refined grains instead of whole grains prevents us from gaining these benefits.

- **Reduction in risk of heart disease:** Whole grains are high in fiber which help to decrease serum low-density lipoprotein cholesterol "bad cholesterol" and blood pressure. They contain 0g of cholesterol which can help the blood vessels to work properly in flowing from and to the heart, causing less buildup of plaque in the arteries which can decrease the risk of heart diseases[92].

- **Reduced obesity:** Since whole grains contain high amounts of fiber, which are insoluble and indigestible form of carbohydrates. They give us the feeling of fullness because they cannot be broken down in the stomach, escape digestion in the small intestine then fermented in the gut to produce short-chain fatty acids which help to lower colonic pH, serve as an energy source for the colonocytes and may alter blood lipids. Thus, this mechanism results in obesity prevention and lipids regulation[93].

- **Diabetes prevention:** The health effects of whole wheat mainly depend on its digestibility, which determines its effect on blood sugar levels. The Glycemic Index (GI) is a relative ranking of carbohydrate in foods according to how they affect blood glucose levels. Carbohydrates with a low GI value (55 or less) are more slowly digested, absorbed and metabolized and cause a lower and slower rise in blood glucose which prevents the high sudden peaks of blood sugar level. Therefore, it can regulate blood sugar level and insulin production to prevent diabetes[94]. Glycemic index can be categorized into 3 categories as shown in the figure:



[92] https://health.howstuffworks.com/diseases-conditions/cardiovascular/cholesterol/foods-that-lower-cholesterol9.htm

[93] https://www.cambridge.org/core/journals/proceedings-of-the-nutrition-society/article/why-whole-grains-are-protective-biological-mechanisms/25042F202584EDAE68C7CBBFCDBB5471

[94] https://www.gisymbol.com/about-glycemic-index/

- **Cancer prevention:** Usually, cancer cells start to grow when there are no enough antioxidants to fight them and high amounts of free radicals circulating in the blood. Free radical attack the cell's DNA, lipids and protein which is thought to be an initiating factor for cancer[8]. Whole grains contain high amounts of antioxidants which can help to prevent the growth of cancer cells and decrease the free radicals damage.

5. Gluten – Explained

When one talks about whole grains, gluten invariably comes up. Gluten is a protein naturally found in some grains including wheat, barley, and rye. It acts like a binder, holding food together and adding a "stretchy" quality. Moreover, Gluten is most often associated with wheat and wheat-containing foods that are abundant in our food supply. Negative media attention on wheat and gluten has caused some people to doubt its place in a healthful diet. There is little published research to support these claims; in fact, published research suggests the opposite[95]. However, the issue with gluten is that some people suffer from a gluten allergy, which makes gluten consumption detrimental for them.

Simplified: Gluten Allergies

According to Harvard School of Public Health, gluten is not ideal because it can cause serious side effects in certain individuals. Some people react differently to gluten, where the body senses it as a toxin, causing one's immune cells to overreact and attack it. If an unknowingly sensitive person continues to eat gluten, this creates a kind of battle ground resulting in inflammation. The side effects can range from mild (fatigue, bloating, alternating constipation and diarrhea) to severe (unintentional weight loss, malnutrition, intestinal damage) as seen in the autoimmune disorder celiac disease. Other conditions that may require the reduction or elimination of gluten in the diet include:

- Non-celiac gluten sensitivity, also referred to as gluten sensitive enteropathy (GSE) or gluten intolerance.
- Wheat allergy
- Dermatitis herpetiformis (DH)

It is very important to note that gluten is a problem only for those who react negatively to it, or test positive for celiac disease. Most people can and have eaten gluten most of their lives, without any adverse side effects.

6. Better alternative to refined grains

Beside whole wheat grains, there are many healthy alternatives of refined wheat which have better nutritional value and minerals content. Examples include millets, whole oats, barely, whole rye, buckwheat, spelt and quinoa. The table below shows the difference in nutrients content between refined wheat, whole wheat and millets (per 100g). As evident from the table, whole wheat and millets fair much better than refined wheat with lesser fat, calories and carbohydrates and more nutrients and minerals.

[95] https://www.hsph.harvard.edu/nutritionsource/gluten/

	Refined wheat	Whole wheat	Millet
Calories (kcal)	370	340	119
Protein (g)	6.8	11	9
Fat (g)	0.5	2	1
Carbohydrates (g)	81.7	75	24
Fiber (g)	2.8	7	13
Vitamin A (IU)	0	9	13
Vitamin E (mg)	0	1	1.2
Iron (mg)	1.6	3.9	19
Potassium (mg)	77	405	62
Phosphorus (mg)	71	346	100

Table 21 Wheat - Refined, Whole and Millets

Millet: A healthy option

Millet is a cereal grain that belongs to the grass family, it is a healthy substitute to rice and wheat largely due to its nutritional values and low glycemic index that makes it more suitable for diabetics. Also, it is high in protein, fiber, minerals and antioxidant contents[96]. Since millet is rich in phenolic compounds which act as antioxidants, it can help to protect the body from harmful oxidative stress which caused by free radicles. Also, it helps to boost liver and kidney function which are essential for removal of harm substances outside the body. Also, the high fiber content in millet helps prevent constipation by promoting the growth of the good bacteria in the intestine. Unlike rice and wheat, they contain less fiber amount than millet[97]. The table below highlights different types of raw millets and reveals how many of them fair better on protein, fiber, minerals, iron and calcium than regular wheat and rice (per 100g).

Crop / nutrient	Protein (g)	Fiber (g)	Minerals (g)	Iron (mg)	Calcium (mg)
Sorghum	10	4	1.6	2.6	54
Pearl millet	10.6	1.3	2.3	16.9	38
Finger millet	7.3	3.6	2.7	3.9	344
Foxtail millet	12.3	8	3.3	2.8	31
Proso millet	12.5	2.2	1.9	0.8	14
Kodo millet	8.3	9	2.6	0.5	27
Little millet	7.7	7.6	1.5	9.3	17
Barnyard millet	11.2	10.1	4.4	15.2	11
Brown top millet	11.5	12.5	4.2	0.65	0.01
Quinoa	14.1	7	*	4.6	47
Rice	6.8	0.2	0.6	0.7	10
Whole Wheat	11	7	3.9	5.3	41

Table 22 Wheat - Types of Millets

[96] https://doi.org/10.9755/ejfa.v25i7.12045
[97] https://pubs.acs.org/doi/abs/10.1021/jf100868b

Millet is a gluten-free grain (a protein that occurs naturally in grains like wheat, barley, and rye) making it a viable choice for people with celiac disease or those following a gluten-free diet. People with celiac disease or gluten intolerance must avoid it because it triggers harmful digestive symptoms, such as diarrhea and nutrient malabsorption. On the other hand, wheat and rice contain gluten so celiac disease patients cannot consume them.

7. Ayurveda Says

This section throws light on some insights formulated by Ayurvedic experts related to consumption of refined and whole wheat.

- Focus on holistic diet – According to Ayurveda, a diet which combines consumption of refined grains with met products is responsible for many modern diseases like cancer of the colon, diverticulitis, colic and many others. The refined grains coat the intestinal walls with a glue-like substance that prevents correct absorption. This when combined with the high fat content in animal products makes an environment perfect for the breading of diseases, clogging or congesting the channels or arteries, increasing blood pressure and contributing to the formation of cancerous cells in the body.

- Allergy to grains – Some people have allergies to certain grains — especially wheat. There are several interesting reasons for this, and several possible solutions. Wheat allergies have been traced to the early eating habits of babies when their mothers fed them wheat before six months or even twelve months of age. Another cause is that children were not nursed or nursed for too short of a time. However, people who do have allergies to wheat can be cured of them by increasing enzyme function in the intestine and by following a re-education program to change previous habits of digestion. This process is individual and should be structured and advised by an Ayurvedic practitioner.

- Consumption of whole grains in the form of breads and pasta – While grains can be taken in the form of breads and pasta very effectively, people who are sensitive to yeast or candida should use sour dough breads instead and bread and pasta made from refined wheat should not be consumed.

5. Tea

Executive Summary

Tea is an aromatic beverage commonly prepared by pouring boiling water over cured or fresh leaves of *Camellia Sinensis* (an evergreen plant native to East Asia). Globally, India is the second largest producer of tea and accounts for the highest tea consumption[98]. Consumption of limited amount of tea can offer several health benefits. However, many of these health benefits come with consumption of tea coupled with an overall healthy diet. Moreover, overconsumption of tea is detrimental to one's health in many ways as listed below and amount of tea safe for one to consume depends on the way the body responds to some compounds that are present in tea[99].

Deficiency of Vitamins and Minerals	This mainly happens because of the presence of caffeine, tannins and EGCG in different variants of tea[100] which prevent the absorption of Vitamin D3 and Iron and also cause the body to flush out valuable vitamins such as B-Complex vitamins and Vitamin C.
Heartburn and stomach cancer	Caffeine relaxes the sphincter between the esophagus and stomach, allowing acidic contents to more easily flow into the esophagus. It may also contribute to increased stomach acid production.
Women's Health	Caffeine consumption influences estrogen levels, long-term variations in which are associated with such disorders as endometriosis, osteoporosis, and endometrial, breast, and ovarian cancers[101]. It also increases risk of complications during pregnancy (miscarriage and low infant birth weight[102]).
Anxiety and Insomnia	Caffeine blocks the effects of adenosine, triggers the release of adrenaline, and increases the release of stress-fighting hormones. At high doses, this may lead to anxiety and nervousness. Additionally, once in the body, caffeine persists for 6 hours and prevents restorative sleep[103].
Impact of heavy metals	Heavy metals and metalloids found in tea can interfere with metabolism in multifarious ways and can interfere with neurological development in children.

Table 23 Tea- Impact on Health

However, we can alter our habits related to consumption of tea for a healthier body and life –

- Using healthier alternatives: Such as herbal tea which is easy to make and drastically healthier
- Monitoring consumption: Remember that in small amounts, tea has medicinal properties
- Paying attention to when you consume tea: Avoid it on an empty stomach as it can cause you to lose appetite and may lead to chronic gastritis. Additionally, avoid tea before a meal (up to 1 hour) as it hinders the absorption of protein in the body
- Paying attention to how you drink tea:
    - Drinking extremely hot tea can irritate your mouth, throat, esophagus and stomach.
    - Taking tea when on medication may lead to dangerous interactions if your drugs include calcium, iron, aluminum, cobalt, sedatives, hypnotics and enzymes.
    - Some research suggests that the protein and possibly the fat in milk may reduce the antioxidant capacity of tea so avoid consumption of tea with milk.

[98] http://www.teaboard.gov.in/pdf/Executive_Summary_Tea_Consumption_20062018_pdf5940.pdf
[99] https://timesofindia.indiatimes.com/life-style/health-fitness/photo-stories/how-much-tea-is-too-much/photostory/65164614.cms
[100] https://www.justvitamins.co.uk/blog/why-you-should-never-drink-tea-near-a-mealtime/#.Xz4Z8MgzY2w
[101] https://www.nih.gov/news-events/news-releases/nih-study-shows-caffeine-consumption-linked-estrogen-changes
[102] https://pubmed.ncbi.nlm.nih.gov/29276412/
[103] https://www.sleepfoundation.org/articles/caffeine-and-sleep

1. Introduction

Tea is an aromatic beverage commonly prepared by pouring hot or boiling water over cured or fresh leaves of the *Camellia Sinensis*, an evergreen plant native to East Asia. After water, it is the most widely consumed drink in the world.

In 1689, John Ovington, recorded that tea was taken by the *banias* in Surat without sugar, or mixed with a small quantity of conserved lemons, and that tea with some spices added was used against headache, gravel and gripe. The tea leaves for such use may have come from China[104]. In the early 19th century, Great Britain popularized the concept of afternoon tea, a break from one's routine in which tea is served alongside sandwiches and baked goods such as scones[105]. Tea is an extremely popular drink in India as well who is the second largest producer of tea in the world, after China.

There are many different types of tea; some, like Darjeeling and Chinese greens, have a cooling, slightly bitter, and astringent flavor, while others have vastly different profiles that include sweet, nutty, floral, or grassy notes. Tea has a stimulating effect in humans primarily due to its caffeine content. Caffeine constitutes about 3% of tea's dry weight, translating to between 30 and 90 milligrams per one cup, depending on the type, brand and brewing method[106]. Tea contains some nutrients which can offer some health benefits to the body, which can be attributed to the presence of polyphenols. They work as antioxidants and are the most abundant compounds in tea leaves, making up 30–40% of their composition. Polyphenols include flavonoids, epigallocatechin gallate (EGCG), and other compounds. Also, tea has some vitamins and minerals, such as manganese, fluoride, zinc, vitamin C, D and K.

For the purpose of this document, we will delve into tea and try to break down its constituents revealing its possible health benefits and possible negative consequences of its unmonitored consumption.

2. Tea production

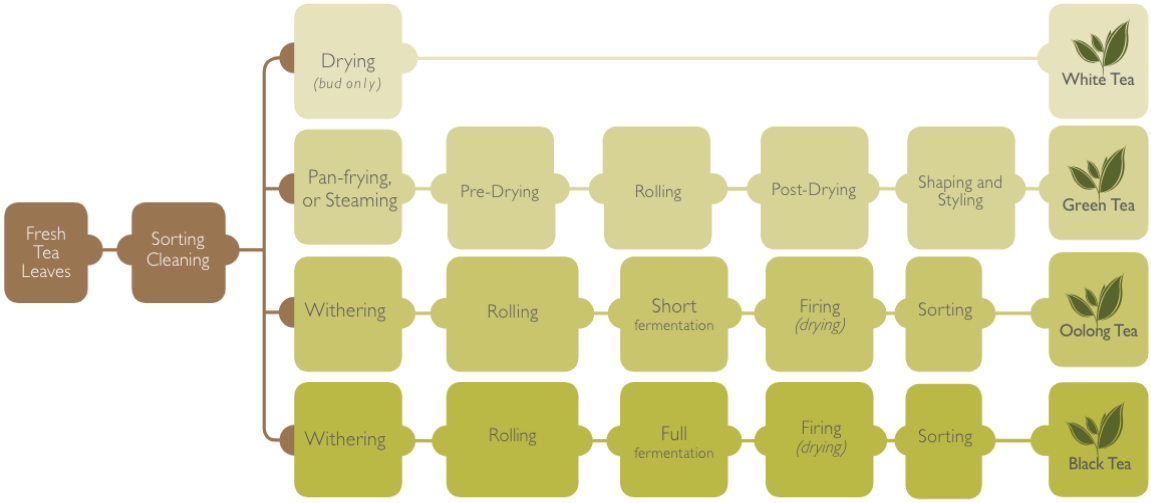
The tea manufacturing process is an intricate one that begins with the plucking of good leaf – two leaves and a bud and results in the final tea leaf that you see. First, plucking process, expert tea pickers pluck only the fresh leaf consisting of the bud and the leaves which is the key to ensuring a tea that is rich in flavor and character. Then, the plucked tea leaves are brought to the factory where they are put into large withering troughs which fan hot air to reduce the moisture content of the tea leaf. There are also important chemical changes that take place during this time such as the breakdown of molecules to smaller units which increase amino acids and flavor compounds, the partial breakdown of walls between cells (cell wall permeability) which is important for the subsequent stages of manufacture, the plucked leaves are withered for a minimum of 6 hours.

After that, rolling process starts to break up the leaf cells and to mix up the chemical components of the leaves with the enzymes. Various types of rollers are used to achieve this objective. The first roll is often very gentle and known as the 'pre-conditioning roll'. The main action of the pre-conditioning

[104] https://en.wikipedia.org/wiki/History_of_tea_in_India
[105] https://www.hsph.harvard.edu/nutritionsource/food-features/tea/
[106] https://en.wikipedia.org/wiki/Tea

roll has been found to be the gentle expression of the leaf juice on to the surface of the twisted particles. These juices dry up on the surface of the particles to contribute to the blackness of tea. Subsequent rolling is programmed to achieve thorough breakdown of the leaf cells. A considerable amount of heat is generated by friction during the rolling process, but care must be exercised to ensure that temperature does not exceed 35ºC (95ºF), because undesirable chemical and enzyme reactions could occur at higher temperatures.

Next, fermentation process. Once the leaf is sifted, it is spread out and left to allow fermentation. The process of fermentation represents a series of complex chemical reactions, including the breaking up of cells which causes the mixing up of the enzymes, results in the oxidation of polyphenols and the formation of some flavor compounds. This process defines the tea type, color and flavor according to the duration of fermentation and oxidation processes, as seen in the figure.



Then, firing process starts which removes most of the leaf moisture and stops fermentation by destroying the enzymes. Further, the flavor of the tea is balanced during firing. The fired tea leaves are then sorted into particle sizes by sending them through sifters, then tea is tasted and assessed by the teamaker and expert tasters, to ensure it meets all quality standards in terms of leaf appearance, aroma, cup color and character of the tea[107]. There are a number of healthy compounds naturally found in the tea leaf, including antioxidants, polyphenols, vitamins, minerals and caffeine. In fact, each kind of tea contains different amounts of these nutrients based on its characteristics. The table below shows the difference in nutrients content in some kinds of tea (per 1 cup/237g):

Content	Black tea	Green tea	White tea
Calories (kcal)	2	2	7
Protein (g)	0	0.5	1
Carbohydrates (g)	0.7	0	
Sodium (mg)	7	2.5	18
Potassium (mg)	87	20	4
Caffeine (mg)	47	29	30
Folate (mg)	11	0.4	0

Table 24 Tea - Black, Green and White

[107] http://www.zestaceylontea.com/blog/tea-manufacturing-process/

Amount of tea safe for one to consume depends on the way the body responds to some compounds that are present in tea[108]. In fact, India is the second largest producer of tea in the world and accounts for the highest tea consumption globally. Around 80% of the total tea produced in India is consumed by the domestic population. On average, each adult drink 2 cups of tea a day[109].

However, tea also contains unwanted heavy metals and air contaminants that leech into tea through the soil and air. Common off-the-shelf varieties of black, green, white, and oolong teas sold in tea bags also contain. In a recent study published in the Journal of Toxicology, researchers used common, off-the-shelf varieties of black, green, white, and oolong teas in tea bags. They found that all brewed teas contained lead. Further, 73% of teas brewed for 3 minutes, and 83% of those brewed for 15 minutes had lead levels that considered unsafe for consumption by women who were pregnant or lactating. In addition, they found that in 20% of brewed teas, aluminum levels were above levels set by recommended guidelines[110]. This is mainly because tea production and sale is not regulated in any way. There are no existing guidelines for routine testing or reporting of toxicant levels in "naturally" occurring products[111].

3. Impact of tea on health

Since tea is a source rich polyphenol that act as anti-oxidants, consumption of less processed tea can offer several health benefits, such as:

- **Cancer prevention:** Antioxidants that are present in the tea fight the harmful effects of free radicals. Free radicals are unstable molecules that attack other molecules in the body, leading to cell damage. Antioxidants inhibit the oxidation reactions caused by free radicals, thereby preventing damage to cells and tissues. The type and amount of flavonoid contained in tea depends on the variety of leaf, growing environment, processing, and brewing method. Both green tea and black tea contain high amounts of antioxidants which help to protect cells from the damaging, physiological process known as 'oxidative stress' which produces free radicals. These are unstable molecules, which occur naturally in the body and excess amounts of them can damage the cells in our body, resulting in cancer and other diseases[112].

- **Weight management:** Teas have a type of flavonoid called catechins that may boost metabolism and help the body to increase fat metabolism and lipolysis which is the process of fat breakdown. Also, the caffeine in many teas increases the energy use, such as dilating the blood vessels causing the body to burn more calories[113].

- **Protect against heart diseases:** Many researchers have found that tea may significantly lower the risk of heart disease and stroke by reducing low-density lipoprotein, or LDL, the "bad" cholesterol that can build up in arteries causing heart diseases. Furthermore, tea also can increase the good cholesterol "HDL-cholesterol" which will result in cholesterol removal of the blood vessels and decrease the risk of heart diseases[114].

---

[108] https://timesofindia.indiatimes.com/life-style/health-fitness/photo-stories/how-much-tea-is-too-much/photostory/65164614.cms
[109] http://www.teaboard.gov.in/pdf/Executive_Summary_Tea_Consumption_20062018_pdf5940.pdf
[110] https://www.mdlinx.com/article/to-tea-or-not-to-tea-that-is-the-question/lfc-3354
[111] https://www.hindawi.com/journals/jt/2013/370460/
[112] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3679539/
[113] https://www.webmd.com/diet/tea-and-weight-loss
[114] https://www.heart.org/en/news/2018/07/12/regular-tea-drinking-might-help-your-heart-as-you-age-study-suggests

- **Reduce type 2 diabetes risk:** Some studies indicated that tea consumption <4 cups per day may lower the risk of type 2 diabetes. The antioxidants in tea have shown to decrease the lipid peroxidation and enhance insulin activity, which helps the body cells to react to the insulin secreted by pancreas in order to maintain normal blood sugar level. These antioxidants showed antidiabetic effects that can reduce the risk of type 2 diabetes[115].

However, many of these health benefits do not come from tea drinking alone. According to Qi Sun, assistant professor in the Department of Nutrition, Harvard School of Public Health, "Tea consumption, especially green tea, may not be the magic bullet, but it can be incorporated in an overall healthy diet with whole grains, fish, fruits and vegetables, and less red and processed meat." Moreover, drinking tea more than the amount that is right for one's body can is detrimental to one's health in the following ways –

- Can lead **to deficiency of several essential vitamins and minerals, especially Iron**: This mainly happens because of the presence of caffeine, tannins and EGCG in different variants of tea[116]:
    - Caffeine inhibits Vitamin D receptors within your body, which limits the amount absorbed when you take supplemental forms such as Vitamin D3. Reduced Vitamin D levels affect the absorption and use of calcium in building strong bones. Caffeine is also diuretic which causes you to urinate more frequently, flushing out water-soluble vitamins such as the B-Complex vitamins and Vitamin C. Caffeine significantly reduces the absorption rate of Iron in your intestines - believed to be up to 80%
    - Tannins (found mainly in black tea) are a type of polyphenol found in plants, fruits and vegetables and have a bitter taste. They are responsible for the bitter taste in black tea, red wine and unripe fruits. Tannins don't affect the absorption of vitamins, but they do bind (chelate) to iron and block its absorption into the body from your intestines.
    - EGCG – Epigallocatechin gallate (found mainly in green tea) has been found to bind to iron in the intestine, preventing its absorption - instead simply being excreted out. Iron is necessary to carry oxygen from the lungs throughout the body and for other cell functions.

- **Heartburn and stomach cancer:** Researchers suggest that caffeine can relax the sphincter that separates your esophagus from your stomach, allowing acidic stomach contents to more easily flow into the esophagus. It may also contribute to an increase in total stomach acid production. According to Harvard School of Public Health, there may be an increased risk of esophageal and stomach cancers from drinking tea that is too hot (130-140° F).

- **Impact on women's health and complications during pregnancy**: Results from an NIH study have indicated that caffeine consumption among women of child-bearing age influences estrogen levels. While short term, these variations in estrogen levels among different groups do not have any pronounced effects, it is known that variations in estrogen level are associated with such disorders as endometriosis, osteoporosis, and endometrial, breast, and ovarian cancers[117]. Moreover, exposure to high levels of caffeine from beverages like tea

[115] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2669862/
[116] https://www.justvitamins.co.uk/blog/why-you-should-never-drink-tea-near-a-mealtime/#.Xz4Z8MgzY2w
[117] https://www.nih.gov/news-events/news-releases/nih-study-shows-caffeine-consumption-linked-estrogen-changes

during pregnancy may increase your risk of complications, such as miscarriage and low infant birth weight[118].

- **Anxiety and Insomnia:** Caffeine is known to increase alertness, it works by blocking the effects of adenosine, a brain chemical that makes you feel tired. At the same time, it triggers the release of adrenaline, which is a hormone associated with increased energy. However, this also increases the release of stress-fighting hormones which are saved for fight-or-flight situations. At higher doses of caffeine, these effects may become more pronounced, leading to anxiety and nervousness due to the hormonal imbalance.

  Too much caffeine makes it difficult to get enough restorative sleep. Caffeine enters the bloodstream through the stomach and small intestine and has a stimulating effect as soon as 15 mins after it is consumed. Once in the body, caffeine persists for 6 hours and takes that much time to be eliminated from the bloodstream, which can stimulate the brain continuously and prevents sleep[119].

- **Impact of heavy metals**: Heavy metals and metalloids found in tea can interfere with metabolism in multifarious ways, including cytotoxicity, endocrine disruption, mitochondrial dysfunction, and oxidative stress. These heavy metals accumulate in the body over time and are recycled via bile. Of note, lead found in tea could interfere with neurological development in children.

- **Addiction to tea**: One of the worst side effects of consuming excess tea is that you can easily get addicted to it. The caffeine in tea makes it addictive. Dr. Simran tells us, "When regular tea drinkers don't get their daily cup at the same time, it can leave them weary, lethargic, and irritable and bring down their energy levels." Some people may even experience headaches and fatigue until they get their daily quota of three to four cups of tea[120].

4. Alternatives to Tea

Healthy alternatives –

For some, the high amount of caffeine can cause nervousness, anxiety, digestive distress and headaches. So, there are many healthy alternatives of coffee which could offer some health benefits.

- Herbal Tea – which is a combination of herbs and spices boiled in water. It does the work of a hot beverage such as tea or coffee, but does not contain any caffeine, thereby preventing any detrimental effects of it. It also contains herbs and spices that support our immune system. Different combinations can be created with a large set of ingredients available such as Ginger, Lemon, Mint, Cinnamon, Cardamom, Basil (Tulsi), Lemongrass, Cloves, Star Anise and many other household spices with jaggery added as a sweetener. This herbal tea known by various names in India – Kehva in Kashmir, Kadhaa in Maharashtra etc. Further, each region has personalized it into a unique flavor using the locally grown, regional spices and ingredients.

[118] https://pubmed.ncbi.nlm.nih.gov/29276412/
[119] https://www.sleepfoundation.org/articles/caffeine-and-sleep
[120] https://food.ndtv.com/food-drinks/5-side-effects-of-tea-that-will-compel-you-to-drop-the-cup-1746324

Unhealthy alternatives –

- Energy drinks: Energy drink is a type of drink containing stimulant compounds, usually caffeine, which is marketed as providing mental and physical stimulation. Caffeine content in a 16-oz bottle is about 90 to 240 mg. Energy drinks can have serious health effects, particularly in children, teenagers, and young adults. Too much caffeine from any beverage, particularly when several are taken in one day in sensitive individuals, can lead to anxiety, insomnia, heart problems like irregular heartbeat and elevated blood pressure, and in rare cases seizures or cardiac arrest. Some energy drinks may contain as much as 500 mg per can (the amount in 14 cans of cola). Energy drinks increase the range of risk-seeking behavior, such as substance misuse and aggression, mental health problems in the form of anxiety and stress, to increased blood pressure, obesity, kidney damage, fatigue, stomachaches and irritation. Also, sugar is the main ingredient in energy drinks (about 42 mg per bottle) which could contribute to many health risks. Consuming high-sugar drinks of any kind can lead to weight gain and an increased risk of type 2 diabetes, cardiovascular disease, and gout[121].

- Soft drinks**:** Soft drink refers to any beverage with added sugar or other sweeteners (high fructose corn syrup, sucrose, fruit juice concentrates, and more). This includes soda, pop and cola. Soft drink intake is as a major contributor to obesity and many health problems, such as hypertension, diabetes and cardiovascular diseases. They provide so many calories and virtually no other nutrients. Researchers have found that people who drank sugar-sweetened drinks were at a higher risk of developing type 2 diabetes. For every additional regular can-sized, sugar-sweetened drink per day, there was an 18% risk of developing the disease[122].

- Green tea: As mentioned above, green tea, same as other variants contain high amounts of heavy metals making it detrimental to our health. In fact, it was found by an independent lab that the green tea plant is known to absorb lead at a higher rate than other plants from the environment, and lead also can build up on the surface of the leaves. A new report also shows that due to lack of regulation, green tea can vary widely from one cup to the next. Some bottled varieties appear to be little more than sugar water, containing little of the antioxidants that have given the beverage its good name[123].

What is most dangerous is the association of drinking green tea as part of a 'healthy lifestyle' which has actually made the product more detrimental for us as we consume it without regulation. By some estimates, Americans drink nearly 10 billion servings of green tea each year. Consumerism has led to the creation of countless varieties being available in the market, each more colorfully packaged than the other in biodegradable or reusable boxes creating an image for the product not synonymous with reality.

[121] https://www.hsph.harvard.edu/nutritionsource/energy-drinks/
[122] https://www.hsph.harvard.edu/nutritionsource/healthy-drinks/sugary-drinks/
[123] https://well.blogs.nytimes.com/2013/05/23/whats-in-your-green-tea/

5. Ayurveda Says

The central concept of Ayurvedic medicine is the theory that health exists when there is a balance between the three fundamental bodily bio-elements or doshas called Vata, Pitta, and Kapha[124].

According to Ayurvedic experts, Caffeine increases Vata dosha. Vata governs all movement in the physiology, such as the activity of digestion and the nervous system. With small amounts of caffeine, we can see the increased alertness and the effect it has on elimination. But in large amounts this aggravation of Vata dosha can be experienced as insomnia, anxiety, worry, dryness, fatigue (as seen in the caffeine lows) and headaches[125].

While at present, the FDA has suggested that 400 milligrams of caffeine a day from all sources is safe for adults, although some medical experts believe that adults can safely consume more. However, there is far less data about safe caffeine levels for teenagers, where research is ongoing. The Ayurvedic perspective questions not only the safety of tea but also the lifestyle choices that promote regularly pushing the body beyond its natural rest cycle as Ayurveda has a long history of addressing and supporting energy levels naturally, and provides a variety of modalities to support healthy sustained energy, without side effects[126].

[124] http://www.eattasteheal.com/ayurveda101/eth_bodytypes.htm
[125] https://www.mapi.com/blog/high-caffeine-energy-drinks-the-ayurvedic-perspective.html
[126] https://www.mapi.com/blog/high-caffeine-energy-drinks-the-ayurvedic-perspective.html

6. Coffee

Executive Summary

Coffee is a beverage brewed from the roasted and ground seeds of the tropical evergreen coffee plant of African origin and is one of the three most-popular beverages in the world and one of the most-profitable international commodities. It is estimated that 2.25 billion cups of coffee are consumed each day worldwide[127].

Coffee's impact on our health has been a controversial topic of debate for a long time and has seen a shift in perspective from being an inherently unhealthy drink to one that leads to several health benefits, mainly because there has been a shift in what the researchers were actively looking for[128]. Coffee contains many micronutrients, some of which possess biological benefits, including antiproliferative, antioxidant, and antimicrobial effects. This has led to coffee being associated with various health benefits such as reduces risk of type-2 diabetes, Parkinson's disease and cardiovascular issues. However, coffee is only safe up to an amount. Up to 400mg of caffeine a day appears to be safe for most healthy adults. Excess consumption of coffee can cause the following impact on one's health.

Deficiency of Vitamins and Minerals	This mainly happens because of the presence of caffeine, which prevent the absorption of Vitamin D3 and Iron and also cause the body to flush out valuable vitamins such as B-Complex vitamins and Vitamin C.
Women's Health	Caffeine consumption influences estrogen levels, long-term variations in which are associated with such disorders as endometriosis, osteoporosis, and endometrial, breast, and ovarian cancers[129]. It also increases risk of complications during pregnancy (miscarriage and low infant birth weight[130]).
Anxiety and Insomnia	Caffeine blocks the effects of adenosine, triggers the release of adrenaline, and increases the release of stress-fighting hormones. At high doses, this may lead to anxiety and nervousness. Additionally, once in the body, caffeine persists for 6 hours and prevents restorative sleep[131].
Coffee Addiction	When we cut down coffee, dopamine is being reabsorbed quickly and lost which makes us feel depressed and lazy and leads to withdrawal symptoms like headache, fatigue, mood swings and difficulty concentrating[132].

Table 25 Coffee - Impact on Health

However, we can alter our habits related to consumption of coffee for a healthier body and life –

- Using healthier alternatives: Such as chicory coffee, sukki kaapi and herbal tea.
- Monitoring consumption: Remember that in small amounts, coffee has medicinal properties
- Paying attention to when you consume coffee:
    - The best time of day to drink coffee is between 6 am and 10 am. At this time, coffee's heating, stimulating qualities can counterbalance that sluggishness by stimulating the mind and the body's digestive fire.
    - It is also advised to drink coffee after a meal in a small amount rather than before.

[127] https://d-nb.info/1180444302/34
[128] http://www.proceedings.com/13100.html
[129] https://www.nih.gov/news-events/news-releases/nih-study-shows-caffeine-consumption-linked-estrogen-changes
[130] https://pubmed.ncbi.nlm.nih.gov/29276412/
[131] https://www.sleepfoundation.org/articles/caffeine-and-sleep
[132] https://www.medicalnewstoday.com/articles/324768#caffeine-withdrawal

1. Introduction

Coffee is a beverage brewed from the roasted and ground seeds of the tropical evergreen coffee plant of African origin. Coffee is one of the three most-popular beverages in the world (alongside water and tea) and one of the most-profitable international commodities. It is estimated that 2.25 billion cups of coffee are consumed each day worldwide. Coffee is served internationally, and most countries have developed their own preferences about how to prepare and present it[133].

Coffee is a complex chemical mixture reported to contain more than a thousand different chemicals, including carbohydrates, lipids, nitrogenous compounds, vitamins, minerals, alkaloids and phenolic compounds. Caffeine has been perhaps the most widely known compound and is the most investigated component of coffee, it is a natural stimulant most commonly found in tea, coffee, and cacao plants. It works by stimulating the brain and central nervous system, helping you stay alert and prevent the onset of tiredness[134].

Coffee could offer some health benefits along with some side effects of unmonitored consumption. Human response to coffee or caffeine can also vary substantially across individuals, depending on the dose, type of coffee and body characteristics which depends not only on the original structure of the coffee beans but also the process of refining and processing[135]. For the purpose of this document, we will delve into coffee and try to break down its constituents to uncover both benefits to health and possible negative consequences of its unmonitored consumption.

2. Coffee production

Coffee beans are actually seeds that are planted in large beds in shaded nurseries. The seedlings are then watered frequently and shaded from bright sunlight until they are hearty enough to be planted permanently. Planting often takes place during the wet season, so that the soil remains moist while the roots become firmly established. Depending on the variety, it takes approximately 3 to 4 years for the newly planted coffee trees to bear fruit. The fruit, called the coffee cherry, turns a bright, deep red when it is ripe and ready to be harvested[5].

After picking, cherries are processed where the fruit covering the seeds is removed. Cherries can be processed in wet process in which fruit covering is removed before cherries are dried and then the pulp is removed by pressing the fruit by a machine. Then, coffee beans are dried in the sun by spreading them on drying tables or floors, where they are turned regularly, or they can be machine-dried in large tumblers[136].

[133] https://d-nb.info/1180444302/34
[134] https://www.healthline.com/nutrition/what-is-caffeine#what-it-is
[135] https://www.hsph.harvard.edu/nutritionsource/food-features/coffee/
[136] http://www.historyofcoffee.net/coffee-making/how-coffee-is-made/

Finally, beans that are unsatisfactory due to deficiencies (unacceptable size or color, over-fermented beans, insect-damaged) are removed. In many countries, this process is done both by machine and by hand, ensuring that only the finest quality coffee beans are exported[137].

Coffee contains many micronutrients, some of these chemical compounds possess biological activities, including antiproliferative, antioxidant, and antimicrobial effects. These micronutrients which include caffeine, chlorogenic acid, diterpenes, and trigonelline, play key roles in these bioactive effects of coffee[138]. According to the USDA, 1 cup of black coffee (270g) contains the following[139]:

Content	Amount	% of daily recommended intake
Calories (kcal)	2	~
Protein (g)	0.3	0%
Fat (g)	0	0%
Carbohydrates (g)	0	0%
Sodium (mg)	4.7	0%
Potassium (mg)	116	2%
Caffeine (mg)	94	24%

Table 26 Coffee- Nutritional Composition

According to Mayo Clinic, up to 400mg of caffeine a day appears to be safe for most healthy adults. That's approximately the amount of caffeine in four cups of brewed coffee. Women who are pregnant or who are trying to become pregnant and those who are breast-feeding should limit caffeine use to less than 200 mg daily[140].

3. Coffee impact on health

Coffee's impact on our health has been a controversial topic of debate for a long time and has seen a shift in perspective from being an inherently unhealthy drink to one that leads to several health benefits. This shift has mainly been caused as in the past researchers were actively looking for the proof that coffee was detrimental to health and now, they are actively looking for the opposite[141].

Coffee consumption has been associated with various health benefits and health risks. In general, moderate consumption which ranges between three or four cups daily, is linked to many health benefits, as discussed below.

- **Coffee and type-2 diabetes:** Coffee has been found to have some preventive effect on reducing type-2 diabetes risk. Caffeine influences the secretion of gastrointestinal peptide compounds which work on lowering the absorption of glucose in the small intestine, which result in less sugar circulating in the blood stream and less insulin secretion. Also, caffeine consumption may affect glucose metabolism by different mechanisms: increasing insulin sensitivity, which allows the cells of the body to use blood glucose more effectively by reducing blood sugar. Caffeine also inhibits the action of α-glucosidase, which is an enzyme that increases blood glucose level. Generally, coffee consumption promotes the regulation of blood glucose level, insulin secretion and glucose absorption which will eventually decrease the risk of type 2 diabetes[142].

[137] https://www.ncausa.org/About-Coffee/10-Steps-from-Seed-to-Cup
[138] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4045301/
[139] https://www.coffeeandhealth.org/topic-overview/nutrition-information/
[140] https://www.mayoclinic.org/healthy-lifestyle/nutrition-and-healthy-eating/in-depth/caffeine/art-20045678
[141] http://www.proceedings.com/13100.html
[142] https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2761298/

- **Coffee and cardiovascular diseases:** There are some nutrients in coffee help to improve blood cholesterol level, which could decrease the risk of heart diseases since high cholesterol level is the main cause of cardiovascular diseases. These compounds include polyphenols and caffeine. Polyphenols are chemical compounds with antioxidant properties that may help to protect against various diseases such as cardiovascular diseases. It works on lowering of blood pressure and promotes the oxidation of low-density lipoprotein cholesterol "LDL" or bad cholesterol, which leads to decrease its absorption in the liver and increase its excretion in the kidneys. Thus, keeping the blood vessels normally functioning with no plaques of LDL cholesterol which helps to protect against cardiovascular diseases[143].

- **Coffee and Parkinson's disease:** Parkinson's disease is a debilitating neurodegenerative disorder; symptoms include stiffness and difficulty with balance and coordination. The underlying pathological lesion is the progressive destruction of dopaminergic neurons in the midbrain. Some coffee components (caffeine and others) can prevent the formation of the toxic protein aggregates associated with Parkinson's development[144].

On the other hand, coffee overconsumption can cause some side effects on our health and stability, as shown below:

- **Anxiety:** Caffeine is known to increase alertness, it works by blocking the effects of adenosine, a brain chemical that makes you feel tired. At the same time, it triggers the release of adrenaline, which is a hormone associated with increased energy. However, this also increases the release of stress-fighting hormones which are saved for fight-or-flight situations. At higher doses of caffeine, these effects may become more pronounced, leading to anxiety and nervousness due to the hormonal imbalance.

- **Insomnia:** Caffeine's ability to help people stay awake is one of its most prized qualities. On the other hand, too much caffeine can make it difficult to get enough restorative sleep. Caffeine enters the bloodstream through the stomach and small intestine and can have a stimulating effect as soon as 15 minutes after it is consumed. Once in the body, caffeine will persist for about 6 hours to be eliminated from the bloodstream, which can stimulate the brain continuously and prevents sleep[145].

- **Digestive issues:** Coffee's laxative effect has been attributed to the release of gastrin; a hormone the stomach produces that speeds up activity in the colon. Caffeine stimulates the bowel movements by increasing peristalsis, the contractions that move food through the digestive tract, leading to lose stools or even diarrhea in some people[146].

  According to Ayurveda, Coffee is very astringent in action and can actually aid the digestive process when it is taken after meal in small amounts. However, when it is taken before a meal it cuts the digestive process and suppresses appetite.

- **Coffee addiction:** Caffeine addiction is the excessive and harmful use of caffeine over a period of time, which has negative effects on the health, social interactions and mental stability. When coffee is consumed, caffeine enhances dopamine signaling in the brain, which is a hormone and a neurotransmitter that plays several important roles in the brain and body,

[143] https://academic.oup.com/jn/article/135/10/2291/4669864
[144] https://parkinsonsnewstoday.com/2019/12/16/coffee-prevent-neurodegenerative-diseases-parkinsons/
[145] https://www.sleepfoundation.org/articles/caffeine-and-sleep
[146] https://www.healthline.com/nutrition/caffeine-side-effects#section3

making us feel pleasure and motivated. Caffeine increases the amount of dopamine in the brain by blocking its reabsorption into our bodies, which slows the rate at which dopamine leaves our system, to make us feel pleasant for a longer time[147].

Caffeine addiction can cause and exacerbate many different health problems, symptoms associated with stimulation of the brain and nervous system. While caffeine users enjoy the increased energy and alertness that caffeine gives them, unpleasant symptoms experienced by many consumers, especially those who are addicted, may appear if they cut down caffeine. When we cut down coffee, dopamine is being reabsorbed quickly and lost which makes us feel depressed and lazy, then caffeine withdrawal symptoms may appear. They include headache, fatigue, mood swings and difficulty concentrating[148]. Symptoms of withdrawal begin 12 to 24 hours after the last caffeine intake and can last 2 to 9 days.

- **Deficiency of several essential vitamins and minerals, especially Iron**: Caffeine inhibits Vitamin D receptors within your body, which limits the amount absorbed when you take supplemental forms such as Vitamin D3. Reduced Vitamin D levels affect the absorption and use of calcium in building strong bones. Caffeine is also diuretic which causes you to urinate more frequently, flushing out water-soluble vitamins such as the B-Complex vitamins and Vitamin C. Caffeine significantly reduces the absorption rate of Iron in your intestines - believed to be up to 80%[149]

- **Impact on women's health and complications during pregnancy**: Results from an NIH study have indicated that caffeine consumption among women of child-bearing age influences estrogen levels. While short term, these variations in estrogen levels among different groups do not have any pronounced effects, it is known that variations in estrogen level are associated with such disorders as endometriosis, osteoporosis, and endometrial, breast, and ovarian cancers[150]. Moreover, exposure to high levels of caffeine from beverages like tea during pregnancy may increase your risk of complications, such as miscarriage and low infant birth weight[151].

4. Alternatives to Coffee

Healthy alternatives –

For some, the high amount of caffeine can cause nervousness, anxiety, digestive distress and headaches. So, there are many healthy alternatives of coffee which could offer some health benefits.

- Chicory coffee. Chicory is a root that can be roasted, ground and brewed into a delicious hot beverage. It tastes very similar to coffee but is caffeine-free. It also may aid in digestion and support a healthy gut by promoting the growth of beneficial bacteria in the small intestine.

[147] https://driftaway.coffee/brain/
[148] https://www.medicalnewstoday.com/articles/324768#caffeine-withdrawal
[149] https://www.justvitamins.co.uk/blog/why-you-should-never-drink-tea-near-a-mealtime/#.Xz4Z8MgzY2w
[150] https://www.nih.gov/news-events/news-releases/nih-study-shows-caffeine-consumption-linked-estrogen-changes
[151] https://pubmed.ncbi.nlm.nih.gov/29276412/

- Sukki Kaapi: This is a traditional alternative to coffee that is popular in South India as well as in Sri Lanka. *Sukku,* the Tamil word for dried ginger, is the key ingredient in this beverage that is both healthy and invigorating. There's also a version that incorporates coriander seeds with crushed pepper and cumin (jeera) in the powder. To prepare the ginger-based version, one has to bring the water to boil, add dry ginger powder and then boil it for another minute. After that one can add palm jaggery, after which the kaapi is ready[152].

- Herbal Tea – which is a combination of herbs and spices boiled in water. It does the work of a hot beverage such as tea or coffee, but does not contain any caffeine, thereby preventing any detrimental effects of it. It also contains herbs and spices that support our immune system. Different combinations can be created with a large set of ingredients available such as Ginger, Lemon, Mint, Cinnamon, Cardamom, Basil (Tulsi), Lemongrass, Cloves, Star Anise and many other household spices with jaggery added as a sweetener. This herbal tea known by various names in India – Kehva in Kashmir, Kadhaa in Maharashtra etc. Further, each region has personalized it into a unique flavor using the locally grown, regional spices and ingredients.

Unhealthy alternatives –

- Energy drinks: Energy drink is a type of drink containing stimulant compounds, usually caffeine, which is marketed as providing mental and physical stimulation. Caffeine content in a 16-oz bottle is about 90 to 240 mg. Energy drinks can have serious health effects, particularly in children, teenagers, and young adults. Too much caffeine from any beverage, particularly when several are taken in one day in sensitive individuals, can lead to anxiety, insomnia, heart problems like irregular heartbeat and elevated blood pressure, and in rare cases seizures or cardiac arrest. Some energy drinks may contain as much as 500 mg per can (the amount in 14 cans of cola). Energy drinks increase the range of risk-seeking behavior, such as substance misuse and aggression, mental health problems in the form of anxiety and stress, to increased blood pressure, obesity, kidney damage, fatigue, stomachaches and irritation. Also, sugar is the main ingredient in energy drinks (about 42 mg per bottle) which could contribute to many health risks. Consuming high-sugar drinks of any kind can lead to weight gain and an increased risk of type 2 diabetes, cardiovascular disease, and gout[153].

- Soft drinks**:** Soft drink refers to any beverage with added sugar or other sweeteners (high fructose corn syrup, sucrose, fruit juice concentrates, and more). This includes soda, pop and cola. Soft drink intake is as a major contributor to obesity and many health problems, such as hypertension, diabetes and cardiovascular diseases. They provide so many calories and virtually no other nutrients. Researchers have found that people who drank sugar-sweetened drinks were at a higher risk of developing type 2 diabetes. For every additional regular can-sized, sugar-sweetened drink per day, there was an 18% risk of developing the disease[154].

- Decaf Coffee: According to Ayurveda, coffee is also prepared with many chemicals and the decaffeinated variety is even worse than "normal" coffee as the chemicals used in this process are poisonous to the human system. It would be better to buy organic coffee beans and freshly grind them each time you have a coffee as ground coffee also oxidizes very rapidly.

---

[152] https://food.ndtv.com/food-drinks/sukku-kaapi-this-traditional-coffee-and-tea-alternative-is-back-in-the-mix-2085927
[153] https://www.hsph.harvard.edu/nutritionsource/energy-drinks/
[154] https://www.hsph.harvard.edu/nutritionsource/healthy-drinks/sugary-drinks/

5. Ayurveda Says

The central concept of Ayurvedic medicine is the theory that health exists when there is a balance between the three fundamental bodily bio-elements or doshas called Vata, Pitta, and Kapha[155].

According to Ayurvedic experts, Caffeine increases Vata dosha. Vata governs all movement in the physiology, such as the activity of digestion and the nervous system. With small amounts of caffeine, we can see the increased alertness and the effect it has on elimination. But in large amounts this aggravation of Vata dosha can be experienced as insomnia, anxiety, worry, dryness, fatigue (as seen in the caffeine lows) and headaches[156].

While at present, the FDA has suggested that 400 milligrams of caffeine a day from all sources is safe for adults, although some medical experts believe that adults can safely consume more. However, there is far less data about safe caffeine levels for teenagers, where research is ongoing. The Ayurvedic perspective questions not only the safety of coffee but also the lifestyle choices that promote regularly pushing the body beyond its natural rest cycle as Ayurveda has a long history of addressing and supporting energy levels naturally, and provides a variety of modalities to support healthy sustained energy, without side effects[157].

Moreover, as there exists contradictory evidence when it comes to the consumption of coffee and its impact on our health, Ayurvedic experts provide a more holistic insight. Larissa Hall Carlson, Kripalu Schools faculty member and former Dean of the Kripalu School of Ayurveda (KSA), says “every type of food can be a poison or a medicine,” depending on what your individual constitution is—and how and when you consume it. Keeping this in mind, Ayurveda provides the following tips when it comes to drinking coffee[158].

- Consumption before 10:00 am: The best time of day to drink coffee is between 6 am and 10 am. At this time, coffee’s heating, stimulating qualities can counterbalance that sluggishness by stimulating the mind and the body’s digestive fire.
- Pay attention to portion size: According to Ayurveda, “a little bit of coffee can be medicinal.” However, overdosing on coffee can deplete the adrenals, dehydrate the system, and lead to other unpleasant side effects such as acid reflux or a racing mind, she says. Ayurveda doesn’t recommend more than one cup of coffee per day for anyone. To curb one’s coffee habit, it is recommended that one cut one’s intake in half and drink a cup of warm water first, to hydrate the system
- Pay attention to consumption of coffee in relation to meal intake: It is advised to drink coffee after a meal in a small amount rather than before.

[155] http://www.eattasteheal.com/ayurveda101/eth_bodytypes.htm
[156] https://www.mapi.com/blog/high-caffeine-energy-drinks-the-ayurvedic-perspective.html
[157] https://www.mapi.com/blog/high-caffeine-energy-drinks-the-ayurvedic-perspective.html
[158] https://kripalu.org/resources/five-ayurvedic-rules-coffee-drinkers

Part II: Labels – Food and Food-Like Substances in Common Packaged Foods

1. Tomato Ketchup:

The image below lists the ingredients of ketchup and the table below lists both the food and food-like substances present in it –

Food	Food-like substances
Water	Sugar
Tomato Paste	Salt
Onion Powder	**Acidity Regulator**
Garlic Powder	**Stabilizers 1422 ,415**
Spices and Condiments	**Preservative -211**

The table below highlights the effects of consuming food-like substances in tomato ketchup:

Name	Ingredients	Reason for Addition	Impact on Body	Remarks
Sugar	-	-	-	As per the nutrition table, 1 serving (1tbsp - 15 gms) contains 4.8 gm of sugar
Salt		-	-	As per the nutrition table, 1 serving (1tbsp - 15 gms) contains 136 mg of sodium.
Acidity Regulator	260 - Acetic acid	Helps to control the acidity or alkalinity	trigger asthma	The required pH level can be maintained which prevents the growth of bacteria in the product.
Class II Preservatives	211 - Sodium Benzoate	Helps prevent the growth of fungus and bacteria in acidic products	damage to the DNA and increased hyperactivity.	- FDA permits its use upto 0.1% of product weight
Stabilizers	1422 - Hydroxypropyl distarch phosphate / Acetylated distarch adipate	used to maintain the consistency, necessary uniformity and strength of the food product	Excessive use disturbs the functioning of gastro-intestinal tract	Usually produced from corn or potato starch

2. Brown Bread:

The image below lists the ingredients in brown bread and the table below lists both the food and food-like substances present in it –

Food	Food like -substances
Whole wheat flour	Sugar
Yeast	Edible Common Salt
Wheat Bran	Edible vegetable Oil
	Class II Preservatives
	Emulsifier
	Emulsifier Blend
	Improvers
	Acidity Regulator
	Flour Treatment Agent
	Permitted Natural Food Colour AZ

The table below highlights the effects of consuming food-like substances in brown bread:

Name	Ingredients	Reason for Addition	Impact on Body	Remarks
Sugar	-	-	-	As per the nutrition table, 1 serving (1tbsp - 15 gms) contains 4.8 gm of sugar (little more than 1 tsp)
Edible Common Salt	-	-	-	As per the nutrition table, 1 serving (1tbsp - 15 gms) contains 136 mg of sodium
Edible Common Oil	-	-	-	All packaged foods are made of palm oil which is one of the cheapest edible oils that is bad for our health, environment and economy.
Class II preservative (282)	Calcium propionate	Helps in the prevention of mold formation and extends shelf life	headaches, migraine, asthma and also aggravates food intolerances	Acts as an antimicrobial preservative in food products, especially in bakery.

Emulsifier 472e	Diacetyltartaric and fatty acid esters of glycerol.	-	-	Obtained from either soybean (possibly GMO) or pork.
Improvers	Improver 1100 (Amylase)	Helps to break down complex starch found in flour	-	Amylase occurs naturally in yeast
	Improver 1104 (Lipases)	Causes the bread to rise	-	-
	Improver 300 (L-ascorbic acid)	it is used as an emulsifier and processing aid in the breakdown of fats and oils	-	-
Acidity regulator	Acetic acid	Helps to control the acidity or alkalinity	Can trigger asthma	the required pH level can be maintained which prevents the growth of bacteria in the product.

3. Jam

The image below lists the ingredients in jam and the table below lists both the food and food-like substances present in it –

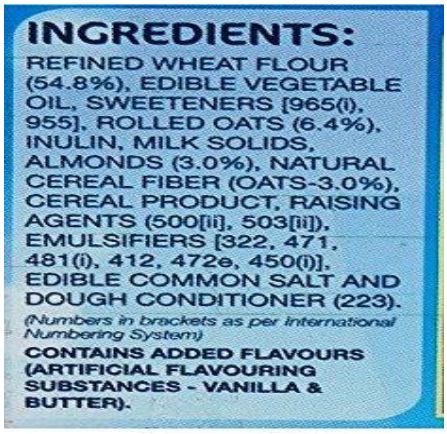
Food	Food Like -Substances
Mixed Fruit Pulp Blend	Thickener
	Acidity Regulator
	Vitamin B3
	Preservatives-211,223
	Permitted Synthetic Food Colour
	Added Flavours

The table below highlights the effects of consuming food-like substances in jam.

Name	Ingredients	Reason for Addition	Impact on Body	Remarks
Thickener	-	-	-	-
Acidity Regulator	Acetic acid	Helps to control the acidity or alkalinity	trigger asthma	the required pH level can be maintained which prevents the growth
Preservatives-211,223	211 - Sodium Benzoate	Helps prevent the growth of fungus and bacteria in acidic products	• damage to the DNA • increases hyperactivity • carcinogen and DNA damager	- FDA permits its use up to 0.1% of product weight

4. Nutri-choice essential oat biscuits

The image below lists the ingredients in nutri-choice biscuits and the table below lists both the food and food-like substances present in it –



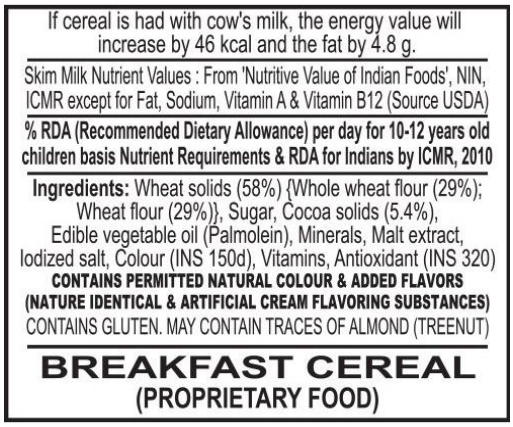
Food	Food Like -Substances
Refined wheat flour	Refined wheat flour
Almonds	Edible Common Oil
Natural cereal fibres	Sweeteners
Cereal Products	Inulin
Rolled Oats	Milk Solids
	Raising Agents
	Emulsifiers
	Dough Conditioner

The table below highlights the effects of consuming food-like substances in nutri-choice biscuits

Name	Ingredients	Reason for Addition	Impact on Body	Remarks
500(ii) - Sodium Hydrogen carbonate / Sodium bicarbonate 503(ii): Ammonium Hydrogen carbonate		Used mainly as a raising agent.		Prepared synthetically. All baked goods use a combination of baking powder and/or baking soda, which aren't good for your tummy if consumed in excess. Irritant to mucous membranes, alters pH of urine and may cause loss of calcium and magnesium.
Emulsifiers	Diacetyltartaric and fatty acid esters of glycerol.			Obtained from either soybean (possibly GMO) or pork.
Dough Conditioner	Sodium metabisulphite		causes asthmatic and allergic reactions	

5. Kellog's Chocos

The image below lists the ingredients in Kellogg's Chocos and the table below lists both the food and food-like substances present in it –


If cereal is had with cow's milk, the energy value will increase by 46 kcal and the fat by 4.8 g.

Skim Milk Nutrient Values : From 'Nutritive Value of Indian Foods', NIN, ICMR except for Fat, Sodium, Vitamin A & Vitamin B12 (Source USDA)

% RDA (Recommended Dietary Allowance) per day for 10-12 years old children basis Nutrient Requirements & RDA for Indians by ICMR, 2010

Ingredients: Wheat solids (58%) {Whole wheat flour (29%); Wheat flour (29%)}, Sugar, Cocoa solids (5.4%), Edible vegetable oil (Palmolein), Minerals, Malt extract, Iodized salt, Colour (INS 150d), Vitamins, Antioxidant (INS 320)

CONTAINS PERMITTED NATURAL COLOUR & ADDED FLAVORS (NATURE IDENTICAL & ARTIFICIAL CREAM FLAVORING SUBSTANCES)

CONTAINS GLUTEN. MAY CONTAIN TRACES OF ALMOND (TREENUT)

BREAKFAST CEREAL
(PROPRIETARY FOOD)

Food	Food Like -Substances
Wheat Solids(Whole Wheat Flour, Wheat Flour)	Sugar
Cocoa	Edible Vegetable Oil
	Minerals
	Vitamin
	Malt Extract
	Iodized Salt
	Colour (INS 150d)
	Antioxidant

The table below highlights the effects of consuming food-like substances in Kellogg's Chocos

Name	Ingredients	Reason for Addition	Impact on Body	Remarks
Sugar	-	-		additional sugar is not added on top of it while serving with milk
Edible Vegetable Oil	Palmolein		Oxidized palm oil induces reproductive toxicity and organotoxicity particularly of the kidneys, lungs, liver and heart.	We need to be aware of the source of the oil.
Minerals	Synthetic minerals	high in calcium and iron		Synthetic minerals are added separately, in order to make the brand promise more health-focused.
Iodized Salt		salt brings out the sweet flavour more prominently.	salt increases addictive property	
Colour (INS 150d)	caramel colour	-	-	It is also used in carbonated drinks like Coke. The maximum permissible intake is up to 200 mg/kg body weight for E150c and E150d
Antioxidant	INS 320 - Butylated hydroxyanisole (BHA			Anti-oxidants found in fruits and vegetables that are good for our body are different than this

6. Frooti

The image below lists the ingredients in Frooti and the table below lists both the food and food-like substances present in it –

Food	Food Like -Substances
Water	Sugar
Mango Pulp	Acidity Regulator
	Permitted Class II Preservatives
	Antioxidants

The table below highlights the effects of consuming food-like substances in Frooti

Name	Ingredients	Reason for Addition	Impact on Body	Remarks
Sugar	-	-	-	As per the nutrition table, 1 serving(1tbsp - 15 gms) contains 4.8 gm of sugar (little more than 1 tsp
Acidity Regulator	-Acetic acid	Helps to control the acidity or alkalinity	trigger asthma	The required pH level can be maintained which prevents the growth
Permitted Class II Preservatives	-	-	-	-
Antioxidants	INS 320 - Butylated hydroxyanisole (BHA	-	-	Anti-oxidants found in fruits and vegetables that are good for our body is different from this.

7. Bournvita/Boost

The image below lists the ingredients in Bournvita and the table below lists both the food and food-like substances present in it –

Food	Food Like –Substances
	Liquid Glucose
	Malt Extract
	Sugar
	Cocoa Solids
	Protein Isolate
	Maltodextrin
	Vitamins
	Milk Solids
	Emulsifiers(322,471)
	Raising Agent
	Minerals
	Edible Salt

The table below highlights the effects of consuming food-like substances in Bournvita

Name	Ingredients	Reason for Addition	Impact on Body	Remarks
Malt Extract				
Sugar	-	-	-	As per the nutrition table, 1 serving (1tbsp – 15 gms) contains 4.8 gm of sugar
Emulsifiers(322,471)	Diacetyltartaric and fatty acid esters of glycerol.			Obtained from either soybeans (possibly GMO) or pork.

500(ii) - Sodium Hydrogen carbonate / Sodium bicarbonate	-	-	-	Used mainly as a raising agent. Prepared synthetically. All baked goods use a combination of baking powder and/or baking soda, which aren't good for your tummy if consumed in excess.
Edible Salt	-	-	-	As per the nutrition table, 1 serving (1tbsp - 15 gms) contains 136 mg of sodium

8. Parle-G

The image below lists the ingredients in Parle-G and the table below lists both the food and food-like substances present in it –

Food	Food Like –Substances
	Sugar
	Edible Vegetable Oil
	Invert Sugar Syrup
	Raising Agent
	Salt
	Milk Solids
	Emulsifier
	Dough Conditioner

The table below highlights the effects of consuming food-like substances in Parle-G.

Name	Ingredients	Reason for Addition	Impact on Body	Remarks
Sugar	-	-		As per the nutrition table, 1 serving (1tbsp - 15 gms) contains 4.8 gm of sugar
Edible Vegetable Oil	Palmolein		Oxidized palm oil induces reproductive toxicity and organ toxicity particularly of the kidneys, lungs, liver and heart.	we need to be aware of the source of the oil. is the cheapest edible oil available on the planet.

Invert Sugar Syrup		It reduces crystallization in the final product, resulting in longer shelf life.		Invert sugar is sucrose (a disaccharide of glucose and fructose) that has been broken into free glucose and free fructose. This is a similar composition as that of High Fructose Corn Syrup (HCFS)
Raising Agent	503(ii): Ammonium Hydrogen carbonate		Irritant to mucous membranes alters pH of urine and may cause loss of calcium and magnesium.	
Salt	-	salt brings out the sweet flavour more prominently	- salt increases addictive property	
Emulsifier	Diacetyltartaric and fatty acid esters of glycerol.	-	-	Obtained from either soybean (possibly GMO) or pork.
Dough Conditioner	Sodium metabisulphite		(causes asthmatic and allergic reactions	

9. Real Mixed Fruit Juice

The image below lists the ingredients in Real Mixed Fruit Juice and the table below lists both the food and food-like substances present in it –

Food	Food Like –Substances
Water	Sugar
Mixed Fruit Concentrate	Acidity Regulator
	Antioxidant
	Stabilizer

The table below highlights the effects of consuming food-like substances in Real Mixed Fruit Juice.

Name	Ingredients	Reason for Addition	Impact on Body	Remarks
Sugar	-	-	-	As per the nutrition table, 1 serving (1tbsp - 15 gms) contains 4.8 gm of sugar (little more than 1 tsp
Acidity Regulator	Acetic acid	Helps to control the acidity or alkalinity	trigger asthma	the required pH level can be maintained which prevents the growth
Antioxidant	INS 320 - Butylated hydroxyanisole (BHA	-	-	Anti-oxidants found in fruits and vegetables that are good for our body.
Stabilizer	1422 - Hydroxypropyl distarch phosphate / Acetylated distarch adipate	used to maintain the consistency, necessary uniformity and strength of the food product	Excessive use disturbs the functioning of gastro-intestinal tract	Usually produced from corn or potato starch

10. Maggi Noodles

The image below lists the ingredients in Maggi Noodles and the table below lists both the food and food-like substances present in it –

Food	Food Like –Substances
	Refined Wheat Flour
	Palm Oil
	Salt
	Wheat Gluten
	Acidity Regulators
	Thickeners
	Humectant

The table below highlights the effects of consuming food-like substances in Maggi Noodles.

Name	Ingredients	Reason for Addition	Impact on Body	Remarks
Palm Oil			Oxidized palm oil induces reproductive toxicity and organotoxicity particularly of the kidneys, lungs, liver and heart. .	We need to be aware of the source of the oil.
Salt		salt brings out the sweet flavor more prominently	salt increases addictive property	
Acidity Regulators (500, 501, 170)	Acetic acid	Helps to control the acidity or alkalinity	trigger asthma	The required pH level can be maintained which prevents the growth of bacteria in the product.