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Case Study

CHOCOLATE PROCESSING

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ABSTRACT
Chocolate is a product processed from cocoa, rich in flavonoids and antioxidant compounds. It grows best in tropical rainforests. Chocolate processing consists of a multistep process which, starting from cocoa beans, involves fermentation, drying, roasting, nib grinding and refining, conching and tempering (Owen, 2013). During cocoa processing, the naturally occurring antioxidants (flavonoids) are lost, while others such as Maillard reaction products are formed. Primary chocolate categories are dark, milk and white chocolate, which differ in their contents of cocoa solid, milk fat and cocoa butter. Chocolate has become one of the most popular food types and flavours in the world. Chocolate is very sensitive to temperature and humidity (Mattia and Sager, 2014). Quality chocolate is characterized by glossy shine, snap, aroma, texture and taste. Chocolate processing is complex and requires several technological operations and processes to achieve the desired product quality. Chocolate is lower in caffeine than tea and coffee. Chocolate contains antioxidants which may help prevent cancer and heart disease (Afoakwa, 2009).

KEYWORDS: Cocoa, flavonoids, fermentation, antioxidants, processing.

INTRODUCTION

The use of cocoa beans dates back at least 1400 years (R¨ossner, 1997), when Aztecs and Incas used the beans as currency for trading or to produce the so-called *chocolatl*, a drink made by roasting and grinding cocoa nibs, mashing with water, often adding other Ingredients such as vanilla, spices or honey. In the 1520s, the drink was introduced into Spain (Minifie, 1989) although Coe and Coe (1996) emphasized that the European arrivals in the new world, including Christopher Columbus and Herman Cortes, were unimpressed with the Mayan beverage, sweetening it with honey. Nevertheless, the conquistadors familiarised the chocolate beverage throughout Europe, and being expensive, it was initially reserved for consumption by the highest social classes, and only in the seventeenth Century that the consumption of chocolate spread through Europe. As the consumption of chocolate became more and more widespread during the eighteenth Century, the Spanish monopoly on the production of cocoa soon became untenable and Plantations were soon established by the Italians, Dutch and Portuguese. At this point, Chocolate was still consumed in liquid form and was mainly sold as pressed blocks of a grainy mass to be dissolved in water or milk to form a foamy chocolate drink. The mass Production of these chocolate blocks also began in the eighteenth century when the British Fry family founded the first chocolate factory in 1728, using hydraulic equipment to grind the cocoa beans. Chocolate is a typically sweet, usually brown food preparation of the *obroma cacao* seeds, roasted and ground. It is made in the form of a liquid, paste, or in a block, or used as a flavouring ingredient in other foods. Cacao has been cultivated by many cultures for at least three millennia in Mesoamerica. The earliest evidence of use traces to the Mokaya (Mexico and Guatemala), with evidence of chocolate beverages dating back to 1900 BCE. In fact, the majority of Mesoamerican people made chocolate beverages, including the Maya and Aztecs, who made it into a beverage known as *xocolātl* a Nahuatl meaning "bitter water". 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 cocoa mass, unadulterated chocolate in rough form. Once the cocoa mass is liquefied by heating, it is called chocolate liquor. The liquor also may be cooled and processed into its two components: cocoa solids and cocoa butter. Baking chocolate, also called bitter chocolate, contains cocoa solids and cocoa butter in varying proportions, without any added sugars. Much of the 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. Chocolate has become one of the most popular food types and flavours in the world, Many candies are filled with or coated with sweetened chocolate, and bars of solid chocolate and candy bars coated in chocolate are eaten as snacks Although cocoa originated in the Americas, recent years have seen African nations assuming a leading role in producing cocoa. Since the 2000s, Western Africa

produces almost two-thirds of the world's cocoa, with Ivory Coast growing almost half of that amount.

TYPES OF CHOCOLATE

Chocolate is a range of foods derived from cocoa (cacao), mixed with fat (*e.g.*, cocoa butter) and finely powdered sugar to produce a solid confectionery. There are several types of chocolate**,** classified according to the proportion of cocoa used in a particular formulation.

The use of particular name designations is sometimes subject to international governmental regulation. Some governments assign chocolate solids and ranges of chocolate differently.

Different forms and flavours of chocolate are produced by varying the quantities of the different ingredients. Other flavours can be obtained by varying time and temperature when roasting the beans.

Milk chocolate is solid chocolate made with milk, in the form of milk powder, liquid milk, or condensed milk, added. In 1875, Swiss confectioner Daniel Peter, in cooperation with his neighbour Henri Nestlé in Vevey, developed the first solid milk chocolate using condensed milk. The bar was named "Gala Peter", combining the Greek word for "milk" and his name. A German company Jordan & Timaeus in Dresden, Saxony had already invented milk chocolate in 1839 hitherto it had only been available as a drink. The US Government requires a 10% concentration of chocolate liquor. EU regulations specify a minimum of 25% cocoa solids. However, an agreement was reached in 2000 that allowed what by exception from these regulations is called "milk chocolate" in the UK, Ireland, and Malta, containing only 20% cocoa solids, to be traded as "family milk chocolate" elsewhere in the European Union.

- Cadbury chocolate is the brand leader in the United Kingdom. First produced by George Cadbury Junior in 1905, Cadbury Dairy Milk was made with a higher proportion of milk than previous chocolate bars, and it became the company's best selling product by 1914. It is the best selling milk chocolate bar in the UK, followed by Galaxy.
- "Hershey process" milk chocolate is popular in the US. The process was invented by Milton S. Hershey, founder of The Hershey Company. The process uses fresh milk from local farms. The logistics of purchasing and delivering fresh milk is difficult as, according to state regulations fresh milk cannot be held for more than 72hours after its reception. If not immediately processed into milk chocolate, the milk must be disposed of the actual Hershey process is a trade secret, but experts speculate that the milk is partially lipolyzed, producing butyric acid, and then the milk is pasteurized and stabilized. This process gives the product a particular taste, to which the US public has shown to have an affinity, to the extent that some rival manufacturers now add butyric acid to their milk chocolates.

Dark chocolate, also known as "plain chocolate" or "black chocolate", is produced using higher percentages of cocoa, traditionally with cocoa butter instead of milk, but there are also dark milk chocolates and many degrees of hybrids. Dark chocolate can be eaten as is, or used in cooking, for which thicker, baking bars, usually with high cocoa percentages ranging from 70% to 99% are sold. Dark is synonymous with semisweet, and extra dark with bittersweet, although the ratio of cocoa butter to solids may vary.

White chocolate is made of sugar, milk, and cocoa butter, without the cocoa solids.

A 200 gram bar of dark baking chocolate, with a minimum cocoa content of 40% Swiss dark chocolate

- "**Cocoa powder**" is used for baking, and for drinking with added milk and sugar. There are two types of unsweetened cocoa powder: natural cocoa (like the sort produced by the Broma process), and Dutch-process cocoa. Both are made by pulverizing partially defatted chocolate liquor and removing nearly all the cocoa butter; Dutch-process cocoa is additionally processed with alkali to neutralize its natural acidity. Natural cocoa is light in colour and somewhat acidic with a strong chocolate flavour. Natural cocoa is commonly used in recipes that also use baking soda; as baking soda is an alkali, combining it with natural cocoa creates a leavening action that allows the batter to rise during baking. Dutch cocoa is slightly milder in taste, with a deeper and warmer colour than natural cocoa. Dutch-process cocoa is frequently used for chocolate drinks such as hot chocolate due to its ease in blending with liquids. However, Dutch processing destroys most of the flavonoids present in cocoa. In 2005 Hershey discontinued their pure Dutch-process European Style cocoa and replaced it with Special Dark, a blend of natural and Dutch-process cocoa.
- **Organic chocolate** is chocolate which has been a certified organic ingredient.
- "**Raw chocolate**" is chocolate that has not been processed, heated, or mixed with other ingredients. It is sold in chocolate-growing countries, and to a much lesser extent in other countries, often promoted as healthy.
- **Unsweetened chocolate**, also known as bitter, baking chocolate, or cooking chocolate, is pure chocolate liquor mixed with some form of fat to produce a solid substance. The pure, ground, roasted cocoa beans impart a strong, deep chocolate flavor. With the addition of sugar, however, it is used as the base for cakes, brownies, confections, and cookies.
- "**Bittersweet chocolate**" is chocolate liquor (or unsweetened chocolate) to which some sugar (less than a third), more cocoa butter, vanilla flavouring, and sometimes lecithin have been added. It typically has less sugar and more liquor than semisweet chocolate, but the two are interchangeable when baking. Bittersweet and semisweet chocolates are sometimes referred to as "couverture". Many brands now print on the package the percentage of cocoa in the chocolate (as chocolate liquor and added cocoa butter). The higher the percentage of cocoa, the less sweet the chocolate is.
- "**Semisweet chocolate**" is frequently used for cooking purposes. It is a dark chocolate with (by definition in Swiss usage) half as much sugar as cocoa, beyond which it is "sweet chocolate". Semisweet chocolate does not contain milk solids.

- "**Couverture**" is a term used for chocolates rich in cocoa butter. Popular brands of couverture used by professional pastry chefs and often sold in gourmet and specialty food stores include: Valrhona, Felchlin, Lindt & Sprüngli, Scharffen Berger, Cacao Barry, Callebaut, Chocolate, Chocó fig fuel chocolates, and Guittard. These chocolates contain a high percentage of cocoa
- "**Compound chocolate**" is the technical term for a confection combining cocoa with vegetable fat, usually tropical fats and/or hydrogenated fats, as a replacement for cocoa butter. It is often used for candy bar coatings. In many countries it may not legally be called "chocolate".
- "**Modeling chocolate**" is a chocolate paste made by melting chocolate and combining it with corn syrup, glucose syrup, or golden syrup. It is primarily used by upscale cake makers and patisseries to add decoration to cakes and pastries.

Flavours such as mint, vanilla, coffee, orange, or straw berry are sometimes added to chocolate in a creamy form or in very small pieces. Chocolate bars frequently contain added ingredients such as peanuts, nuts, fruit, caramel, and crisped rice. Pieces of chocolate, in various flavours, are sometimes added to cereals and ice cream.

The U.S. Food and Drug Administration (FDA) regulates the naming and ingredients of cocoa products:

Product	Chocolate Liquor	Milk Solids	Sugar	Cocoa Fat	Milk Fat
Milk Chocolate	≥ 10%	≥ 12%			
Sweet Chocolate	≥ 15%	< 12%			
Semisweet or Bittersweet (Dark) Chocolate	≥ 35%	< 12%			
White Chocolate		≥ 14%	≤ 55%	≥ 20%	≥ 3.5%

Chocolate facts

1. There is a correlation between the amount of chocolate a country consumes on average and the number of Nobel Laureates that country has produced.
2. A jewel thief made off with $28 million dollars of gems in 2007 because he was able to gain the trust of the guards working the bank in Antwerp, Belgium, by repeatedly offering them chocolate.
3. The blood in *Psycho*'s famous shower scene was actually chocolate syrup.
4. At one point the Nazis plotted to assassinate Winston Churchill with an exploding bar of chocolate.
5. The scientific name for the tree that chocolate comes from, Theobroma cacao, means "food of the gods."
6. It takes a almost a full year for a cocoa tree to produce enough pods to make 10 standard-sized Hershey bars.
7. Chocolate has over 600 flavour compounds, while red wine has just 200.
8. Theo bromine, the compound in chocolate that makes it poisonous to dogs, can humans well. You'd have to be a real glutton to go out this way though, as an average 10-year-old child would have to eat 1,900 Hershey's miniature milk chocolates to reach a fatal dose.
9. The ancient Maya are believed to be the first people to regularly grow cacao trees and drink chocolate. The Aztecs got it later, but they had to trade for cacao because they couldn't grow the trees.
10. The word "chocolate" comes from the Aztec word "xocoatl," which referred to the bitter, spicy drink the Aztecs made from cacao beans.

CHOCOLATE MYTHS AND TRUTHS

Chocolate raises bad cholesterol

If you've given up chocolate in the name of lowering LDL (bad) cholesterol, you may have been unwittingly sacrificing the sweet treat for nothing. *Quelle tragique*! While it's true that chocolate contains cocoa butter, which is high in saturated fat, much of the fat comes from stearic acid, which doesn't act like saturated fat. Studies have shown that chocolate does not raise bad cholesterol, and in fact for some people, chocolate can lower cholesterol levels.

Chocolate is high in caffeine

Contrary to popular belief, chocolate is not loaded with the jitter-inducing compound known as caffeine. A Hershey's chocolate bar contains 9 milligrams of caffeine and a Hershey's Special Dark bar contains 31 milligrams, as compared to the 320 milligrams found in a Starbuck's grande brewed coffee. Darker varieties are higher in caffeine, it's true, but not as high as many people think.

The sugar in chocolate causes hyperactivity

Excessive sugars cause's kids to jump off the walls, bounce off the ceiling, and generally mimic a rogue helicopter, right? So we thought. But more than a dozen good-quality studies have failed to find any link between sugar in children's diets and hyperactive behavior. Two theories: It's the environment that creates the excitability (birthday parties, holidays, etc) and/or that the connection is simply in the minds of the parents expecting hyper behavior following sugar-fuelled revelries.

People with diabetes have to give up chocolate

Chocolate does not need to be completely avoided by people with diabetes. In fact, many are often surprised to learn that chocolate has a low glycemic index. Recent studies suggest that dark chocolate may actually improve insulin sensitivity in people with normal and high blood pressure and improve endothelial dysfunction in people with diabetes. Of course, always check with your doctor before ripping open the Ritter wrapper.

Chocolate causes tooth decay and cavities

A study investigating the development of plaque from chocolate found that chocolate has less of an effect on dental plaque than pure table sugar. Of course, most of us aren't snacking on straight sugar, but another study backed it up when it showed no association between eating chocolate and getting cavities. In fact, a study from Osaka University in Japan found that parts of the cocoa bean, the main ingredient of chocolate, thwart mouth bacteria and tooth decay. Fighting cavities never tasted so good.

While stuffing yourself with a box of chocolates won't do you any favours in the weight department, eating a small

amount of chocolate five times a week has been linked to a lower BMI.

Chocolate makes you gain weight

Of course it does. Well, not necessarily. Obviously, monumental hot fudge sundaes aren't going to do your waistline any favours, but a large study funded by the National Institutes of Health found this: Consuming a small amount of chocolate each of five days during a week was linked to a lower BMI, even if the person ate more calories overall and didn't exercise more than other participants. Hello, chocolate diet.

Eating sugar and chocolate can add to stress

A study found that eating about an ounce and a half of dark chocolate a day for two weeks reduced levels of stress hormones in the bodies of people feeling highly stressed.

Chocolate lacks nutritional value

If you've seen any of the deluge of scientific studies touting the health benefits of chocolate, you know this is not true. But just how nutritious is chocolate? It has bona fide super food status. A typical dark chocolate bar contains as much antioxidant capacity as 2 3/4 cups of green tea, 1 glass of red wine, or 2/3 cup of blueberries. In addition, chocolate also contains minerals and dietary fiber.

Chocolate must contain at least 70 percent cacao to be good for you

The general recommendation is to consume dark chocolate with a minimum of 70 percent cacao to reap the health benefits; in general, the darker the chocolate, the higher the antioxidant content. However, in one 18-week study, participants who ate a small amount of 50 percent cacao chocolate experienced a significant reduction in systolic and diastolic blood pressure. As well, another study showed short-term improvements in blood flow and blood pressure after consumption of a 60 percent cacao dark chocolate.

Chocolate causes acne

Although any teen will tell you that chocolate cause's acne, studies going as far back as the 1960s have failed to show any relationship between chocolate consumption and acne. An extensive review in the Journal of the American Medical Association concluded that "diet plays no role in acne treatment in most patients even large amounts of chocolate have not clinically exacerbated acne."

The moral of the story is: Eat chocolate! Alas, eat it in moderation. An average 3-ounce bar of milk chocolate has 420 calories and 26 grams of fat, almost as much as a Big Mac — and that's a fact.

COCOA PROCESSING AND TECHNOLOGY

Bean selection and quality criteria

Chocolate manufacturers must follow a set of guidelines and quality criteria if they are to
produce products that maintain the consumers' loyalty to their products. Before processing,
the quality of beans is evaluated using two different methods. With the first technique, the
beans are assessed for the following indicators:

1. Degree of fermentation
2. Moisture content (maximum 6%)
3. Number of defects
4. Number of broken beans
5. Bean count (number per 100 g)
6. Degree of mouldiness
7. Flavour profile
8. Colour
9. Fat content (minimum 52%)
10. Fat quality relating to percentage of free fatty acids (as oleic acid)
11. Shell content (10–12%)
12. Uniformity of bean size
13. Insect and rodent in the second technique is evaluated based on the size of the beans using either bean count (Number of beans per 100 g) or the weight in grams of 100 beans. On the international cocoa Market, different bean sizes attract different prices. Beans with smaller sizes usually contain proportionately lower amount of nibs, higher shell content, lower fat content and attract lesser prices. Typically, beans from Asian origin have higher shell content than beans from West Africa. The bean cut test is used to assess defects and the degree of fermentation. In this process, a sample of 300 beans are randomly selected and split open longitudinally. The cut surfaces are then examined and assessed based on the following criteria:

1. Flat and shrunken beans
2. Mouldy beans
3. Slaty beans
4. Germinated beans
5. Degree of insect and rodent infestation

All these factors affect the flavour and taste of the finished products, for which the beans would be used. Good cocoa beans should be well fermented, dry and free from insect and rodent infestation, abnormal odours and contaminations/ adulterations. Another key criterion is the flavour quality. In this regard, considerations must be given to the desired quality of the finished chocolate and/or products upon which or in which the chocolate would be used. For instance, harsh cocoa and bitter notes are required to contrast a very sweet or heavily flavoured centre, using delicately flavoured beans such as Java bea. It is important to note that just because a bean comes from a flavour grade stock does not mean it will automatically improve a product's profile. The overall impact a Particular stock has on its inclusion upon the blend has to be carefully assessed. Also noteworthy is the fact that while beans are characteristically typed, flavour quality may vary from year to year, crop to crop, etc., and therefore requires a continuous assessment of availability of the beans before using them in recipe formulations The following are five examples of the varied selection of bean blends in assorted products types and explanations of the reasoning involved in their selections. For the industrial production of:

1. ***Milk chocolate***: The use of predominantly medium roast West African beans with Ecuadorian bean is advised. This blend would deliver a good clean cocoa note with nutty and slightly fruity undertones. It is important to note that the addition of the highly acidic Brazilian and Malaysian beans would negatively contrast with the milky notes desired.
2. ***Light milk chocolate***: This product could be made from lightly roasted Java beans that are known for their light colour and very mild overall flavour with distinctive nutty overtones. This would help attain a good standard

of identity for milk chocolate, as the coating would be several shades lighter than a 100% West African bean. It could be best used to complement very delicately flavoured centres.

3. ***High-quality semisweet chocolate***: The use of predominantly West African stock is advised for its cocoa character and slightly nutty undertones (light to medium roast) to heighten desirable notes and limit burnt/bitter notes. This blend when complemented by Caracas and Trinidad beans would contribute floral and slightly spicy notes to create balanced yet unique profile.
4. ***Harsh bittersweet chocolate***: This product is mainly designed for use on very sweet and highly flavoured cream centres as it produces very harsh and bitter coatings. If eaten alone, this coating may be harsh enough to be objectionable to many consumers. However, in a finished piece as described, it complements and balances the product's flavour. Delicate flavour grades would be wasted in such a product as they would be overridden fully by the bitterness, astringency and acidity of the blend.
5. ***Semisweet cookie drop***: The use the dominant West African beans is advised in this Product to provide a good cocoa impact. The strong profiles of the Brazilian and Sanchez Components complement and contrast the West African component. In this application, a robust flavour is desirable for contrast in the baked cookies.

Cleaning, breaking and winnowing

Before processing, cocoa beans are passed through the processes of cleaning, breaking and winnowing to obtain nibs of consistent quality. These processes also ensure that the nibs are cleaned (free from dirt and infestation), well broken and properly de shelled. The kernels (nibs) obtained after the process must be of uniform size to achieve constant quality. The process involves, first, sieving the beans and removing all extraneous materials such as stones, strings, coins, wood pieces, soil particles and nails. The cleaned beans are then broken to loosen the shells from the nibs using multiple steps to avoid an excess of fine particles. The products obtained are then sieved into smaller number of fractions to obtain Optimal separation during subsequent winnowing. The fractions are then transported to the Winnowing cabinet where the lighter broken shells are removed by a stream of air. The Breaking and winnowing steps are vital in separating the essential components of the bean, the nibs from the shells, and the shells are then discarded and sold for use as agricultural Mulch or as fertilisers. Strong magnets are then used to remove magnetic foreign materials from the nibs, which are then stored, awaiting further processing.

Sterilisation

Sterilisation is the technique of exposing the cocoa beans or nibs to sufficiently higher temperatures for a sufficiently long times to destroy all micro-organisms in the beans. Depending on the factory and equipment used, this process can either be done before or after the roasting process. The treatment can be done in a batch or continuous process by wetting or heating with steam, all micro-organisms that might have contaminated the nibs during the post-harvest processes of fermentation, drying, bagging and transportation. The process ensures that the Total Plate Count (TPC) is reduced to less than 500 per gram, and all pathogenic bacteria are destroyed. After sterilisation, the nibs can then be roasted directly (natural process) or can be alkalised first by the Dutch process before roasting. In situations where sterilisation is done after roasting, the heat treatment is used to ensure total destruction of heat-resistant bacteria and spores that might have survived the high temperatures of the roasting process. The procedure is to inject, over a period of about 20 seconds, a fine water spray of steam into the roasting drum at the end of the roasting period. This guarantees a considerable reduction in microbial count in the roasted nibs

Alkalisation

The technique of alkalisation was first introduced by a Dutchman known as van Houten in 1928 and therefore named it as the Dutch process. All cocoa, beans, nibs or liquor that is so treated is described as 'alkalised' or 'Ducted'. This consists of treating the cocoa nibs with an alkali solution such as potassium or sodium carbonate. The alkali is used to raise the pH of the beans or nibs from 5.2 to 5.6 to near neutrality at 6.8–7.5, depending on the alkali used, and the purposes are primarily to modify the colour and flavour of cocoa powder or cocoa liquor, and also improve dispersibility or suspension of the cocoa solids in water. During the process, the alkali solution is sprayed into the drum after it has been charged with the nibs, which is then slowly dried at a temperature below 100◦C (212◦F).

Roasting

Cocoa beans are roasted to develop further the original cocoa flavour that exists in the form of precursors generated during the processes of fermentation and drying of the beans. During roasting of the dried fermented beans, several physical and chemical changes take place, which include the following:

1. Loosening of the shells.
2. Moisture loss from the beans to about 2% final content.
3. The nibs (cotyledons) become more friable and generally darken in colour.
4. Additional reduction in the number of micro-organisms present in the beans. This helps attain food-grade products, such as cocoa butter, cocoa powder and cocoa liquor, which have stringent microbiological specifications.
5. Degradation of amino acids takes place and proteins are partly denatured. The natural reducing sugars are almost destroyed during degradation of amino acids.
6. Losses of volatile acids and other substances that contribute to acidity and bitterness. A large number of compounds have been detected in the volatile compounds including aldehydes, ketones, pyrazines, alcohols and esters. The substances that undergo only minimal changes are the fats, polyphenols and alkaloids explained that the degree of changes is related to the time and temperature of roasting and the rate of moisture loss during the process. The roasting temperature varies between 90 and 170◦C depending on the type of roasting adopted, being dry or moist roasting three main methods of roasting are employed within the

cocoa processing industry and these include the following:

1. Whole bean roasting
2. Nib roasting
3. Liquor roasting

Whole bean roasting is usually the traditional way of producing cocoa liquor. By this process, the beans are roasted first before winnowing to facilitate removal of the shells which are broken by high-speed impact against metal plates. During the process, the heat causes some of the fat to migrate into the shells, thus resulting in a loss of some cocoa butter. This is particularly important in the case of broken or crushed beans. Nib roasting is done by first removing the shells before roasting, and by this many of the limitations of whole bean roasting are overcome. This also makes it possible to treat the nibs with alkaline or sugar solution during roasting to help improve flavour development in certain types of cocoa. In liquor roasting, thermal pre-treatment is often used before winnowing for liquor roasting. The nib is then ground to liquor before roasting. The major disadvantage of both nib and liquor roasting is that the shell must be removed before it has been loosened from the nib by heating, and this may result in poor separation, especially with some type of cocoa. As a result, a variety of machines have been developed to thermally pre-treat the beans. These develop a high surface temperature and evaporate the internal moisture, which in turn builds up a pressure within the bean, causing the shell to come away from the nib.

Nib grinding and liquor treatment

Nib grinding involves milling of cocoa nibs to form cocoa liquor. The purpose is to produce as low a viscosity as possible to obtain smooth cocoa powder and chocolate taste during subsequent use of the liquor. The nib has a cellular structure containing about 55% cocoa butter in solid form locked within the cells. Grinding of nib cells releases the cocoa butter into liquor with particle size up to 30 μm, and for production of cocoa powder, fine grinding is particularly important. The viscosity of the liquor is related to the degree of roasting preceding the grinding and to moisture content of the nib. Many machines are used for reducing the nibs into liquor, and these include stone mills, disc mills, pin or hammer mills and bead or ball mills. The grinding is done in a multistage process, and the heat treatment generated during the grinding process causes the cocoa butter in the nib to melt, forming the cocoa liquor. The refined cocoa liquor is heated in storage tanks at a temperature of about 90–100◦C for aging and microbial destruction, after which the liquor is packaged for sale . Typically approximately 78–90% of cocoa butter is collected by pressing; residual lipids may be removed by supercritical fluid extraction.

Liquor pressing

Cocoa butter constitutes about half the weight of the cocoa nib. This fat is partially removed from the cocoa liquor by means of hydraulic presses applying pressures as high as520 kg/cm^2, and the larger presses take a charge of up to 113.4 kg per pressing cycle. Depending on the pressing time and the settings of the press, the resulting cake may have a fat content of between 10 and 24%. Two kinds of cocoa cake can be obtained by the process:

1. High-fat cake containing between 22 and 24% residual fat in the pressed cake
2. Low-fat cake containing between 10 and 12% residual fat in the pressed cake

The cocoa butter extracted is discharged into receptacles from which it is pumped into an intermediate tank for further processing.

Cake grinding (kibbling)

After pressing, the cakes released are quite big to handle and are therefore passed through kibbling machines to be broken down into smaller pieces, known as kibbled cake. The kibbled cake obtained is stored by fat content and degree of alkalisation, and may be blended before pulverisation to obtain the desired type of cocoa powder.

Cocoa powder production

The powder grinding lines usually comprise hammer-and-disc or pin mills, which pulverise cocoa cake particles into the defined level of fineness of cocoa powder. The powder is then cooled after pulverisation so that the fat of the cocoa powder crystallises into its stable form. This prevents any discolouration (fat bloom) and the formation of lumps in the bags after packing, a phenomenon that is caused by insufficient crystallisation of the fat at the moment of filli. The free flowing powder is then passed through sieves and over magnets prior to packing in bulk containers or four-ply multiwall paper bags lined with polyethylene.

CHOCOLATE MANUFACTURING PROCESSES

Chocolate manufacturing processes generally share common features such as:

(1) Mixing
(2) Refining
(3) Conching of chocolate paste
(4) Tempering and depositing
(5) Moulding and demoulding

The outcome sought is smooth textures of products considered desirable in modern confectionery and elimination of oral perceptions of grittiness.

Mixing

Mixing of ingredients during chocolate manufacture is a fundamental operation employed using time–temperature combinations in a continuous or batch mixers to obtain constant formulation consistency. In batch mixing, chocolate containing cocoa liquor, sugar, cocoa butter, milk fat and milk powder (depending on product category) is thoroughly mixed normally for 12–15 minutes at 40–50◦C. Continuous mixing is usually used by large chocolate manufacturers such as Nestl´e and Cadbury using well-known automated kneaders, producing somewhat tough texture and plastic consistency.

Refining

Refining of chocolate is important to the production of smooth texture that is desirable in modern chocolate confectionery. Mixtures of sugar and cocoa liquor (and milk solids depending on the type of chocolate) at an overall fat content of 8–24% are refined to particle size of less than 30 μm normally using a combination of two- and five-roll refiners. Final particle size critically influences the rheological and sensory properties.

Conching

Conching is regarded as the endpoint or final operation in the manufacture of bulk chocolate, whether milk or dark.

It is an essential process that contributes to development of viscosity, final texture and flavour. Conching is normally carried out by agitating chocolate at more than50◦C for few hours. In the early stages, moisture is reduced with removal of certain undesirable flavour-active volatiles such as acetic acid, and subsequently interactions between disperse and continuous phase are promoted. In addition to moisture and volatile acid removal, the conching processing promotes flavour development due to the prolonged mixing at elevated temperatures, giving a partly caramelised flavour in non-milk crumb chocolate. The process also aids reduction in viscosity of refiner pastes throughout the process, and reduction in particle size and removal of particle edges .The name of the equipment, the conche, is derived from the Latin word 'shell', as the traditional conche used in chocolate manufacture resembled the shape of a shell is an illustration of a Frisse conche. The Frisse conche is a typical example of an overhead conche used in modern chocolate industry. It consists of a large tank with three powerful intermeshing mixer blades, providing shearing and mixing action. Conching times and temperatures vary typically: for milk crumb 10–16 hours at 49–52◦C, with milk powder products 16–24hours at up to 60◦C, and with dark chocolates at 70◦C and continue up to 82◦C. Replacing full-fat milk powder with skimmed milk powder and butter fat, temperatures up to 70◦Cmaybe used . To give chocolate a suitable viscosity, additional cocoa butter and lecithin can be added towards the end of conching to thin or liquefy the chocolate prior to tempering

TEMPERING

The final process is called tempering. Uncontrolled crystallization of cocoa butter typically results in crystals of varying size, some or all large enough to be clearly seen with the naked eye. This causes the surface of the chocolate to appear mottled and matte, and causes the chocolate to crumble rather than snap when broken. The uniform sheen and crisp bite of properly processed chocolate are the result of consistently small cocoa butter crystals produced by the tempering process.

The fats in cocoa butter can crystallize in six different forms (polymorphous crystallization) The primary purpose of tempering is to assure that only the best form is present. The six different crystal forms have different properties.

Crystal	Melting temp.	Notes
I	17 °C (63 °F)	Soft, crumbly, melts too easily
II	21 °C (70 °F)	Soft, crumbly, melts too easily
III	26 °C (79 °F)	Firm, poor snap, melts too easily
IV	28 °C (82 °F)	Firm, good snap, melts too easily
V	34 °C (93 °F)	Glossy, firm, best snap, melts near body temperature (37 °C)
VI	36 °C (97 °F)	Hard, takes weeks to form

As a solid piece of chocolate, the cocoa butter fat particles are in a crystalline rigid structure that gives the chocolate its solid appearance. Once heated, the crystals of the polymorphic cocoa butter are able to break apart from the rigid structure and allow the chocolate to obtain a more fluid consistency as the temperature increases –the melting process. When the heat is removed, the cocoa butter crystals become rigid again and come closer together, allowing the chocolate to solidify.

The temperature in which the crystals obtain enough energy to break apart from their rigid conformation would depend on the milk fat content in the chocolate and the shape of the fat molecules, as well as the form of the cocoa butter fat. Chocolate with a higher fat content will melt at a lower temperature.

Making chocolate considered "good" is about forming as many type V crystals as possible. This provides the best appearance and texture and creates the most stable crystals, so the texture and appearance will not degrade over time. To accomplish this, the temperature is carefully manipulated during the crystallization.

Generally, the chocolate is first heated to 45°C (113 °F) to melt all six forms of crystals. Next, the chocolate is cooled to about 27°C (81 °F), which will allow crystal types IV and V to form. At this temperature, the chocolate is agitated to create many small crystal "seeds" which will serve as nuclei to create small crystals in the chocolate. The chocolate is then heated to about 31°C (88 °F) to eliminate any type IV crystals, leaving just type V. After this point, any excessive heating of the chocolate will destroy the temper and this process will have to be repeated. However, other methods of chocolate tempering are used. The most common variant is introducing already tempered, solid "seed" chocolate. The temper of chocolate can be measured with a chocolate temper meter to ensure accuracy and consistency. A sample cup is filled with the chocolate and placed in the unit which then displays or prints the results.

Two classic ways of manually tempering chocolate are:

- Working the molten chocolate on a heat-absorbing surface, such as a stone slab, until thickening indicates the presence of sufficient crystal "seeds"; the chocolate is then gently warmed to working temperature.
- Stirring solid chocolate into molten chocolate to "inoculate" the liquid chocolate with crystals (this method uses the already formed crystals of the solid chocolate to "seed" the molten chocolate).

Chocolate tempering machines (or temperers) with computer controls can be used for producing consistently tempered chocolate. In particular continuous tempering machines are used in large volume applications. Various methods and apparatuses for continuous flow tempering have been described by Aasted, Sollich and Buhler, three manufacturers of commercial chocolate equipment, with a focus now on energy efficiency. In general, molten chocolate coming in at 40–50°C is cooled in heat exchangers to crystallization temperates of about 26–30 °C, passed through a tempering column consisting of spinning plates to induce shear, then warmed slightly to re-melt undesirable crystal formations.

Chocolate defects

When a product has defect(s) in quality, it may either be rendered unwholesome due to food safety concerns or unacceptable in sensory character. In the case of the latter, it may be subjected to rework to meet expected or aspired sensory perceptions. Typically, two main types of defects occur in chocolates during post-processing handling, storage, warehousing and distribution. These include fat and sugar blooms.

Fat bloom

Fat bloom occurs when fat crystals protruding chocolate, or chocolate-flavoured coating surface, disturb the reflection of light and appears visible as a whitish film of fat, usually covering the entire surface, making the products unacceptable for marketing and consumption. Although fat-bloomed chocolate does not pose any public health or safety hazards to consumer, the process renders the product unappealing, and therefore renders it inedible. Fat bloom can be caused by the following:

1. Insufficient crystallisation during tempering
2. Recrystallisation without appropriate tempering
3. In homogeneity of the chocolate or chocolate-flavoured coatings
4. Differences in temperature between the chocolate and the centre
5. Incorrect cooling conditions
6. Fat migration
7. Touch, also known as touch bloom
8. Inappropriate storage conditions, i.e. humidity and temperature

When chocolate is poorly tempered, there is formation of the soft Form IV that transforms over a period to the denser and stable Form V, influenced by temperature. During this transformation, some cocoa butter remains in liquid state as the stable form (V) solidifies and contracts. This coupled with the release of thermal energy as more stable form (V) forms, the liquid fat forces between solid particles and onto the surface where large crystals impart a white appearance to the surface and recognized as fat bloom. Naturally, Form V transforms to the more stable Form VI, slowly over an extended period, again influenced by temperature. This process also results in formation of fat bloom. When optimally tempered products are stored under high Temperatures such as exposure to sunlight, chocolate melts, and during re-crystallisation, in the absence of seeding to ensure the direct formation of the stable form (V), a gradual transition from unstable to stable forms results in fat bloom. A fourth mechanism of fat blooming occurs with chocolates that have centres. Usually, liquid fat from the centres migrates and consequently reaches surfaces along with some cocoa butter. Re crystallisation of this cocoa butter results in fat bloom. Chocolate with nut centres is mostly predisposed to this type of bloom.

Sugar bloom

Sugar bloom occurs through either poor storage conditions (high humidity) or rapid transition of products from an area of low to high temperature. Both conditions result in sweating of the chocolate, which consequently dissolves sugar. As the surface water evaporates, sugar crystals remain on the surfaces, producing a white appearance. This phenomenon is often confused with fat bloom but is completely different. The difference can be established microscopically or whichever is simpler by heating the chocolate to 38◦C. Fat bloom disappears at this temperature, whereas sugar bloom remains visible.

TOP TEN MOST POPULAR CHOCOLATE BRANDS

Toblerone

Toblerone began in Switzerland as a chocolate treat only fit for royalty. Today the Toblerone chocolate brand extends around the world. Toblerone chocolate fans love the distinct prisms that are made from this chocolate. Each one packed full of cocoa, nougat, almonds, and honey all mixed perfectly together. It tastes as delicious as it sounds. Now, it is offered in different flavours such as white, pralines, plain, fruit & nuts, and honeycomb**.**

Guylian

The chocolate brand Guylian originated in Belgium. Now, its famous chocolate is offered in more than 40 countries worldwide. Guylian is best known for making handmade cocoa wafers. More so, Guylian is even better known for their chocolate seahorse which is the Guylian company logo. The Guylian seahorse's tail curves the opposite way than a real seahorse's tail. Also, winning the 2005 title for the biggest Easter egg of all time. It took over eight days to create and used over 50,000 chocolate seahorse bars. That is one huge egg; it made the Guinness Book of World Records.

Lindt & Sprungli

The Lindt & Sprungli chocolate brand is known all over the worlds for making the best white chocolate you have ever tasted. Originally founded in 1845 in Zurich. This company has one of the largest chocolate factories in the world. Taking deep care in the creation of their chocolate desserts using only milk, granular ingredients, and mixed with different flavourful fruits.

Ghirardelli

An Italian chocolatier Domingo Ghirardelli began making the beloved Ghirardelli chocolate brand in 1852. Some of the main ingredients are milk, cream, cocoa, and caramel. Who could resist such a sweet mixture made by the finest Italian craftsmen? The Ghirardelli chocolate brand is historic. Their current headquarters is currently based in the United States. Did you know that every year, Ghirardelli hosts an annual two-day festival displaying their most amazing milk chocolate disc? You will easily recognize Ghirardelli chocolate by the exquisite design on the chocolate. Truly making it one of a kind and one of the very best chocolate brands in the world.

Patchi

Patchi chocolate brand is one of the best-selling chocolate candy bars in the world. Their chocolate is known to be a perfect gift for a dear friend or loved one. Patchi is a combination of both Swiss and Belgium flavors. Truly a delight that is impossible to resist. The finest cocoa and fresh milk are known to be the chocolate brand's core ingredients. The beautiful packaging only increases the irresistibility.

Galaxy

Galaxy started its chocolate enterprise in 1986 from the same makers of the Mars chocolate brand. Galaxy chocolate is made with fresh milk and intense, dark cocoa but is magically entwined with delicious and sweet fruit flavors. It's hard to resist. The first time I saw Galaxy chocolate, I would not take my eyes off of the sweet

chocolate until it touched my taste buds. It is an irresistible chocolate brand of the highest quality.

Cadbury

John Cadbury began his famous chocolate industry in London in 1824. Who knew Cadbury would have come this far? Cadbury is a name recognized worldwide. Every person in the world known of the Cadbury bunny at Easter. Easter is one of the biggest times for selling chocolate and sweets. Although, Cadbury is a famous chocolate brand all year long. All made with milk, honey, cocoa, and fresh ingredients. It is easy to see why Cadbury is one of the most famous chocolate brands in the world.

Ferrero Rocher

There are many reasons why Ferrero Rocher made the top 3 spot on our list. It quite possibly may be the extravagant packaging or the delicious chocolate that everyone so dearly loves. Or maybe it's the fact that Ferrero Rocher has been a leader in the chocolate industry for nearly 200 years. Ferrero Rocher is delightful and sensational chocolate covered in a gold foil wrapping that looks like it should only be eaten by royalty. Every bite will satisfy you from the wafer to the caramel topping, purely mouth watering.

Kit Kat

Give me a break, give me a break. Break me off a piece of that kit kat bar. The famous chocolate brand Kit Kat has hit the number two spot on our list by more than the catchy jingle that goes along with the classic chocolate bar. Thin wafers covered in milk chocolate, delicious, plus, you can break them into pieces to save for later or share with family or friends. My sister and I used to love this treat as children. It was easy to divide between us. Plus, we loved to savor every last drop. Beginning in 1935 as Kit Cat renamed Kit Kat. It has become a household name and has different flavours to satisfy everyone's taste. My personal all time favorite chocolate bar is the Kit Kat white chocolate. Oh, I love it!

Mars

The number one spot, Mars chocolate brand. The Mars chocolate bars are the number one selling chocolate brand across the globe. In my book, that makes it the most famous chocolate brand of all time. Mars bars are absolutely delicious. This chocolate brand got its start in the United Kingdom nearly 100 years. It's timeless recipe of honey, caramel, nougat, minced almonds. The packaging is in perfect little boxes making the Mars chocolate brand a great gift. Like every other famous chocolate brand, Mars developed more than one flavour. Including the flavour variety of Almond, Dark, Light, Midnight, Lava, and The Fling. Customers stay happy having Mars' own versions of Snickers and Milky way. Mars had my vote and had made our list of the top most famous chocolate brand of all time.

HEALTH BENEFITS OF CHOCOLATE

1. It can help your heart to stay healthy

Lots of studies reveal that the flavonoids in chocolate can help your veins and arteries to stay supple. Over 7 studies followed 114,000 participants who were given a few servings of dark chocolate a week. The results showed that their risk of getting a heart attack was reduced by about 37% while the chances of getting a stroke were 29% less when they had a higher consumption of chocolate.

2. It may help improve your memory as you get older

Research has shown that when elderly people were given specially prepared cocoa extracts which was high in flavanols, their cognitive function greatly improved. The only problem is that when it comes to eating chocolate, the percentage of those cocoa flavanols is much reduced due to the processing and the addition of eggs, sugar and milk.

3. It can help to avoid sunburn

One study conducted in London found that women who were given chocolate with high flavanol content were able to withstand double the amount of UV light on their skins without burning, compared to those on lower doses.

4. It may make you better at math

I was never good at math at school. Maybe I should have eaten more dark chocolate! This is the startling conclusion I have reached after reading about the research of Professor David Kennedy who is Director of Brain, Performance and Nutrition at the Research Center of Northumbria University (UK). Participants were given 500 mg of flavanols in a hot cocoa drink. They benefited from increased flow to the brain as a result and were better at coping with difficult math equations.

5. It may put you in a better mood

I wish my uncle had given my aunt some chocolate when he told her to stop crying and to 'cheer up.' He obviously had not read about the work at the University of Swinburne in Australia. These guys again targeted the cocoa polyphenols and they found that it had a beneficial effect on the mood of the participants who were calmer and happier.

6. It may help lower cholesterol levels

The Journal of Nutrition carries an interesting article about the results of a study done to determine whether dark chocolate could have any effect on the LDL cholesterol levels. They found that when subjects were given bars of dark chocolate with plant sterols and flavanols, they were getting lower scores on their cholesterol levels.

7. It may help people with Alzheimer's disease

As we know, the nerve pathways to the brain get damaged when Alzheimer's disease strikes, causing severe loss in certain mental functions. It is fascinating to read about how one extract from cocoa, called lavado, can actually reduce the damage done to these vital pathways.

8. It can help you with your workout

Another magical flavanol in chocolate is epicatechin. Mice were given this substance and they were much fitter and stronger than those mice on water only. Researchers say that to get the best you have to limit the amount to only about half of one square of chocolate a day! If you have too much, it could undo the beneficial effects

9. It is very nutritious

Did you know that if choose chocolate with a high cocoa content (75% to 85%) you are getting a very nutritious snack? Take the typical 100 gram chocolate bar. It has almost all of your RDA for copper and manganese. It contains over half your magnesium RDA and about two thirds (67%) of your RDA for iron. It also has about 10% of fiber. There is also lots of zinc, selenium and potassium too.

10. It can help to lower your blood pressure

You may not know it but having the right amount of NO (Nitric Oxide) in your body can help your arteries to relax. That will, in turn help to take some of the pressure off them and the result is a lower BP count. Just another benefit of the dark chocolate flavanols which help to produce this vital Nitric Oxide.

11. It helps you produce more endorphins

When you are on a high, it may be due to excitement, love or after exercise. This high is due to the release of endorphins which are brain hormones. The great advantage of chocolate is that flavanols can also help in endorphin production without having to run a marathon! Endorphins play a key role in helping to prevent depression and other mental disorders.

12. It may reduce pregnancy complications

One of the complications of pregnancy is known as preeclampsia in which blood pressure can shoot up. Researchers have established that one of the chemicals in dark chocolate, thebromine, can stimulate the heart and help the arteries dilate. When pregnant women were given higher doses of chocolate, they had a 40% less chance of developing this complication.

13. It may help with diabetes

You probably think that chocolate is too sweet for diabetics and is one of their banned treats, but one small study at the University of L'Aquila in Italy found that the right does of chocolate flavonoids can help the body's metabolism and enhance insulin function. This could benefit people with diabetes but more studies need to be done.

14. It may help you reduce your food cravings

You know the feeling: you cannot function until you have a snack. One of the healthiest is a piece of dark chocolate because it fills you up quicker and reduces craving for salty and sweet snacks, according to a small research study.

15. It may help your cough

Another marvelous effect of the theobromine chemical in chocolate is that it can calm a troublesome cough. Manufacturers are looking at this to produce safer cough syrups instead of using codeine which has some undesirable side effects.

16. It may help with blood circulation

Normally you take an aspirin to help prevent blood clotting and to improve circulation. Studies now show that chocolate can have a similar effect.

17. It can also help you see better

University of Reading researchers were curious to see if dark chocolate flavanols could actually improve vision as they knew it certainly improved blood circulation in general. They decided to do a small experiment and gave two groups of volunteers some white and dark chocolate. The dark chocolate groups were doing better on vision tests afterwards.

18. It may help reduce fatigue

If you suffer from Chronic Fatigue Syndrome you should try adding chocolate to your daily diet. One group of sufferers were given a daily dose of chocolate for two months. They were less tired and the best news of all is that they did not put on any extra weight

19. It may help to lower your Body Mass Index

There has been a lot of emphasis on how chocolate can actually reduce your BMI (Body Mass Index) which is how you measure up as regards your height versus your weight. One study took 1,000 Californians and they found that those who ate chocolate more often during the week had a lower BMI. Overall diet and exercise regimes were not factors which influenced this result.

20. It may help reduce your chances of getting cancer

As we have mentioned, the cocoa flavanols in dark chocolate have both anti-inflammatory and antioxidant properties. These are important in keeping the actions of free radicals at bay. As we know, these are the protagonists when cancer starts to invade cells.

Tips for Storing Your Chocolates

Chocolate is very sensitive to temperature and humidity. Ideal storage temperatures are between 15 and 17 °C (59 and 63 °F), with a relative humidity of less than 50%. If refrigerated or frozen without containment, chocolate can absorb enough moisture to cause a whitish discoloration, the result of fat or sugar crystals rising to the surface. Various types of "blooming" effects can occur if chocolate is stored or served improperly.

Chocolate bloom is caused by storage temperature fluctuating or exceeding 24 °C (75 °F), while sugar bloom is caused by temperature below 15 °C (59 °F) or excess humidity. To distinguish between different types of bloom, one can rub the surface of the chocolate lightly, and if the bloom disappears, it is fat bloom. Moving chocolate between temperature extremes can result in an oily texture. Although visually unappealing, chocolate suffering from bloom is safe for consumption. Bloom can be reversed by re tempering the chocolate or using it for any use that requires melting the chocolate.

Chocolate is generally stored away from other foods, as it can absorb different aromas. Ideally, chocolates are packed or wrapped, and placed in proper storage with the correct humidity and temperature. Additionally, chocolate is frequently stored in a dark place or protected from light by wrapping paper.

- **DON'T REFRIGERATE!** Chocolate easily absorbs odours of whatever's in the refrigerator (Roquefort cheese, lamb curry — you get the idea). Moisture in the fridge can also lead to "sugar bloom," meaning the sugar rises to the surface and discolours the chocolate (which has no effect on flavour, but doesn't look too appealing). So instead of the fridge:
- **Store it in a cool, dry place.** When chocolate is kept at a consistent temperature below 70°F (ideally between 65 and 68°F), and at a humidity of less than 55%, the emulsion of cocoa solids and cocoa butter will stay stable for months.
- **But even in a cool, dry place:** Remember that cocoa butter (the vegetable fat in chocolate) picks up the smell of whatever's around it. So unless you want your bonbons and bars to taste like vanilla extract or garlic powder, follow the next rule:
- **Seal them in an air-tight container.** Oxygen does just what you'd expect it to — it oxidizes chocolate, which causes less-than-ideal flavours to develop. And although

chocolates are not known to be a favorite food of vampires...

- **Keep them away from the light!** Not just sunlight (unless you **want to make fondue**), but also artificial light. They both cast the same kind of bad-flavour spell as oxygen does.
- **Stored this way, chocolate will last a while:** Solid **milk chocolate** keeps for over a year; solid dark keeps for nearly two years; and white for four months. Filled chocolates, **such as truffles**, keep for about three to four months (unless they're full of preservatives).
- Of course, **our chocolates** never contain any preservatives or additives, so be sure to eat them while they're fresh! Or, if you have a large supply, create a candy buffet and invite your friends over to share. *(At right, a chocolate buffet adds a **perfect touch to weddings and parties**.)*
- **Sometimes, you have to refrigerate:** Summer's hot, and not everyone uses air conditioning. But before you put chocolate in the fridge, first wrap it tightly to protect against odors and condensation, then seal it in an airtight container. When you take it out, let it come back to room temperature before unwrapping. This will keep your chocolates edible for anywhere from three to six months.
- **And if you need to store it longer:** For durations of six months to a year, the freezer can be your friend. Follow the instructions above for placing your chocolates in the refrigerator. Once a full 24 hours have gone by, move the container from the fridge to your freezer (this avoids temperature shock, and helps preserve texture). To remove from the freezer — just reverse the steps. Move from freezer to fridge, wait a full 24 hours, remove from the fridge, and let come to room temperature before you finally unwrap them. (Always eat your chocolate at room temperature, especially truffles!)

CONCLUSION

Chocolate is enjoyed by consumers by all over the world due to its unique taste, texture and aroma .It can be made in the form of a liquid, paste or in a block, or used as a flavouring ingredient in other foods. Chocolate manufacturing is complex and requires several technological operations and processes to achieve the desired product quality. During processing, the properties, rheological behaviour and sensory perception of chocolate are influenced largely by its processing techniques, particle size distribution and ingredient composition. The cocoa chocolate contains healthy components which include flavonals, antioxidants and oleic acid. Chocolate has so many advantages, but don't eat too much because everything with too much will give bad results. Chocolate is healthy for you in moderation. Chocolate flavour resides not only in a volatile aromatic fraction of flavour-active components but also in non-volatile compounds influencing taste perception. Its complex composition depends on the cocoa bean genotype, specifically on contents of bean storage proteins, polysaccharides and polyphenols. The inheritance and regulation of such flavour origins remain an area for advanced research. Enzymic and microbial fermentations after harvest induce physical and chemical changes in beans over 5–7 days with key browning reactions of polyphenol with proteins (12–15% total) and peptides, giving colours characteristic of cocoa. Drying limits mould growth during transportation and storage, reducing bean moisture content from 60 to 8%. Sun drying is favoured for flavour development and can be carried out above or on hard surfaces, with differences in airflow and final moisture content. Beans are transported under controlled storage conditions to chocolate manufacturing sites,or processed in the origin country to add value with requirements for traceability in quality assurance. Following critical review of the entire process, a summary of the parameters important for chocolate flavour generation has been developed. An appropriate starting composition can be converted through controlled post-harvest treatments and subsequent processing technologies to a high-quality flavour character. Cocoa bean fermentation is crucial to not only the formation of key volatile fractions (alcohols, esters and fatty acids)but also provision of flavour precursors (amino acids and reducing sugars) for important notes contributing to chocolate characters. Drying reduces levels of acidity and astringency in cocoa nibs by decreasing the volatile acids and total polyphenols. Chocolate manufacturing is complex and requires a combination of several ingredients and technological operations to achieve the desired rheological, textural and melting qualities. However, the extent to which the formulated ingredients and the applied processing operations, such as refining and conching, influence these quality characteristics remains quite unclear to processors and therefore requires in-depth investigations to elucidate their effects.

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