IDENTIFICATION OF PROBLEM

Chocolate. to some consumers, is the reward, It's the ultimate indulgence-truly a feel-good pacifier and part, as some chocoholics claim. of an important food group. Presently chocolate is a part of almost every child's favourite food since it has a wonderful
fragrance, delicious taste and smooth mouthfeel. Chocolate has good as well as bad reputations in the field of health and nutrition. Chocolate has been known for its good taste from centuries until recently nutritionist were sceptical whether chocolate should be included in the diet. Most of the times it was associated with sugar-based candy which means it affects child's teeth, plays up with mood and gives energy which is not sustainable.

Chocolate has been acknowledged as the most popular confectionery products in the world. From a nutritional point of view, chocolate is energy rich and have high content of fat and sugar. Chocolate's antioxidant potential may have a range of health benefits. Eating chocolates help in lowering cholesterol levels, preventing cognitive decline and reducing the risk of cardiovascular problems. Moreover, the effect of chocolate on
mental health is uncertain because the few studies that have explored these issues have conflicting results.

Like everything has its strengths and shortcomings, chocolate also has positive and negative effects. Chocolate may have health benefits, but it also possesses certain bad effects. Chocolates are rich in caffeine that positively boosts energy of a person. However, when taken in excess, it can result in side effects like irregular and fast.
heartbeats, dizziness, and sweating and increased anxiety. Eating too much chocolate can result in gastrointestinal discomfort as the nature of caffeine is acidic. It contains high number of calories which leads to inadequate weight gain which further result in problems like high blood pressure, diabetes and heart disease. Chocolate is a potassium rich food which is not good for people who suffer from adrenal disease and kidney disease. Most common side effect of eating too much of chocolate is that it causes acne.
The high sugar content of most chocolate also causes tooth decay.

Chocolate has its advantages and disadvantages. By analysis of chocolate, we can know about various types of chocolates and how the chocolate is manufactured and how it is prepared from cocoa beans. By this analysis we can also know about the chemical
composition of chocolates.

INTRODUCTION

Chocolate is a highly commercialized and money-making programme. It is an accessible luxury that we treat ourselves to for personal gratification. Chocolates are consumed all over the world and they form the basic ingredient in many pastries and cake.
Chocolates can also be used as hot and cold beverages. Each manufacture combines secret formulas of different varieties of cocoa sweets to develop exclusive chocolates and try to make the exotic treat. Gifts of chocolates moulded to different shapes has become traditional on certain occasions and festivals.

Chocolate is the most versatile food item in the whole universe. There is no doubt that chocolate is absolutely one of the most refined pleasures in the world. Its complexity, rich taste, smooth texture is a symbol of pure luxury. In addition, chocolates are delectable and comforting.

From a nutritional standpoint, chocolate is energy rich and has a high content of fat and sugar. It also contains minerals like potassium, phosphorus, magnesium and zinc, flavanols, biogenic amines (tyramine and phenylethylamine), methylxanthines (caffeine and theobromine).

Chocolate is usually sweet, brown food prepared from roasted and ground cacao seeds that is made in the form of a liquid, paste, or in a block, or used as a flavouring ingredient in other foods. The word "chocolate" is derived from the classical Nahuatl word "chocolatl".

BASIC PREPARATION OF CHOCOLATE FROM CACAO SEEDS:

- The seeds of the cacao tree have an intense bitter taste and must be fermented to develop the flavour.
- After fermentation, the beans are dried, cleaned and roasted.
- The shell is removed to produce cacao nibs, which are then ground to cacao mass, unadulterated chocolate in a rough form.
- Once the cocoa mass is liquified by heating, it is called chocolate liquor.
- The liquor is cooled and processed into two components: cocoa solids and cocoa butter.

- Baking chocolate also called as bitter chocolate contain cocoa solids and cocoa butter in varying proportions, without any added sugar.
- Powdered baking cocoa, which contains more fibre than it contains cocoa butter can be processed with alkali to produce Dutch cocoa.
- Much of chocolate consumed today is in the form of sweet chocolate. a combination of cocoa solids, cocoa butter or added vegetable oils and sugar.

- Milk chocolate is sweet chocolate that additionally contains milk powder or condensed milk.
- White chocolate contains cocoa butter, sugar, and milk but no cocoa solids.

Chocolates are highly commercialised and money-making programmes. In the modern factories tons of bitter cocoa beans are turned into one of the world's favourite confectionaries. Today chocolates are made available to us by much guarded secret formula involving varying seeds, different ingredients, combination of fermentation- roasting, timings and temperature etc. flavours such as mint, coffee, orange, strawberry etc. are some of the add ones. Also, today the chocolates can contain ingredients as peanut, different types of walnuts, dry fruits, caramels and crisped rice etc.

HISTORY OF CHOCOLATES

Chocolate has been prepared as a drink for nearly all its history. For example, one vessel found at an Olmec archaeological site on the gulf coast of Veracruz, Mexico, dates chocolate's preparation by pre-Olmec peoples as early as 1750 BC.
Though started in the tropical rainforest of central and south America were cocoa was first grown, the tales of chocolate cultivation now circles the world.
The oldest known cultivation and usage of cocoa was in Puerto Escondido Honduras as the history data between 1100 BC and 1400 BC.
New processes that spread the production of chocolate emerged in the early in the industrial revolution.
The baker chocolate company, famous for producing baker's chocolate is the oldest producer of chocolate in the United States.
White chocolate was first introduced to the U.S. in 1946 by Frederick E, Hebert of Hebert candies in Shrewsbury, Massachusetts, near Boston after he tasted white coat candies in Europe.

CHEMICAL COMPOSITION OF CHOCOLATES:

Chocolates contain more than 300-500 known chemicals, some of which react with human brains to alter mood. Out of these 300-500 chemicals in chocolate the following chemicals play major role in humans.

THEOBROMINE: ($C_7H_7N_4O_2$):

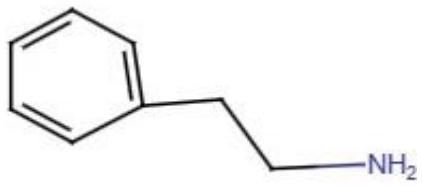
Theobromine, formerly known as xanthoses, is a bitter alkaloid of the cacao plant, with the chemical formula C7H7N4O2. It is found in chocolate as well in other foods including the leaves of tea plant and the kola nut.
It is a natural cough medicine. In large doses, it may cause nausea and anoxia and daily intake of 50-100 g of cocoa (0.8-1.5 g of theobromine) by humans has been associated with sweating, trembling and headache.

It is classified as a xanthine alkaloid, others of which include theophylline and caffeine. Caffeine differs from the compounds in that it has an extra methyl group.

Theobromine acts somewhat like caffeine in the body, and can be considered as stimulant. Theobromine widens blood vessels and causes increased urination and as such can be used to lower blood pressure. Cocoa and chocolate is also very high in potassium, adding to its potential to help with hypertension (high blood pressure). Health chocolates products high in theobromine include cocoa powder, baking chocolate and dark chocolate.

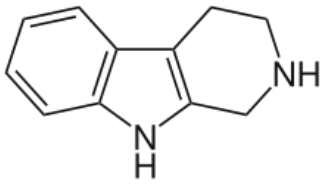
Chocolates	Theobromine per 1oz square	Theobromine per 100g	Theobromine per 200 calories
Becking chocolate (unsweetened)	376 mg	1297 mg	404 mg
Dark chocolate (70-85%)	228 mg	802 mg	268 mg
Dark chocolate (60-69%)	179 mg	632 mg	219 mg
Sweet chocolate candies	175 mg	426 mg	168 mg
Hot cocoa	170 mg	68mg	177 mg
Dark chocolate coated coffee beans	147 mg	368 mg	136 mg
Cocoa powder	142 mg	2634 mg	2395 mg
Dark chocolate (45-59%)	140 mg	493 mg	181 mg

PHENYETHYLAMINE: ($C_8H_{11}N$):



Phenylethylamine has earned the nickname of "chocolate amphetine". High levels of this neurotransmitter help promote feelings of attraction, excitement, giddiness and apprehension. Phenylethylamine works by stimulating the brains pleasure centre
and reaches peak levels. Chocolate has the highest concentration in any food of phenylethylamine, which is the chemical produced in the brain when the person is in love. Most if not all chocolate derived phenylethylamine is metabolized before it reaches the CNS, some people may be sensitive to its effects in very small quantities.

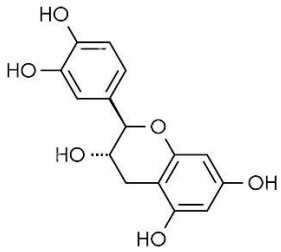
TETRAHYDRO – BETA - CARBOLINE($C_{11}H_{12}N_2$):



Tryptoline

Cacao and chocolate bars contain a group of neuroactive alkaloids known as tetra hydro-beta-carbolines. Tryptolines reuptake are also potent reuptake inhibitors of serotonin and epinephrine, with a significantly greater selectivity for serotonin. Tetra hydro-beta-
carbolines are also found in beer, wine and liquor they have linked to alcoholism. But the possible role of these chemicals in chocolate addiction remains unclear.

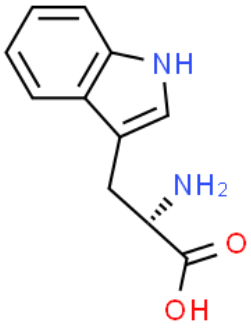
EPICATECHIN ($C_{30}OH_{26}O_{13}$):



catechin

Epicatechin also known as flavonoids are naturally occurring compounds found in plant-based foods that have been shown to have been shown to have many health benefiting properties including anti-inflammatory, anti- allergic and anti-cancer activity.
Cocoa especially dark chocolates has high amount of flavonoid epicatechin and has been found to have nearly twice the anti-oxidants of red wine and up to three times those found in green tea. Epicatechin may improve blood flow and may have potential
application for cardiac arrest. Two recent clinical trials have been found that coca flavanols can boost the flow of blood to key areas of the brain, giving scientist hope for developing treatment for dementia and strokes. Dark chocolates are full of flavonoids epicatechin and gallic acid, which are antioxidants that help protect blood vessels,
promote cardiac health and prevent cancer.

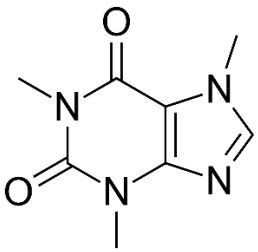
TRYPTOPHAN ($C_{11}H_{12}N_2O_2$):



L-Tryptophan

Tryptophan is a chemical that brain uses to make a neurotransmitter called serotonin. High levels of serotonin can produce feelings of elation. Serotonin is present both in the cocoa powder and in the dark chocolate. The levels of serotonin in chocolate samples containing 70-100% cocoa ranged from 1.30 to 2.93 mg/kg. The majority of the body's serotonin, between 80-90% can be found in the gastrointestinal tract.

CAFFEINE:



Caffeine

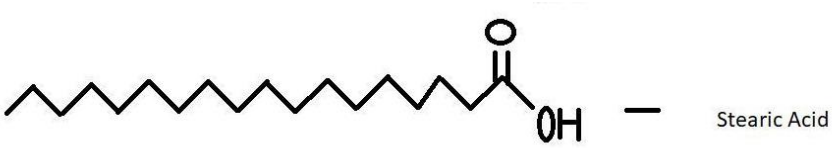
Caffeine is a xanthine alkaloid substance present in the leaves, nuts and fruits of many plants including coffee and 60 other varieties. Out of these plants is the cocoa tree from which the chocolate comes. The caffeine is found in the seeds of cocoa pods. Cocoa beans grow inside the cocoa pods and each cocoa pod contain around 30-40
cocoa beans.

Dark chocolate contains greater percentage of cocoa solids than milk or white chocolate as dark chocolate contains more caffeine than other two.

The table below depicts the amount of caffeine present in different cocoa products.

Common house hold items	Serving	Theobromine	Caffeine
Ice cream rich chocolate	1 cup (148 g)	178 mg	5.9 mg
Peanut M & MS	1 cup (170 g)	184 mg	17 mg
Ready to eat chocolate pudding	4 oz (108 g)	75.6 mg	2.2 mg
Hershey's milk chocolate bar	1.55 oz (43 g)	64 mg	9 mg
Hershey's chocolate syrup	2 tbsp. (39g)	64 mg	5 mg
Milk chocolate	9 pieces (41 g)	61 mg	9 mg
Semi-sweet baking powder	1 tbsp. (15 g)	51 mg	7 mg
Cookies and brownies	56 g	43.7 mg	1.1 mg
Kit Kat Wafer Bar	1 bar (42 g)	48.7 mg	5.9 mg
Peanut butter cups	2 cup (45 g)	32.4 mg	3.2 mg
Doughnut	43 g	12.6 mg	0.6 mg
Chocolate chip cookies	16 g	20.3 mg	2.6 mg
Milky way	1 bar (58 g)	37.1 mg	3.5 mg
Hot fudge Sundae topping.	158 g	77.4 mg	1.6 mg

STEARIC ACID (C17H35COOH):



Stearic acid is as saturated fatty acid with an eighteen-carbon chain and has an IUPAC name octadecanoic acid.

Stearic acid is used along with corn syrup as a hardener in candies.

Chocolates contains cocoa butter, which is high in saturated fat and yet one third of chocolates fat comes from stearic acid.

Although it's a saturated fat, stearic acid does not raise LDL (the bad cholesterol) as do most of the other saturated fats.

36% of cocoa bean fat is deemed good fat be it monosaturated or polysaturated fat, and oleic acid accounts the biggest percentage. Among the saturated fats that cocoa contains, more than that cocoa butter 50% of stearic acid.

MANUFACTURE:

- Pod pickers using long handled knives cut the ripe pods which grow on the both branches of the cocoa trees.
- The pulp and beans are stalked into piles or boxes of large trays
- They are covered with banana leaves and left for fermentation over next 7 days
- Fermentation happens in a temperature of 120 degrees Fahrenheit and hence the begin to develop characteristic aroma and colour.
- After seven days fermentation beans are transferred to be dried either in sunlight or artificially lightened rooms.
- The ultimate brown colour of the beans indicates they are finished being processed.
- Now the good beans are collected for shipping immediately to various manufactures to avoid any heat or moisture.

TYPES OF CHOCOLATES:

Several types of chocolate can be distinguished. Pure, unsweetened chocolate, often called "baking chocolate", contains primarily cocoa solids and cocoa butter in varying proportions. Much of the chocolate consumed today is in the form of sweet chocolate which combines chocolate with sugar.

MILK CHOCOLATE:

Milk chocolate is sweet chocolate that also contains milk powder or condensed milk. In the UK and Ireland, milk chocolate must contain a minimum of 20% total dry cocoa solids; in the rest of the European union, the minimum is 25%.

- It is a solid chocolate made with milk added in the form of powdered milk, liquid milk or condensed milk. In 1875, a swiss confectioner, Daniel peter, developed the first solid milk chocolate using condensed milk.
- Milk chocolate can contain only 20% of cocoa solids, such chocolate is labelled as "family milk chocolate" in the European union. "Cadbury" is the leading brand of milk chocolate in the United Kingdom.
- Hershey company is the largest producer in the United States. The actual Hershey's process is a trade secret, but experts speculate that the milk is partially lipolyzed, producing butyric acid, and then the milk is pasteurized, stabilizing it for use.
- This process gives the product a taste, to which the US public has developed an affinity, to the extent that some rival manufacturers now add butyric acid to their milk chocolate.

WHITE CHOCOLATE:

White chocolate, although similar in texture to that of milk and dark chocolate, does not contain any cocoa solids that impart a dark colour.

- In 2002, the US food and drug administration established a standard for white chocolate as the common or usual name of the products made from cocoa fat, milk solids, nutritive carbohydrates sweeteners, and other safe and suitable ingredient, but containing no fat cacao solids.
- As, white chocolate does not contain cocoa solids, it only contains traces of theobromine and caffeine.
- These may include additional flavourings such as vanilla. White chocolate contains 20% cocoa butter, 14% total milk solids, 3.5% milk fat and no more than 55% of sugar or other sweeteners.
- In the 1930s, the white chocolate Milky bar was launched in Europe by the swiss company, Nestle.

DARK CHOCOLATE:

Dark chocolate is produced by adding fat and sugar to the cacao mixture.

- The U.S food and drug administration calls this as sweet chocolate and requires a 15% concentration of chocolate liquor.
- European rules specify a minimum of 35% of cocoa solids,, as a higher amount of cocoa solids indicates more bitterness. Semisweet chocolate is a dark chocolate with a low sugar content.
- Bittersweet chocolate is a chocolate liquor to which some sugar, more cocoa butter and vanilla are added. Although dark chocolate has a reputation as healthier alternative to other types of chocolate, such as milk chocolate, high quality evidence for significant health benefits, such as blood pressure has not been shown.

UNSWEETENED CHOCOLATE:

It is a pure chocolate liquor, also known as bitter as baking chocolate.

- It is unadulterated chocolate: the pure, ground, roasted chocolate beans impart a strong, deep chocolate flavour.

- It is typically used in baking or other products to which sugar and other ingredients are added. Raw chocolate, often referred to as raw cacao is always dark and a minimum of 75% cacao.
- Poorly tempered or untampered chocolate may have whitish spots on the dark chocolate part, called chocolate bloom; it is an indication that sugar or fat has separated due to poor storage, it is not toxic and can be safely consumed.

NUTRITION:

- Chocolate contains a variety of ingredients which contain different nutrients and affect the bodies functioning in different ways.
- Depending on the relative proportions of cocoa, milk and other ingredients, the overall nutritional content of a bar or piece of chocolate varies considerably.
- For example, chocolate containing greater quantities of milk or milk solids higher calcium content while chocolate containing greater concentrations of cocoa such as dark chocolates is higher in caffeine.
- Adding nuts, fruits and other ingredients to chocolate changes its nutritional composition.
- Chocolate also contains over 400 chemicals including micronutrients which protect the body and its function un various ways.
- These include vitamin E. phosphorus, magnesium, iron, copper and plant chemicals.
- Cocoa and cocoa butter also contains three types of fat. A monounsaturated fat known as oleic acid and two saturated fats stearic acid and palmitic acid.
- Oleic acid does not affect cholesterol level.

- A 100-gm serving of milk chocolate supplies 540 calories. " It is 59% carbohydrates (52% as sugar and 3% as dietary fibre), 30% fat and 8% protein.
- Approximately 65% of the fat in milk chocolate is saturated, mainly palmitic acid and stearic acid, while the predominant unsaturated fat is oleic acid.
- 100 grams of milk chocolate is an excellent source (over 19% of the daily value of DV) of riboflavin, vitamin B12 and dietary minerals, manganese, phosphorus and zinc.
- Chocolate is good source (10- 19% DV) of calcium, magnesium and iron.

CHOCOLATE AND HEALTH:

The health effect of chocolate refers to the possible beneficial or detrimental. physiological effects of eating chocolates mainly for pleasure.

GOOD EFFECTS OF CHOCOLATE:

- Chocolate may be mild stimulant to human cocoa has antioxidant activity.
- Antioxidants helps to free your body of free radicals which cause oxidative damage to the cell.
- Small or regular amounts of dark chocolates are associated with lower risk of heart of attack.
- Dark chocolates contain theobromine, which has been shown to harden tooth enamel.
- Cocoa percentage of at least 74%, significantly improves the blood flow which were tested on smokers.
- Some studies have also observed a modest reduction in the blood pressure and flow mediated dilation after consuming dark chocolates daily.
- Eating dark chocolates may also prevent arteriosclerosis (hardening of the walls of the arteries), thus the best type of chocolates that is benefit is dark chocolate.
- Chocolate lowers cholesterol levels and prevents cognitive decline.
- Chocolate decreases stroke risk as it contains flavonoids whose antioxidant properties help to fight strokes.
- It reduces the risk of heart attacks as the blood platelets clump together more slowly in chocolate eaters.
- Chocolate reduces the risk of diabetes as it increases insulin sensitivity which reduces the risk of diabetes.
- Chocolate is also good for skin as flavonoids found in dark chocolate protect women's skin from the sun UV rays.
- Chocolate helps to strengthens the brain as epicatechin, a compound found in chocolate reduces the brain damage.

Bad effects of chocolate:

While chocolates have many good effects on consuming. it also has many negative side effects.

- Chocolate contains too many bad ingredients including milk fats and saturated fats like caffeine, stearic acid and oxalates.
- Sugar may give energy but too much of it can cause tooth decay and gum disease if eating without regular and proper teeth brushing.
- Sugar plays a harmful role in tooth decay by providing bacteria in mouth.
- Bacteria begins to multiple faster and plague begins to growand thickness on your teeth.
- Dark chocolates contain high amount of caffeine than milk chocolates which affect our health.
- Too much caffeine lead to hypertension anxiety dehydration and inability to concentrate.
- High calories in chocolate can increase the risk of gaining weight.
- Weight gain results when caloric intake exceeds.
- Eating chocolates boosts sugar intake intake can result in developing type 2 diabetes.
- Consumption of chocolates, dairy products and carbohydrates might increase the risk of acne and many of candy bars and chocolate products contain milk, and candy bars are a significant source of carbs.
- Chocolate is a source of caffeine and while chocolate does not have as much of this stimulant as a cup of coffee, it can lead to health-related side effects.
- Caffeine often leads to jittery feeling and might give you anxiety and restlessness and disrupt in feeling.
- Some people may increase in migraine when eating chocolate regularly due to cocoa's tyramine, histamine and phenylalanine content.
- Chocolate might cause poor bone structure and osteoporosis.
- Some cocoa powders, chocolate bars and cacao nibs may contain high levels of cadmium and lead which are toxic to the kidneys, bones and other tissues.
- Eating large amount of chocolate might cause caffeine related side effects such as nervousness, increased urination, sleeplessness and a fast heartbeat.
- Cocoa can cause allergic skin reactions and might trigger migraine headaches.
- Consumption of chocolate may also increase the risk of dental health problems.
- Dental cavities are associated with high sugar intakes so high concentrations of sugar increase the risk of dental caries.
- There is also evidence that regular intake of chocolate can cause tooth discolouration.

REVIEW OF LITERATURE

Conching chocolate is a prototypical transition from fictional jammed solid to flowable suspension with maximal solid content. May 2019.[1]

The science of what makes good chocolate has been revealed by researchers studying a 140-year-old mixing technique. Scientists have uncovered the physics behind the process of conching which is responsible for creating chocolates distinctive smooth texture. **Proceedings of the National Academy of Science, May 7 2019**.[2]

Dark chocolate consumption reduces stress and inflammation-April 2018:

New research shows there might be health benefits to eating certain types of dark chocolate. Findings from two studies being presented at the experimental biology 2018 annual meeting in San Diego show that consuming dark chocolate that has high concentration of cacao. While it is known that cacao is a major source of flavonoids this is
the first time the effect has been studied in human subjects to determine how it support cognitive, endocrine and cardiovascular health. This research was done by **Loma Linda university**. [3]

More flavourful, healthful chocolate could be on its way-2015:

While chocolate has many health, benefits including potentially lower blood pressure, cholesterol and reduce heart stroke. [4] Researchers now claim to have found a way to make chocolate even more nutritious and sweeter[5]. The researchers team divided 300 pods into four groups that were either not stored for seven to ten days before processing.[6] The technique is called pulp preconditioning. The report resulted highest antioxidant activity after roasting. This research was done by **American chemical society in 2015**. [7]

Potential benefit of dark chocolate for liver disease patients (2010):

According to Spanish research, eating dark chocolates reduces damage to the blood vessels of cirrhotic patients and also lowers blood pressure [8] in the liver according to new research paper presented at **the international liver congress in 2010 at Vienna Austria**.[9]

Tracking structural changes in lipid based multicomponent food materials due to oil migration by micro focus small angle X- ray scattering (2015):

An x-ray study carried out by DESY allows to improve the quality of chocolate [10]. The study offers new insights into the formation of fat bloom, an unwelcome white layer that occasionally forms on chocolate. Although the fat blooming is harmful it causes million
damages to the food industry. **This article was published by American chemical society**.[11]

METHODOLOGY

ANALYSIS OF PROTEIN:

5ml of each sample of chocolate was taken in different test tube. One pellet of NaOH to each test tube and then 1-2 drops of $CuSO_4$ solution was added to each of the test tube.
Appearance of violet colouration is observed. Presence of protein in the sample

ANALYSIS OF FAT:

A small sample of each chocolate was taken on different pieces of filter paper. The filter papers were fold and unfold to crush the sample over the flame.
Appearance of translucent spot around the sample which become larger on heating was observed. Presence of fat is observed in the sample.

ANALYSIS OF SUGAR:

5 ml of each sample is taken in different test tube. Then 1 ml of water was added to each of the test tube and then few drops of Moliscli's reagent (alpha naphthol in alcohol).
Then conc.H_2SO_4 was added along the inner edge of the test tube dropwise.
A purple colour ring was formed at the top.
2ml of Fehling's A and B were mixed in different test tubes.
A pinch of chocolate was added into each of the test tube.
Then the solution was kept in the water bathe.
Red-brown precipitate was obtained.
2 ml of Tollens reagent was taken in different test tube. Then a pinch of chocolate was added to each of the test tube. Then the solution was kept in the water bathe solution was kept in the water bathe.
A silver mirror surface is formed.
Presence of sugar is confirmed in the sample.

ANALYSIS OF CALCIUM:

A mixture of NHCL + NH,OH+ $(NH_4)_2CO_3$ was taken in a test tube and then a pinch of chocolate was added to the test tube.
With the help of a glass rod each sample of chocolate solution was placed on different watch glass.
A drop of conc.HCL was added to the watch glass and a paste was made from each sample.
The paste from each sample was taken on the tip of new glass rod and shown to the blue flame of spirit lamp.
A white precipitate is obtained. Brick red colour flame was obtained.
Presence of calcium in the sample is confirmed.

ANALYSIS OF IRON:

A mixture of NH4CL+ NH4OH was made and the mixture was added to each sample of chocolate solutions taken in different test tubes.
no white precipitate was obtained. Iron is absent in the sample.

ANALYSIS OF MAGNESIUM:

A mixture of NH4CL+ NH4OH+Na3PO4 was added to each sample of chocolate solutions taken in different solutions.
No white precipitate is obtained. Absence of magnesium in the sample.

ANALYSIS OF NICKEL:

A mixture of NH4CL+NH4OH was added to each of the test tubes containing sample of chocolate solutions.
Then H2S gas was passed through the solution.
No black precipitate is obtained. Absence of nickel in the sample.

TABULATION:

Table - 01 (presence of lead, nickel and cadmium in different chocolates):

Chocolate analysed		**Lead concentration (mg/g)**		**Nikel concentration (mg/g)**		**Cadmium concentration (mg/g)**	
Type	N	Range	Mean	Range	Mean	Range	Mean
Cocoa based	23	0.236 – 8.04	1.915	0.049 – 8.290	2.763	0.010 – 2.763	0.244
Milk based	22	0.234 – 2.62	0.613	0.137 – 8.288	1.739	0.010 – 2.763	0.071
Sugar based	69	0.049 - 8.04	0.927	0.041- 8.230	1.626	0.001 – 2.730	0.105

Table - 02 (analysis of brands different of chocolates):

Parameters/ brands	**Park**	**Munch**	**Amul**	**Cadbury**	**Nestle**
Energy (cal/100g)	520	500	562	552	546
Moisture in %	1.45	1.45	1.10	1.31	1.50
Total ash %	1.29	1.27	1.29	1.45	1.86
Crude fibre %	0.40	0.40	0.60	0.50	0.55
Carbohydrates (in gm)	63.19	67.82	53.89	55.09	55.65
Protein (in gm)	7.21	6.56	8.50	8.74	7.08
Fat (in gm)	26 .52	22.55	34.60	32.97	32.40
Calcium (in gm)	0.35	0.79	0.47	0.50	0.40

RESULT:

SL. NO	SUBSTANCES	PRESENT/ABSENT
1	PROTEIN	PRESENT
2	FATS	PRESENT
3	SUGARS	PRESENT
4	CALCIUM	PRESENT
5	IRON	ABSENT
6	MAGNESIUM	ABSENT
7	NICKEL	ABSENT

From the above tabulation, we saw that almost all the protein, fat, sugar, calcium and chocolates contain carbohydrates.

But most of the chocolates does not contain iron, magnesium, lead and nickel. Presence of these heavy metals are harmful to human health.

ANALYSIS:

From the above project, we saw that chocolate is the most craved food in the world. Chocolate contains carbohydrates, fat, sugar. calcium and protein.

Chemical composition of chocolates include theobromine, phenylethylamine, epicatechin, carboline, stearie acid and caffeine.
Chocolates are of various types like milk chocolate, white chocolate, dark chocolate and unsweetened chocolate.
Presence of heavy metals like lead, nickel, iron and magnesium in chocolates are harmful for health.
Chocolates are both good and bad for health. Its good effects include it lowers cholesterol levels and help to fight heart diseases and its bad effects include it causes obesity, tooth decay and many more.
The analytical process includes the sample preparation. Sample preparation is the key step to analytical process.
There are two types of analytical process:
Qualitative analysis is the process in which identifying what is in the unknown sample.
Quantitative analysis is the process in which identifying how much analyte is present in the unknown sample.
Analysis of chocolate can have done by various processes which includes distillation, in which the mixture is separated out on differences of component volatilities. Then comes, filtration in which solids are separated from fluids, then membrane filtration occurs
followed by solvent extraction and sample preparation'
By following the following processes, we can determine the chemical composition or presence of various chemicals in chocolate.

CONCLUSION:

Chocolate is the most craved food in the world. Starting from kids to even adults, each person in this world likes chocolates. Chocolate has good as well as bad reputation in the field of health and nutrition. For many years chocolate has been referred to junk and unhealthy food and has been regarded as an indulgence. Recent studies have begun
to erase the poor reputation that chocolate has acquired in the past few decades and is restoring its former status.

Due to its taste and nutritional importance variety of chocolates were made available for consumption. Traditionally, chocolates nutritional value has been its calories, carbohydrates and fats which are now viewed as positive attributes.

The concept of chocolate as food seemed to have overcome its concept of nutrition. The rehabilitation of chocolate, from a nutritional point of view, occurred in recent times, when biomedical science began to search the evidence for its benefits. Chocolate as a
functional food, that recognizes and generates interesting physiological effects it is likely to promoter maintain health. Hence chocolate should be consumed as nutritional food which exalts its nutritional functions and threptic abilities.

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