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A REVIEW ON DARK CHOCOLATE FORMULATION FOR OBESITY MANAGEMENT

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1. Abstract :

Obesity Is A Medical Condition Characterized By An Overabundance Of Body Fat. It Is A Long-Term Condition With Complicated Interplay Between Genetic And Environmental Influences. It Is Being Done.Marked By Elevated Cholesterol, Fatty Acid Concentrations, Insulin Resistance; Increased Blood Tension; And Excessive Accumulation Of Fat Tissue.

At Present, Over 1 Billion Adults Struggle With Being Overweight, And At Least 300 Million Of Them Are Considered Clinically Obese. It Is Specified.Via Body Mass Index And Additionally Assessed Through Both Percentage Body Fat And Overall Body Overweight.

Obesity Poses A Threat To Various Secondary Issues Such As Cardiovascular Disease, Insulin

Pathological Resistance, Retinopathy, Neuropathy, And Malignancy. Different Elements Factors Influencing The Progression Of Obesity Include Age, Gender, Smoking, Hormone Growth Levels,Muscle Metabolism In The Skeleton.

Obesity Is A Complicated, Multifactorial Issue With Increasing Worldwide Prevalence And Few Long-Term Medication Options That Are Both Safe And Satisfactory For Patients. Dark Chocolate—High In Cocoa Polyphenols (Flavonoids), Methylxanthines (Caffeine, Theobromine), And Bioactive Lipids—Has Been Studied For Its Possible Positive Impacts On Appetite Control, Energy Metabolism, Insulin Sensitivity, And Gut Microbiota Composition. Given That Chocolate Is A Popular And Enjoyable Product, It Serves As An Appealing Medium For Administering Bioactive Substances Aimed At Managing Obesity.

Formulation Of Dark Chocolate Includes The Ingredients Like Cocca Material, Cocca Beans, Methanol, Ethanol, Cocca Butter, Curcumin, Caffeine .

Recent Studies Indicate That Cacao Polyphenols Could Boost Cerebral Blood Circulation, A Factor Linked To Enhanced Cognitive Performance. For Example,

Consistent Intake Of These Substances For Months Has Been Demonstrated To Enhance Blood Volume In Brain Regions Associated With Memory.

Dark Chocolate May Contribute To Obesity Management Because Of Its Abundant Bioactive Compounds, Including Flavonoids (Notably Epicatechin And Catechin), Theobromine, Caffeine, And Beneficial Fats Extracted From Cocoa. These Substances Have Various Physiological Impacts That Might Aid In Weight Management Via Metabolic, Hormonal, And Behavioral Processes.

Dark Chocolate May Affect Hormones Related To Appetite, Including Ghrelin (The Hunger Hormone) And Leptin (The Satiety Hormone). Eating Dark Chocolate Has Been Shown To Decrease Cravings And Enhance Feelings Of Fullness, Resulting In A Reduced Total Caloric Consumption. The Pleasure From Sensory Experiences And The Gradual Digestion Of Dark Chocolate's Fat Also Help Decrease Snacking Habits.

Dark Chocolate Enhances Mood By Promoting The Release Of Serotonin And Endorphins, Which May Lower Stress-Induced Or Emotional Eating—Often A Contributing Factor To Obesity.

2.Key Words : Overweight, Body Mass Index ,Metabolic Syndrome, Insulin Resistance, Energy Balance ,Dark Chocolate, Weight Reduction**.**

3.Introduction:-

Obesity Has Emerged As A Significant Public Health Issue Worldwide, Characterized By Its Concerningly High Rates And Growing Prevalence, As Well As Its Contribution To The Development Of Numerous Chronic Diseases.(1)

Obesity And Overweight Are Characterized By Abnormal Or Excessive Fat Buildup That May Have Negative Health Effects.(2)

Since 1975, The Prevalence Of Obesity Has Tripled Worldwide. In 2016, It Was Estimated That Over 1.9 Billion Adults Who Were 18 Years Of Age Or Older Were Overweight, With 600 Million Of Them Being Obese. Furthermore, It Was Shown That Low- And Middle-Income Nations Have A High Prevalence Of Overweight And Obesity, Particularly In Metropolitan Areas.(3)

"Insufficient Physical Activity Combined With Unhealthy Eating Habits Has Been Shown To Play A Major Role In The Rising Rates Of Obesity And Its Related Health Complications."(4)

Consequently, The Beneficial Elements Of Eating Chocolate Might Be Concealed By The Harmful Impacts Of Specific Ingredients, Highlighting The Necessity For A Comprehensive Evaluation Of Chocolate Composition. Authentic Dark Chocolate Should Consist Of Cocoa Bean Solids That Account For As Much As 80% Of The

Overall Weight Of The Chocolate, Along With Cocoa Butter.In Comparison, Milk Chocolate Contains Significantly Less Cocoa (At Least 20–25%) And Has Sugar, Milk Powder, And Lecithin Added. Additionally, White Chocolate Does Not Contain Cocoa Solids At All.(5)

Recent Research In The US And Europe Has Pointed Out The Heart Health Advantages Of Dark Chocolate, Leading Producers To Investigate Specific Processing Methods Designed To Keep These Important Flavonoids Intact. Conventional Roasting And Fermentation Methods Can Reduce These Beneficial Compounds By As Much As 75%, Resulting In An Increasing Focus On Techniques That Preserve The Nutritional Benefits Of Cacao.(6)

It Includes Theobromine, A Compound Similar To Caffeine That Serves As A Gentle Stimulant. Dark Chocolate Generally Contains Higher Levels Of Theobromine—Approximately 10 G/Kg—Compared To Milk Chocolate, Enhancing Its Stimulating Impact On The Nervous System. Furthermore, Cacao Polyphenols Such As Epicatechin And Catechin Are Associated With Antioxidant Benefits That Promote Brain Health.(7)

The Link Between Chocolate Intake And Cognitive Performance Is Extensively Researched, With Evidence Suggesting That Regular Consumption Of Cacao Polyphenols May Enhance Mental Sharpness, Especially During Times Of Stress Or Fatigue. However, The Impacts Of Short-Term Consumption—Like Those From Chocolate Rich In Cacao Polyphenols—Are Still Under Investigation. While Certain Studies Indicate Improved Cognitive Ability After A Single Serving, Others Observe No Notable Effect, Highlighting The Necessity For Additional Research.(8)

Numerous In Vitro And In Vivo Research Studies Have Demonstrated That Polyphenols, Which Possess Antioxidant, Anti-Inflammatory, And Anti-Obesity Characteristics, Can Enhance Energy Expenditure And Thermogenesis, As Well As Reduce Oxidative Stress And Inflammation, While Aiding In Weight Loss Management.(9)

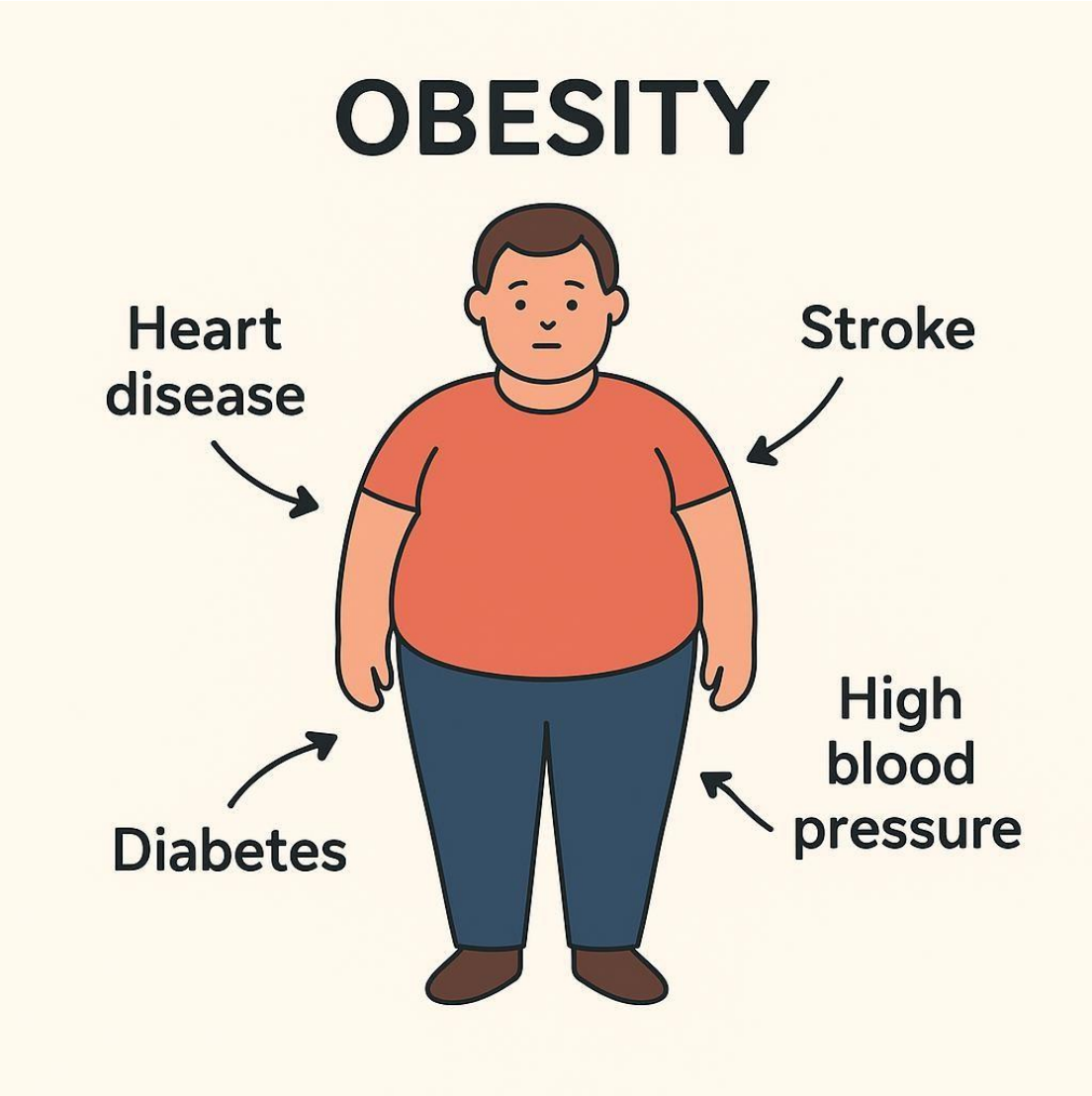
The Main Methods For Managing Obesity Include Dieting And Engaging In Physical Activity. To Add To This, Or In The Event Of In Case Of Failure, Anti-Obesity Medications Can Be Used To Curb Appetite Or Block Fat Absorption.

In Critical Situations, Surgery Is Conducted Or An Intragastric Balloon Is Inserted To Diminish (10) Obesity Is A Long-Term Metabolic Condition Marked By An Overabundance Of Body Fat That Threatens Health.

The World Health Organization (WHO) Characterizes Obesity As Having A Body Mass Index (BMI) Of 30 Kg/M^2 Or Higher. BMI Is Determined By Taking Body Weight In Kilograms And Dividing It By The Height In Meters Squared (Kg/M^2). People With A BMI Ranging From 25 To 29.9 Are Labeled As Overweight, Whereas Those With A BMI Of 30 Or Higher Are Classified As Obese.

Obesity Arises Due To A Mix Of Genetic, Environmental, Behavioral, And Metabolic Influences. Poor Dietary Choices, Lack Of Physical Activity, Calorie-Dense Diets, And Inactive Lifestyles Play A Major Role In Weight Increase. Hormonal Imbalances (Like Hypothyroidism And Cushing's Syndrome) And Some Medications Can Also Lead To Obesity.

This Condition Is Linked To A Higher Risk Of Various Non-Communicable Illnesses, Such As Type 2 Diabetes, High Blood Pressure, Heart Diseases, Fatty Liver, Osteoarthritis, And Specific Cancers. It Also Has Detrimental Effects On Mental Health, Resulting In Low Self-Worth, Depression, And Societal Stigma.(11-12)

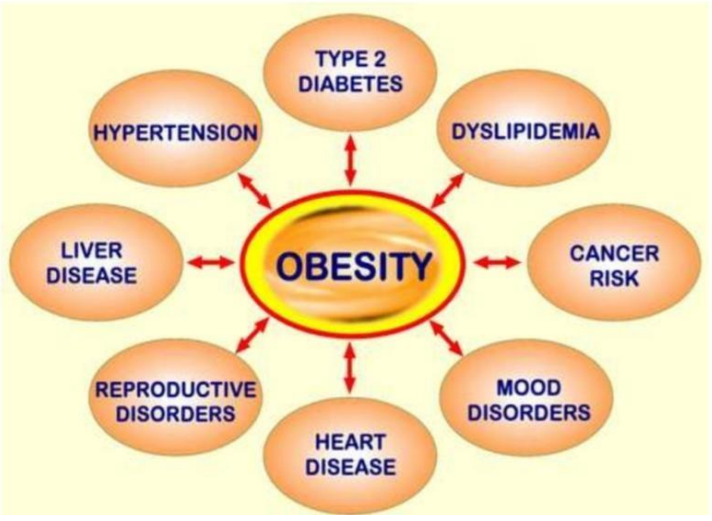


1) Heart Disease – Excess Weight Elevates Cholesterol, Boosts Blood Pressure, And Results In Fat Accumulation In Arteries, Causing Heart Issues Such As Coronary Artery Disease

2) Diabetes – Excessive Body Fat, Particularly In The Abdominal Area, Results In Insulin Resistance, Resulting In Type 2 Diabetes.

3) High Blood Pressure (Hypertension) – Extra Fat Forces The Heart To Exert More Effort To Circulate Blood, Increasing Blood Pressure.

4) Stroke – Accumulation Of Fats And Elevated Blood Pressure Can Harm Blood Vessels And Lessen Blood Flow To The Brain, Heightening The Risk Of Stroke(13)



4. Types Of Obesity

a) Based On Fat Distribution

Types	Description
1) Android Obesity (Central Or Abdominal)	Fat Primarily Gathers In The Abdominal Area And Upper Body.Elevated Chance Of Cardiovascular Disease, Diabetes, And High Blood Pressure.
2) Gynoid Obesity (Peripheral)	Fat Builds Up In The Hips, Thighs, And Buttocks.Reduced Likelihood Of Metabolic Disorders In Comparison To Android Obesity
3) Mixed Type Obesity	Fat Is Spread Across The Body (In Both Upper And Lower Areas).

b) Based On Cause

Types	Description
1) Primary (Exogenous) Obesity	Resulting From Excessive Eating And Insufficient Physical Exercise.As A Result Of Consuming More Calories Than The Body Uses.. Example : Obesity Due To Junk Food
2) Secondary ((Endogenous) Obesity	Resulting From Illnesses, Hormonal Imbalances, Or Drugs.. Example : Hypothyroidism, Pcos

c)Based On Age Of Onset

Types	Description
1) Childhood Onset Obesity	Starts In Early Years.Resulting From Excessive Nutrition And Insufficient Physical Activity.Entails A Rise In The Quantity Of Fat Cells (Hyperplastic Obesity).Difficult To Undo
2) Adult Onset Obesity	Happens After Reaching The Age Of 20.Resulting From Poor Diet, Stress, And Hormonal Shifts.Entails Growth In The Size Of Fat Cells (Hypertrophic Obesity).Simpler To Decrease Through Diet And Physical Activity.

d)Based On Fat Cell Change

Types	Description
1) Hypertopic Obesity	Adipose Cells Grow In Volume.Frequent Among Adults.Simpler To Address.
2) Hyperplastic Obesity	The Quantity Of Fat Cells Rises.Prevalent Among Children.Challenging To Address.

e)Based On Metabolic Health

Types	Description
1) Metabolically Healthy Obesity	The Individual Is Overweight Yet Maintains Normal Levels Of Blood Sugar, Blood Pressure, And Cholesterol.
2) Metabolically Unhealthy Obesity	An Individual Is Overweight And Additionally Suffers From Diabetes, High Blood Pressure, Or Elevated Cholesterol Levels.

(14 - 21)

- **Risk Factor For Obesity**

1) Genetic Factors
2) Poor Diet
3) Lack Of Physical Activity
4) Age
5) Medication (22)

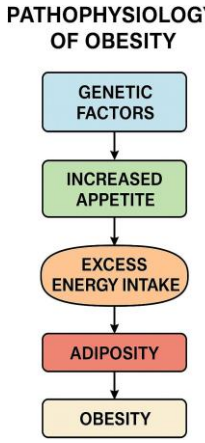
Sign And Symptoms

1) Increase Body Weight
2) Shortness Of Breath
3) Excessive Body Fat
4) Fatigue
5) Excessive Sweating
6) Joint Pain And Back Pain
7) Skin Problem
8) Increase Hunger
9) Difficult In Movement

5.)Causes Of Obesity

Causes	Description
1) Genetic Factors	Family Background Of Obesity Raises The Risk.Some Genes Influence How The Body Accumulates And Utilizes Fat.Example: Mutations In The LEP (Leptin) Or MC4R (Melanocortin-4 Receptor) Genes.
2) Lifestyle Factors	Unhealthy Eating Habits: Excessive Consumption Of Calorie-Dense Foods, Convenience Meals, Sweetened Beverages, And Processed Treats Insufficient Physical Activity: A Sedentary Way Of Living Lowers Energy Output.Consuming Excessive Amounts Of Food Or Inconsistent Eating Habits
3) Environment Factors	Convenient Availability Of Calorie-Dense, Nutritionally-Poor Foods.Absence Of Secure Spaces For Physical Activity Or Strolling.Impact Of Advertisement And Food Promotion
4) Psychological Factors	Emotional Strain, Sadness, And Anxiety May Result In Emotional Eating Or Excessive Eating.Lack Of Sleep Affects Hormones That Regulate Hunger (E.G., Imbalance Of Ghrelin And Leptin)
5) Medical Causes	Disruptions In Hormones Or The Endocrine System Such As: Thyroidcushing's Disorder, Polycystic Ovarian Syndrome (PCOS)Some Medications (Antidepressants, Corticosteroids, Antipsychotics) May Lead To Weight Gain.
6) Socioeconomic Factors	Limited Income Can Restrict Access To Nutritious Foods. The Level Of Education Affects Knowledge Regarding Nutrition And Fitness
7) Genetic Environment Interaction	Individuals With A Genetic Predisposition To Gain Weight Might More Readily Develop Obesity When Subjected To An Unhealthy Setting.

(23-26)



8)Dark Chocolate :

While The Phrase "Dark Chocolate" Does Not Have A Specific Meaning Concerning Cocoa Levels, It Is Generally Employed To Describe To Chocolates Containing Elevated Cocoa Percentages. In The Research Introduced, Chocolates With 70% And 90% Cocoa Levels Are
Referred To As "Dark Chocolates," A Term That Is Rather Deceptive,Since They Vary In The Levels Of Substances Linked To Their Beneficial Health Effects(27)
However, The Research Indicates That The Positive Effects Of Chocolate Consumption Are Primarily Attributed To Polyphenols, Which Constitute 10–15% Of The Dry Weight Of A Cocoa Bean(28- 30)
Chocolate Is A Food That Has A Rich Past. In A Distinctly Different Shape Different From That Used By Contemporary
Individuals,Chocolate Has Its Origins In Mesoamerica. It Was Utilized By Ancient Aztecs As A Valuable Medicine For Various Conditions Or As A General Remedy.Tonic, As Mentioned In The Badianus Manuscript, The Princton Codex And The Codex Florentinus. The Final One, Composed In 1590,Includes A Vast Array Of Medical Applications Gathered By A Spanish Clergyman From The Community. It Appears That Even Montezuma Utilized Chocolate For Its Effects On Enhancing Sexual Desire, Fertility,And Durability(31)

6)History Of Chocolate :

Chocolate Arrived In Europe During The 16th Century. Since That Time, The Contemporary Chocolate Sector Has
Cocoa Seeds Are Now Processed In Various Methods. Chocolate Is The Sweetest Frequently Desired Food Globally (Weingarten HP And Elston D, 1991)
Historically, Because Of Chocolate's Health Benefits, It Was Deemed The Beverage Of The Gods, Leading To The
The Cocoa Tree's Scientific Name, Theobroma Cacao, Originates From The Greek Terms 'Theo'means 'God' And 'Broma' Refers To 'Beverage'.
The Theobroma Cacao Tree And Its Dried Seeds Before They Are Processed Are Referred To As 'Cacao' In American English; Once Processed, Specifically Through Roasting And Grinding, The Term 'Cocoa' Is Utilized. And
The 'Chocolate' Is A Food Made From Roasted Cacao Seeds.(32)

7.)Health Benefits Of Dark Chocolate For Treatment Of Obesity :

Dark Chocolate, Especially Types With A Cocoa Content Of 70% Or Higher, Has Bioactive Substances Like Flavonoids, Polyphenols, Catechins, And Theobromine, Which May Help In Addressing Obesity And Associated Metabolic Issues.

a) Enhances Fat Metabolism :

Dark Chocolate Aids In Lowering LDL (Bad Cholesterol) While Boosting HDL (Good Cholesterol) Levels. Cocoa Polyphenols Prevent Lipid Peroxidation And Enhance Healthy Fat Metabolism, Aiding In The Reduction Of Fat Buildup In Adipose Tissues.

b). Improves Insulin Sensitivity :

The Flavonoids Found In Dark Chocolate Enhance Insulin Sensitivity And Promote Glucose Absorption In Cells.
This Aids In Controlling Blood Sugar Levels And Lowers The Likelihood Of Insulin Resistance, A Frequent Contributor To Obesity.

c.) Decreases Hunger And Desires :

Eating Dark Chocolate Enhances The Sensation Of Fullness By Affecting Hormones That Regulate Appetite, Like Ghrelin And Leptin.
This May Aid In Lowering Calorie Consumption And Avoiding Excessive Eating.Antioxidant And Anti-Inflammatory Properties :

The High Levels Of Antioxidants In Dark Chocolate Counteract Free Radicals And Lessen Oxidative Stress, Associated With Chronic Inflammation In Obesity.
These Characteristics Contribute To Enhancing Overall Metabolic Health.

d) Improves Mitochondrial Performance :

Cocoa Flavanols Enhance Mitochondrial Performance In Skeletal Muscles, Leading To Improved Fat Oxidation And Increased Energy Expenditure.

e) Decreasing Stress :

Dark Chocolate Elevates Serotonin And Endorphin Levels, Alleviating Stress And Emotional Eating — An Essential Component In Managing Obesity.

8)Role Of Cocca Material :

Function: Main Matrix And Origin Of Cocoa Flavanols/Polyphenols (Epicatechin, Catechin, Etc.). Flavanols Possess Antioxidant And Anti-Inflammatory Properties And Might Slightly Influence Insulin Sensitivity, Fat Oxidation, And Certain Anthropometric Indicators.Common Usage: High-Cocoa (≥70%) Powder Or Nibs To Enhance Polyphenol Content While Minimizing Added Sugar(37)

Active Pharmaceutical Ingredients Used In Dark Chocolate For Management Of Obesity :

API (Active Pharmaceutical Ingredients)	**Role In Chocolate Formation**
1) Caffeine	Added As Metabolic Stimulant
2) Curcumin	Added As Bioactive Antioxidants

(38-39)

9)Conclusion :

The Review Might Determine That Obesity Is A Complex Disease Influenced By Multiple Factors And It Is Marked By Excess Fat Deposits, Elevated BMI. It Happened Because Of An Imbalance.In Calorie Consumption And Dietary Habits. The Evaluation Can Be Conducted Utilizing A Fat Diet.

Models Of Obesity Induced By Genetics And Viruses. Consequently, The Assessment And Exploration Of Novel Therapeutic Approaches Are Needed To Avert This Global Co-Morbidity.

Dark Chocolate Can Serve As A Functional Food For Managing Obesity When Prepared With Nutritious Components And Eaten In Moderation. The Incorporation Of Curcumin And Caffeine Improves Its Fat-Burning And Anti-Inflammatory Effects, Rendering It A Flavorful And Advantageous Addition To A Healthy Diet And Exercise Regimen.

When Correctly Formulated, It Can Aid In Appetite Regulation, Fat Metabolism, And Enhancement Of Insulin Sensitivity, Which Are Essential Aspects Of Obesity Management. Adding Curcumin And Various Natural Nutraceuticals To Dark Chocolate Boosts Its Anti-Inflammatory And Metabolic-Regulating Properties.

The Cocoa Butter Matrix Serves As An Excellent Medium For The Delivery Of Lipophilic (Fat-Soluble) Bioactive Compounds, Enhancing Their Stability And Absorption. Nonetheless, Due To Its High Calorie Content, Dark Chocolate Should Be Consumed In Moderation Alongside A Healthy Diet And Regular Exercise.

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