



Schools: Implications of Empty Calories on the Health and Wellbeing of Youngsters

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Abstract: Background: The consumption of empty calories, characterized by high levels of added sugars, solid fats, and sodium, has become a widespread phenomenon among school youngsters. This review aims to synthesize the existing literature on the implications of empty calories on the health and wellbeing of school youngsters. Methods: A comprehensive review of existing literature was conducted, including studies published in peer-reviewed journals and grey literature. The review focused on the effects of empty calories on physical and mental health, academic performance, and social wellbeing. Results: The review revealed that the consumption of empty calories is associated with a range of negative health outcomes, including obesity, diabetes, dental caries, and nutrient deficiencies. Additionally, empty calories consumption was linked to decreased academic performance, decreased attention span, and increased risk of mental health problems, such as depression and anxiety. Conclusion: The implications of empty calories on the health and wellbeing of school youngsters are far-reaching and multifaceted. The review's findings suggest that reducing empty calories consumption is essential for promoting healthy lifestyles, improving academic performance, and enhancing social wellbeing. The review's results have implications for policymakers, educators, and healthcare professionals, highlighting the need for comprehensive interventions to promote healthy eating habits and reduce the consumption of empty calories among school youngsters.

Keywords: Empty calories; school youngsters; health; wellbeing; academic performance

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1. Introduction

In the current chaotic modern landscape of modern nutrition, there is silent destruction called empty calories that is probably unnoticed by many because of poor awareness or comprehension (Hamish & Angus, 2019; Whiteland, 2023). There are dangerous substances been consumed in the name of achievement of modern diets, been taken daily by all and sundry, let alone the characteristic youngsters. On the other hand, albeit empty calories look as of thru are harmless, they are indeed destructive to health, learning, economy, the effect will invariably emerge as we grow (von Braun et al., 2021; Jack, 2023).

Empty calories are simply the energy -dense foods (fast foods, junk foods, beverages) that have negligible or zero nutrients, and contained much energy (due to high fat or added sugars), salt (sodium), and preservatives. Empty calories are dominantly through made through industrial or non-natural processes, so they are ultra-processed items or substances (Al-Ibrahim & Jackson, 2019; Jack, 2023; Wijaya et al. 2023). Empty calories are very predominant I'm modern environments, such as schools or learning institutions. Empty calories spur numerous consequences such as diabetes, cancer, overweight, obesity, cardiovascular diseases, nutritional deficiencies (hidden hunger), addiction, etc (Vidya, 2015; Jack, 2023).

Food companies, and restaurants are using strategies of marketing to advance the selling and trading of empty calories despite the concerns about these products. They make several brands of empty calories that are very attractive, sweet, tasty, coloured, long lasting, accessible, available, cheap, portable, and conspicuous in every corner of markets, stores, and related environments (Gupta & Yadav, 2021). Youngsters may be mostly affected by the empty calories seller's methods of marketing strategies or lobbying due to certain factors such as poverty, growth, naivety, etc (Jia et al., 2022). Albeit, food is meant to provide nutrients, namely carbohydrates, proteins, and lipids, vitamins, minerals, for growth, health, development, empty calories are in contrast (Styrer, 1988; Stenesh, 1998; Jia et al., 2022). After few hours of consuming an empty calories food, instead of feeling energized, the consumer may feel tired, and sleepy, hungry with an urge to eat or consume more, therefore, spring obesity. Empty calories can lead to lack of energy, albeit after consumption empty calories may instigate the person to feel energized for the meantime, happy (through activating the body's reward system), the sugar content of empty calories is speedily exhausted by digestion and absorption, consequently seeking for more consumption (Soil Association, 2019; Sheena, 2020; Rasheed et al., 2021; Jia et al., 2022).

Potentially, there is mechanism leading to effects as a result of frequent consumption of empty calories. The empty calories are quite different from organic or natural foods in terms of profile of nutrients available, the empty calories are of great potential to displace natural foods in our diets, they are having markers of poor diet quality (added sugars, added solid fats, sodium, high energy level, low fibre, low protein, and low or zero micronutrients) (The Regents of the University of Michigan, 2012; Rasheed et al., 2021; Thakur et al., 2022; Oeji-Olorumtoba et al., 2024). Consumption of empty calories has on many occasions displaced consumption of nutritious foods such as fruits, legumes, vegetables, nuts, grains, seeds, etc thereby causing reduced consumption of useful compounds or elements needed by the body, and in turn increase prevalence of chronic diseases (Shridhar et al., 2015; Lane et al., 2024). Additionally, the empty calories serve as greater source of encounter with food additives, such as colorants, nitrites, nitrates, emulsifiers, sweeteners, and others that spur detrimental health effects. Other harmful chemicals that are found in empty calories include, furans, biphenols, heterocyclic amines, industrial trans-fatty acids, polycyclic aromatic hydrocarbons, acrolein, etc. Contaminants present in empty calories include, heavy metals, mineral oils, micro plastics, phthalates, etc (UNICEF, 2019; Sheena, 2020; Udah, 2021; Umar et al., 2022; Lane et al., 2024; Nuanchankong et al., 2024). The objective of this paper is to perform a review on the Implications of empty calories on the health and wellbeing of school youngsters.

2. Factors Increasing the Consumption of Empty Calories

There are numerous reasons or factors encouraging outrageous consumption of empty calories across various age groups, across various populations. Empty calories are addictive in nature due to presence of chemicals (preservatives and additives), added sugars, and added fats are addiction instigators because they stimulate the brain to demand for more of the stimulus (empty calories consumption) (Sharlin, 2019; Islam, 2020). The current trend of world, where people are always engaged or busy, with no time to gather all the ingredients and make foods at home, encourage people to utilize empty calories due to easy access, and easy methods of preparation (Reedy & Krebs-Smith, 2010; Shamsol & Fisol, 2023; Nuanchankong et al., 2024). Due to presence of added sugars, added fats, other food additives (such as preservatives), empty calories are encouraging the precipitation of health consequences such as hypertension, diabetes, overweight, etc in adolescents, youngsters, and adults (Sharma, 2015). Social inequalities such as poverty tend to

incite people to take empty calories as foods. In general sense, people who are having low income are more likely to consume poor and unhealthy diets such as fat containing foods, pizza, sugary foods, drinks, processed meat, bread, etc. This is termed as food poverty (Rajweer & Monika, 2012; Paglia, 2019; Oki & Cunningham, 2019). Empty calories are popular due to availability, they are instantly used, are palatable, portable, and are marketed easily (Sharma, 2015). Food environments (schools, homes, society) put youngsters in a difficult situation that prevent them from accessing healthy diet. Empty calories are peculiar because they are affordable, desirable (by mere looking), accessible, available, cheap (comparatively), poorly regulated, widely marketed (Mateljan, 2010; UNICEF, 2021; Michigan WIC Program, 2022).

2.1. Empty Calories (ECs)

Empty calories refer to many foods and beverages containing added solid fats, added sugars, few or no nutrients (see table 1 about some nutrients needed by the body), hence the name, empty calories. Some empty calories contain solely added fat, some have only added sugar, and some contain combinations, some contain much salt, and they contain combinations of added chemicals (additives) (United States Department of Agriculture, 2015; Kim et al., 2018; Krazal & Maillow, 2022).

Empty calories are unhealthy, classified as diet linked to obesity, high blood pressure, high blood glucose, overweight, high cholesterol. Hence, empty calories are major risk factors inciting death especially in developing countries (Mixon & Davis, 2020; Jia et al., 2022). Empty calories have different types of names depending on locality or strategies utilized by industries for marketing (to incite the public on consumption, conceal food materials to the laymen). Some of the names of empty calories are junk foods, ultra-processed foods, fast foods, energy-densed foods, etc. Ultra-processed foods are foods are typically containing excesses free (added) sugars, sodium, saturated fats (trans fats) (Mirza et al., 2017; Berkley, 2023; Mukoro et al., 2023). Ultra-processed foods are out for maximum profit to the industries, they are highly palatable, diversely marketed, contained low-cost ingredients, have dense-calories, have unhealthy fats, unhealthy sugars (free or added sugars), and sodium (Soil Association, 2019; Meena et al., 2023). The ultra-processed foods (UPFs) are also made through following series of industrial processes such as drying, milling, canning, additives incorporating and related adventures (Rezaei, 2017; Mageswari et al., 2021; UNICEF, 2021). Fast food, is a

terminology referring to any type of empty calories food that can be prepared and served quickly (Vaida, 2013; Mayo Clinic News Network, 2018). Lucas et al. (2010) cited examples of fast foods such as chips, sandwiches, fried chicken, hamburgers, pizza, ice cream.

Solid fats are types of fats existing as solids at room temperature, such as beef fats, shortening, butter. Solid fats help to serve as food additives making food or beverages appealing, flavoring, and tasty. Solid fats containing foods or beverages include, cakes, pastries, donuts, cheese (containing solid fats), sodas, sport drinks, cookies, energy drinks, ice cream, sausages, ribs, bacon, hot dogs etc (Smith, 2002; USDA, 2015; Lane et al., 2024).

Table 1. Some Micronutrients Required by the Body and Consequences of their Deficiencies

Type	Nutrients	Consequences or symptoms
Mineral	Iodine	Goiter, birth defects, mental retardation, dwarfism, paralysis of the limbs
Mineral	Iron	Weakness, reduced physical shortness of breath, reduced mental capacity
Vitamin	Ascorbic acid	Bleeding gums, joint pain, hemorrhage in the skin
Mineral	Magnesium	Tremors, irregular heartbeat, muscle weakness
	Choline	Effects on memory and learning
Lipid	Essential fatty acids	Hair loss, poor wound healing, scaly skin
Mineral	Manganese	Scaly, red rash on the upper torso
Vitamin	Vitamin B6	Depression, seizures, confusion, and convulsion
Vitamin	Vitamin E	Lesions in muscles and nerves, anemia, retinal degradation, loss of coordination
Mineral	Zinc	Diarrhea, facial rash, poor immune function, hair loss, lack of sexual maturation, and small stature,
Vitamin	Vitamin D	skeletal deformities
Vitamin	Vitamin A	Visual impairment, total blindness, night blindness

Vitamin	Niacin	Severe dermatitis, dementia, fissure scrabs, death
Vitamin	Riboflavin	Swelling, ulceration in mouth and lips, fissuring, retarded growth, nerve degeneration
Vitamin	Thiamine	Anorexia, coma, paralysis of eye muscles, death, mental confusion, and quivering of limbs (or hands)

Source: Smith (2022)

2.2. Food Additives in Empty Calories and heir Classes

Food additives are rampant and prevalent in empty calories despite their effects (as shown in Table 2). Food are chemicals added to foods along the course of their productions (processing) in order to achieve certain goals, such as coloring, increase taste, increase texture, increase palatability, etc. Food additives are added to the foods during processing by anthropogenic means, they are not normal part of the food. Food additives may be added in the preparation, processing, manufacturing, treatment, transporting, packaging, etc (Awuchi et al., 2020; Gupta & Yadav, 2021; Asfiya & Syeda, 2023). Food additives mostly are included to improve appearance, quality, flavor, and texture. Substances from the packaging or other materials in contact with foods may find it ways into foods, they are indirect food additives (Udah, 2021). Some food additives are carried over as a result of raw materials sneaking into the final food products. Food may contain as many as food additives, for instance, biscuits, breads, gum, beverages, fruit juice contain 12 food additives or less or more. Food preservatives are forms of food additives present in empty calories. Food preservatives are groups of chemicals that are added into foods to slow down or prevent spoilage of food materials, such as sulphite, nitrites, propionic acid, sorbic acid, benzoic acid, sulphur dioxide, etc (Baig & Kasim, 2018; Oo, 2019; Lopez, 2021; Kiran et al., 2023).

2.3. Classes of Food Additives

Food additives are different types or classes as shown in this part. Antioxidants are substances intended to retard oxidation (leading to spoilage) for instance, ethyl gallate, octyl gallate, citric acid, tartaric acid, gallic acid, etc. Preservatives are added in order to retard or inhibit microbial activities (such as decomposition, fermentation,

acidification), examples of preservatives include, sulphur dioxide, sulphites, bisulphites, nitrites, nitrates, benzoic acids, sorbic acids. Colouring agents are used to maintain appealing appearance in foods (Gupta & Yada, 2021; Udah, 2021; Harris et al., 2023). Coloring agents include, beta-carotene, canthaxanthin, annatto, saffron, turmeric, sunset yellow, tartrazine, carmoisine. Flavoring agents add flavor properties to foods, such as enhancing taste, odour, eugenyl methyl ether, saffrole, isothojune, thujone, coumarin, isosaffrole, estragole. Emulsifying (stabilizing) agents are added to foods to ensure uniform dispersion of oils and fats in water medium. These are used severally in foods such as in creams, chocolate, bread, confectioneries, soft drinks. Examples of stabilizing agents include, calcium pectate, sodium citrate, albumin, gelatin, lecithin, methyl cellulose, modified starches, agar, methyl alginic acid, sodium tartrate. Anticaking agents are substances that pick up moisture without been wet, they include sodium, potassium, phosphates of calcium or magnesium, carbonates of calcium or magnesium or aluminum or sodium, palmitates of aluminum, stearates of aluminum. Sweetening agents provides sweet and calories to foods. Calorie sweeteners increase the sweetness, and add 4 calories per gram of the substance, they include, dextrose, invert sugar, golden syrup, icing sugar, jaggery, glucose syrup. Low-calorie sweeteners add about 1 and 3 calories per gram, example, mannitol, sorbitol. Non-calorie sweeteners are yet to be evaluated in terms of safety, example, monellin, Haumatin, acesulfame, aspartame, sucralose, saccharin sodium, neotame (Baig & Kasim, 2018; Oo, 2019; Lopez, 2021; Kiran et al., 2023).

Table 2. Selected Effects of Food Additives

Food additive	Type of food	Effects
Tartarazine (E102)	Soft drinks	Asthma, rhinitis, urticaria, behavior change, allergy
Curcumin (E100), mutation of cells	Margarine	Thyroid damage
Sunset yellow (E110)	Biscuits	Kidney damage, allergy, cancer
Caramels (E150)	Cola drinks, beer, alcohol, bread, sauces, crisps	Convulsions, affect white cells, inhibition of vitamin B6 absorption
Benzoates	Fruit juices, jam, salad cream, soft drinks, beer	Asthma, hyperactivity
Sulphites	Fruit juices, syrups, beer, wine, biscuits, dried fruits	Mutation, asthma, urticaria

Nitrates, and nitrites	Cured meats, cheeses	Mutation, cancer, diabetes, risk of respiratory tract infections
Monosodium glutamate (MSG)	Soups, sauces, snacks, savory foods	Severe chest pressure, asthma, headache, obesity, eye damage, disorientation
Saccharin	Soft drinks, sweet foods	Mutation, growth inhibition, affect skin, cancer
Aspartame (E951)	Soft drinks, sweet foods	Cancer

Source: Oo et al. (2019); Kiran (2023)

2.4. Empty Calories and Implications for Mental Health

Nutrition is very important for all domains of human health, both the physical and mental (brain) health require good nutrition, therefore empty calories affect all forms of health. Because empty calories are poor, have little or no essential nutrients they are of great potential to pose risk and effects upon physical, and mental health domains in humans. A deficiency of omega-3 fatty acids causes behavioral and mental problems like dementia, depression, dyspraxia, aggressiveness, etc (APFHF, 2007; Arimond et al., 2021). The best source of the omega -3-fatty acids is the natural foods. Parable, alpha-linolenic acid is provided mainly by green vegetables (nuts, seed oils, fish); linoleic acid is provided in meat, egg, and dairy products. These acids (omega -3-fatty acids) are utilized to maintain fluidity, flexity in brain cells membranes, thereby helping rapid transmission of impulses, and protecting the integrity of neuron (APFHF, 2007; Shamsol & Fisol, 2023).

Food additives present in empty calories act to deplete the levels of essential nutrients needed by the body. Parable, sunset yellow and tartrazine are color additives that are believed to behave as chelating agents against the essential nutrient zinc need by the brain functions (Lane et al., 2024). Zinc is needed at least by 200 different enzymes in the brain, and human body. Low level of zinc can cause serotonin depletion and consequently aggressiveness and poor performance in young people. People taking empty calories are more prone to iron deficiency, schizophrenia, depression, dementia (Jack, 2023; Umar & Sarkingobir, 2024). Additives present in empty calories lead to depletion of gut microbiome, a state that incite bipolar disorders, and mental wellbeing, autism, schizophrenia, and poor emotional health (Oo et al., 2019; Soil Association, 2019).

3. Empty Calories and Schools

Mostly, the youngster's schools are tempted with the desire to take in empty calories due to the prevailing environmental conditions, such as lack of natural or home-made foods, prevalence of marketing, lack of time, peer pressure, partying, pressures or stress, and many other factors. The nature of the body of youngsters require balanced diet or natural foods more than ever, failure to have them cause short-term or long-term effects (Wheeler et al., 2012; Shridhar et al., 2015). Of the effects of poor nutrition at schools include, behavior change, and poor performance academically. However, their state of growth or development characterized with the love to party with peers, love to experiment new things (curiosity), love to solve life problems, naivety, school stress, increase the tendency of youngsters to consume empty calories and implications are affecting their health, education in the short and long ranges, as well as the society (Shamsol & Fisol, 2023; Arimond et al., 2021; UNICEF, 2021). Parable, many empirical studies were conducted, showing tendency of youngsters to consume empty calories. Nayak (2020) in a study among medical students in north Karnataka, show that, among the 178 students, there was prevalent preference and consumption of empty calories among the participants despite their knowledge of the harms. Kumari et al. (2021) among young students in Noda, reveal that, out of 100 participants, 75 percent of them were with inadequate knowledge of harms of fast foods. Vidya et al. (2015) in a survey of schooling children (200 of them) at Bangalore, show consumption of junk foods as favorite thing including, snacks, fast foods, candies, due to taste, color, marketing, and parenting, stressing the role of parents in nutrition and inculcation of physical activities to children. Albeit, in general population, Rezaei (2017) in a study from southwestern Iran among 504 participants show that, fast food consumption was high, especially among students and youngsters, thus, expressed the need for intensive education about the side effects of fast foods in the society. In Iraq, Abdulrahman et al. (2022), recruited 233 respondents in a study determining awareness and food consumption habits of university community in Suleimanyah. The results show, moderate knowledge of food safety, staff and students are abreast about the hazards of contaminated foods, but their level of education do not prevent them from the risk of fast foods consumption. In Egypt, Ayed et al. (2019) studied effect of nurse program about junk food, among school -age children. The result of 100 sampled particularly show that, the program improves knowledge, attitude, and practice towards junk foods.

4. Consequences of Empty Calories (Excessive) Consumption

Empty calories are peculiar with their ability cause addiction and in turn vicious cycle. Humans are naturally included to taste (such as sweet and salty) therefore, due to the presence of added sugars, added fat, humans tend to like empty calories excessively (Liebman, 2012; Johar, 2016; Kim et al., 2023). Additionally, presence of other food additives tends to instigate human brain to demand for more of the empty calories, thus, there is very possibility of occurrence of addiction to empty calories, especially in children or youngsters due to their characteristics. There is decrying submission about the lack of hygiene during the preparation of empty calories foods that in turn easily cause microbial contamination, that affect the public health (Das, 2015; Brunk, 2018; Bagyalakshmi et al., 2022). Empty calories are risky due to levels of chemicals pollutants such as heavy metals and the likes. A situation that endanger the health of consumers (Abdulrahman et al., 2022; Shamsol & Fisol, 2023). A study by Abdulrahman et al. (2022) reported effects felt by study participants due to empty calories consumption such as loss of appetite, headache, vomiting, diarrhea, stomach pain. The presence of chemical pollutants in empty calories, deliberate lack of addition of nutrients (such as vitamin A, iron, vitamin C, calcium, magnesium) will surely invite an issue relating to malnutrition (Hamish & Angus, 2019; Jack, 2023).

Inequalities in the society such as poverty, lead to poor diet consumption. Inequalities as a result of poor access to healthy food spur other health inequalities. This is an instigator of high consumption of fat, high intake of sugar, high intake of salt, poor intake of minerals, vitamins, and dietary fiber. Consequently, spurring ill health (Oki & Cunningham, 2019; Horowitz et al., 2023). Certainly, poor access to healthy diet lead to health inequalities. Poor diet (consumption of empty calories) is linked to 30 percent of life years missed in early death, and disability. The effects due to empty calories manifest initially as raised blood glucose, raised blood lipids, obesity, overweight, in turn subsequently eliciting other killer disorders such as chronic heart disease, cancer, and diabetes, low birth weight, childhood morbidity, childhood mortality, and dental caries (Lucas et al., 2010; Oki & Cunningham, 2019; Fardet et al., 2021).

5. Selected Diseases Elicited by Empty Calories

Eating or consuming empty calories is described as risk factors of obesity, heart diseases, and diabetes among others. Obesity is a complex and multifactorial health

condition characterized by an excess amount of body fat. It is typically measured by calculating an individual's body mass index (BMI), which is the ratio of their weight in kilograms to the square of their height in meters. A BMI of 30 or higher is generally considered to be obese. Obesity is not just a matter of aesthetics or personal appearance; it is a serious health condition that can have significant consequences for an individual's physical and mental well-being. Excess body fat can increase the risk of developing a range of chronic diseases, including type 2 diabetes, high blood pressure, heart disease, stroke, and certain types of cancer (Associate Parliamentary Food and Health Forum, 2007; McGill, 2014; Markowitz et al., 2019; Abdel Ghani et al., 2024).

Obesity can also have a significant impact on an individual's quality of life, causing symptoms such as fatigue, joint pain, and breathing difficulties. Additionally, obesity can have a negative impact on an individual's mental health, increasing the risk of depression, anxiety, and other mental health conditions. Obesity is a complex condition that is influenced by a range of factors, including genetics, environment, and lifestyle. While some individuals may be more prone to obesity due to their genetic makeup, lifestyle factors such as a poor diet and lack of physical activity can also play a significant role in the development of obesity (Story et al., 2015). Treatment for obesity typically involves a combination of lifestyle changes, such as a healthy diet and regular exercise, as well as medical interventions, such as medication or surgery. In some cases, behavioral therapy may also be recommended to help individuals develop healthy eating habits and a positive body image. Overall, obesity is a serious health condition that requires a comprehensive and multifaceted approach to treatment. By understanding the causes and consequences of obesity, individuals can take steps to prevent and manage the condition, and improve their overall health and well-being (Associate Parliamentary Food and Health Forum, 2007; Daneman & Nakhla, 2020).

Obesity and the consumption of empty calories are significant public health concerns in children and youngsters. The World Health Organization (WHO) defines obesity as a body mass index (BMI) of 30 or higher, and it is estimated that over 18% of children and adolescents worldwide are overweight or obese. Empty calories, which come from solid fats and added sugars, are a major contributor to obesity in children and youngsters. These calories are found in foods and beverages that provide little to no nutritional value, such as sugary drinks like soda, sports drinks, and sweet tea, refined grains like white bread, sugary cereals, and processed snacks, processed meats like hot dogs, sausages, and bacon, and fried foods like French fries, fried chicken, and doughnuts. The consumption of empty calories can lead to a range of

negative health effects, including weight gain and obesity, increased risk of chronic diseases like diabetes, heart disease, and certain types of cancer, poor dental health and tooth decay, low self-esteem and body image issues, and decreased physical fitness and athletic performance (Daneman & Nakhla, 2020).

Factors that contribute to the consumption of empty calories in children and youngsters include easy access to unhealthy foods and beverages, lack of physical activity and sedentary lifestyle, poor eating habits, including skipping meals and relying on convenience foods, limited knowledge about healthy eating and nutrition, and societal and cultural influences, such as advertising and peer pressure. To address the issue of obesity and empty calorie consumption in children and youngsters, it is essential to promote healthy eating habits and lifestyles. Encouraging a balanced diet rich in whole foods, fruits, vegetables, whole grains, and lean protein sources is crucial. Limiting access to unhealthy foods and beverages, especially in schools and at home, can also help. Promoting regular physical activity, such as sports, dance, or simply playing outside, is also important. Educating children and youngsters about healthy eating and nutrition can help them make informed choices. Supporting policies and programs that promote healthy lifestyles, such as nutrition education in schools and community-based initiatives, can also play a critical role. Parents, caregivers, and healthcare providers can play a critical role in promoting healthy eating habits and lifestyles in children and youngsters. By working together, we can help prevent obesity and related health problems, and promote a healthier future for our children (Associate Parliamentary Food and Health Forum, 2007; Petitti et al., 2019).

Diabetes in children is a condition where the body is unable to produce enough insulin, a hormone that regulates blood sugar levels. There are two main types of diabetes that affect children: type 1 diabetes and type 2 diabetes. Type 1 diabetes is an autoimmune disease in which the body's immune system attacks and destroys the cells in the pancreas that produce insulin. This type of diabetes typically develops in children and young adults, and it requires insulin therapy to control blood sugar levels. Type 2 diabetes, on the other hand, is a metabolic disorder that is caused by a combination of insulin resistance and impaired insulin secretion. It is more common in adults, but it is increasingly being diagnosed in children, particularly those who are overweight or obese (WHO, 2018).

Children with diabetes may experience a range of symptoms, including increased thirst and urination, fatigue, blurred vision, slow healing of cuts and bruises, tingling or numbness in the hands and feet, and weight loss despite increased appetite. If left

untreated, diabetes can lead to serious complications, such as diabetic ketoacidosis, a life-threatening condition that occurs when the body produces high levels of ketones, dehydration and electrolyte imbalances, damage to the kidneys, eyes, and nerves, and increased risk of heart disease and stroke. Diabetes in children can be managed with insulin therapy, which involves injecting insulin into the body to control blood sugar levels, monitoring of blood sugar levels, which involves checking blood sugar levels regularly to ensure they are within a healthy range, healthy eating habits, which involve following a balanced diet that is low in sugar and unhealthy fats, and regular physical activity, which can help to improve insulin sensitivity and reduce blood sugar levels (Lobstein & Jackson-Leach, 2016).

Early diagnosis and treatment of diabetes in children are critical to preventing long-term complications and ensuring optimal health outcomes. If you suspect that your child may have diabetes, it is essential to consult with a healthcare professional for proper diagnosis and treatment. Risk factors for diabetes in children include family history of diabetes, obesity or being overweight, physical inactivity, unhealthy diet, and certain ethnicities, such as African American, Hispanic, or American Indian. Prevention and early detection of diabetes in children are key to reducing the risk of long-term complications and improving health outcomes. Children with diabetes require ongoing medical care and support to manage their condition and prevent complications. With proper treatment and care, children with diabetes can lead active and healthy lives (Lobstein & Jackson-Leach, 2016; WHO, 2018).

Diabetes and the consumption of empty calories in children and youngsters is a growing concern worldwide. Empty calories, which come from solid fats and added sugars, provide little to no nutritional value and can have serious negative effects on overall health. Consuming high amounts of empty calories can lead to an increased risk of developing type 2 diabetes in children and youngsters. This is because empty calories can cause a rapid spike in blood sugar levels, which can lead to insulin resistance and ultimately, diabetes. Type 2 diabetes is a serious health condition that can have long-term consequences, including damage to the kidneys, eyes, and nerves. It can also increase the risk of heart disease and stroke. Children and youngsters who consume high amounts of empty calories are also more likely to be overweight or obese, which is a major risk factor for developing type 2 diabetes. Furthermore, a diet high in empty calories can lead to a range of other health problems, including dental cavities, digestive issues, and nutrient deficiencies. Foods and beverages that are high in empty calories include sugary drinks, refined grains, and processed snacks. These foods are often marketed to children and youngsters, making them easily accessible and appealing (Lobstein & Jackson-Leach, 2016).

To prevent diabetes and promote overall health, it is essential for children and youngsters to consume a balanced diet that is rich in whole, nutrient-dense foods. This includes fruits, vegetables, whole grains, lean proteins, and healthy fats. Parents, caregivers, and healthcare providers can play a critical role in promoting healthy eating habits in children and youngsters. By limiting access to empty calorie foods and beverages and encouraging a balanced diet, they can help prevent diabetes and promote overall health. Additionally, regular physical activity can also help prevent diabetes and promote overall health. Children and youngsters should aim to engage in at least 60 minutes of moderate-intensity physical activity per day. By taking a comprehensive approach to health, including a balanced diet and regular physical activity, children and youngsters can reduce their risk of developing diabetes and promote overall health and well-being (World Health Organization, 2018).

6. Good Nutrition

Nutrition describes food and its consumption. A food is any solid or liquids material consumed for nutritional purposes. Foods provide nutrients to keep the body well, as well supply energy the body system, enable growth, enable repair, and synthesis of tissues and organs. Food prevent diseases, and regulate body functions (Sarac & Butnariu, 2020). Good nutrition refers to enough, well- balanced diet consumed, along with regular physical activity that support health. It is a practice of taking healthy dies, consisting of blanc amounts of fats, carbohydrates, proteins, micronutrients, energy, and calories in order to support healthy growth, without causing toxicity, overweight or other adversities British Nutrition Foundation (2023). A person should daily eats potatoes, rice (or other carbohydrates), at least 5 fruits or vegetables every day, and the consumption of foods like meat, eggs, fish, and other related proteinous foods should be moderate; while salt, fat (saturated/trans) should be very least consumed Mayo Clinic News Network (2018). Good nutrition may refers to balanced diet, which includes variety of foods adequately combined in correct proportions according to the requirements for growth, health, and development, every day. The balanced diet incudes, fats, carbohydrates, proteins, minerals, water, vitamins, and fibre. Mostly, balanced diet is supposed to be consumed according to the recommended dietary allowances (RDAs) British Nutrition Foundation (2023).

6.1. Instances of Empty Calories and Good Foods

The following items are typically strongly of empty calories in the environment, and may be very access in many schools nowadays: Fizzy drinks, chocolate, crisps, snacks, ice cream, breads, cakes, margarines, biscuits, buns, breads, pasta, pizza, burgers, sausages, hot dogs, pies, noodles, powdered soups, packaged soups, mayonnaise, mustard, fast foods, gums, alcoholic drinks, soft drinks, refined cereals, candies, white bread, flavored drinks (Islam, 2020; Bhagyalakshmi et al., 2022).

Meanwhile, examples of good foods include, oats, vegetables, brown rice, brown bread, white fish, oily fish (mackerel, trout, salmon), olive oil, egg whites, sweet potatoes, yams, soy beans, red lentils, kidney beans, taro, nuts, etc (Associate Parliamentary Food and Health Forum, 2007; Vaida, 2012; Lalnunthara & Kumar, 2020; Horowilz et al., 2023).

6.2. Nutrients Providing Energy to the Body

Basically, three types of nutrients are known to provide energy to the body to humans, namely, carbohydrates, proteins, and lipids; albeit, along with energy provisions they provide other chemicals appreciable in the human body. Carbohydrates provide four calories per gram, fat provides nine calories per gram, and protein provides four calories per gram (Arya & Mishra, 2013; Pandey, 2023).

- **Carbohydrates (CHOs)**

Chaos are major principal energy sources to the body, about 45percent to 65 percent daily energy calories needed are obtained from carbohydrates. Glucose, a major actor that serve as energy source in the body, it is the sole energy source to red cells, and more preferable to the brain, fetus, placenta, and central nervous system (Camara et al., 2021; Comerford et al., 2021). Carbohydrates may be simple or complex. Simple carbohydrates include (sucrose, a disaccharide from cane sugar, corn), lactose (from milk, and is broken down to glucose and galactose), and glucose (the main energy, and can be obtained from fruits, honey, vegetables, etc). Complex carbohydrates include, fibre, and starches, and relations. Starches can be obtained from foods like rice, potatoes. Starch is a polymer of several glucoses joined together, and is the glucose storage in plants. Sources of starches include grains (corn, rice, wheat, oats), legumes (peas, dry beans), starchy vegetables (yams, corn, potatoes) (Wheeler et al., 2012; UNICEF, 2019; Arimond et al., 2021; Abdulrahman et al., 2022).

- **Fibre**

Fibre is a branched chains combination of sugar molecules used for rigidity in plants; like sponge, absorbing water, and adding in softening the faeces humans make. Soluble fibre is obtained specifically from barley, flax seeds, apples, oats, citrus fruits, beans. Soluble fibre aid in defecation, lower blood sugar, lower cholesterol, thereby preventing diabetes and heart disease. Insoluble fiber comes from grain flours, whole grains, nuts, wheat bran, and vegetables. This fibre also, albeit absorbs less water, give stool easier way to pass. It reduces constipation, diverticular disease, and hemorrhoids (Oki & Cunningham, 2019; Arimond et al., 2021).

- **Proteins**

Proteins are polymers of amino acids joined by peptide bonds. Proteins build and maintain the tissues of the human body. Every tissue of the body has proteinous component in it's fold. Proteins are versatile to regulate processes in the body, for instance, they monitor to the body through enzymes, hormones, messengers, as parables of proteins regulatory functions of physiology. Proteins provide energy when catabolized, when the body is unable to obtain energy from fats or carbohydrates. Food sources for obtaining proteinous nutrients include many plant-based products (foods), and animal -based foods. Animal -based sources of proteins include, meat, eggs, milk products; plant-based foods, albeit contain insufficient amounts of essential amino acids, they include, beans (low level of methionine), peas, nuts. A complementary combination includes, grains and legumes (Wheeler et al., 2012; Tegmire et al., 2021; Asfiya & Syeda, 2023; Pandey, 2023).

- **Fats**

Fats provides energy to the human body; every gram provides nine calories. A person needs 20 percent to 35 percent energy calories every day. Fats are utilized for storage, absorption, and circulation of certain vitamins (A, K, E, D). Fats are used to provide cushioning and insulation, to body parts such as liver. In the skin, fats sheath and store energy, and help in temperature regulation. The most needed acids, namely, linoleic, arachidonic, and linolenic are provided in fats, to support proper growth and brain functions (UNICEF, 2019). Typically, in our foods, fats may be of three types, saturated and unsaturated, and trans fats. Saturated fats existing as some solid entities at room temperature, mostly from animals, such as cheese, milk, egg yolk. Plant-based sources of saturated fats include, palm oil, coconut oil. It is quite noteworthy that consumption of much saturated fats elicits high levels of cholesterol in the blood. High saturated fats may also be found in pork, high areas of beef, turkey skin,

chicken skin, palm kernel oils, coconut, chocolate, butter, beef fat, whole milk (Temgires et al., 2021; Michigan MIC Program, 2022). Unsaturated fats exist in liquid form whenever there is room temperature, mostly come from plants such as oils, nuts, avocados, seeds, animal sources include, trout, salmon, herring. Unsaturated fats are monounsaturated and polyunsaturated; they are useful due to their ability to reduce cholesterol if they are replacing trans or saturated fats. For instance, linolenic acid, linoleic acid, and arachidonic acid are typically essential and polyunsaturated fatty acids, that build omega-3 and omega-6 for proper functioning. The omega-3s fatty acids reduce tendency to chronic disease, mental disorders, diabetes, and cancer. Trans fats, albeit occur naturally, mostly are prepared through hydrogenation of oils industrially, in a view to improve texture, shelf life, but harmful nutritionally speaking. Even without taking cholesterol from food, the liver can synthesize enough to make hormones such as testosterone, estrogen, and make useful items like bile, vitamin D, cell walls. However, High consumption of cholesterol lead to its deposition in arteries, thereby causing heart disease or related disorders. In the blood and tissues interaction for cholesterol distribution, the cholesterol is shuttle using a layer of lipoprotein, therefore, it can be high density lipoprotein (responsible for removing cholesterol from the blood or tissues) or low-density lipoprotein (responsible for depositing cholesterol in the arteries, hence the risk of plaque and consequent disorders) (Mageswari et al., 2021; Michigan MIC Program, 2022).

7. Food Groups

There are about five food groups useful for human nutrition purposes that will be described in details in this section.

Vegetables includes dark green vegetables (broccoli, leaf lettuce, Brussels sprouts, spinach), orange (carrots, pumpkin, sweet potatoes), starchy (potatoes, corn, yam), squash (a corn or butternut), and others (eggplant, tomatoes, green beans, cabbage, cauliflower, onions, peppers). Vegetables should be taken every day in fresh or frozen or related preparations (European Union, 2014; Arimond et al., 2021).

- **Fruit**

Every day, a person supposed to consume about 3 cups of fruits in equivalence. The focus on fruits should be given to oranges, grapes, berries, melons, peaches, apricots, pineapples, raisins, dried fruit, citrus juices, plums. Fruits are to be consumed for minerals, fiber, and vitamins (EU, 2014; von Braun et al., 2021).

- **Milk**

Milk group to be consumed be about 3 cups per day. The group consists of cheese, milk, milk-based soups. Milk provide vitamins, proteins, vitamin D, and calcium (Audu, 2014; Ainuson-Quampah et al., 2022).

- **Grain**

Every day, a person should consume 9 ounces of grain. Grain group consists of foods such as cereals, rice. This group is a source of carbohydrates, vitamins, energy, and nutrients minerals. Whole grain consists of germ, endosperm, and bran, and more amounts of vitamins and minerals (Wani & Sarode, 2018; Cámara et al., 2021).

- **Meat and Beans**

5.5 ounces meat should be taken every day. Meat can be obtained from chicken, turkey, fish, eggs, salmon, tuna etc. Beans include, peas, nut, seeds. The group provide nutrients like iron, zinc, protein, B vitamins, albeit animal-based proteins (meats) contain high level of cholesterol and saturated fat, but lean meat may be a good source (from fish, poultry without skin). Plant-based products in this group provide excellently vitamins, protein, fiber, and minerals (Mateljan, 2010; Michigan MIC Program, 2022; Nicklas & O'Neil, 2022).

8. Characteristics Features Identifying Empty Calories

Empty calories foods possessed some common features that are harmful to humans indeed (Arya & Mishra, 2013; Nagothi, 2021; Whiteland, 2023). Some of them have more features than others, but at least, any empty calories food must have one of the following features:

- They are ultra-processed, made through series of industrial or anthropogenic processes
- Contain little amount or no while food
- Are fatty in nature
- Are salty or sugary in nature
- Have depleted level of fibre if any
- Contain additives (artificial preservatives for example) (The Regents of the University of Michigan, 2012; Herfoth et al., 2019; Nayak et al., 2021; Asfiya & Syeda, 2023).

9. Empty Calories and Natural or Good Foods Alternatives

Each and every type of empty calories has natural food to be utilized as alternative or the major initial choice, in fact some empty calories are made through mimicking the organic natural foods in our domains, therefore it is important to mention them so that the public take need and make rationale choices (Zehra et al., 2018; Mixon & Davis, 2020). The following are typically instances of empty calories and their alternatives for healthy choice:

- Fruits juices in beverages - homemade juices, natural fruits
- Pizza, hot pockets chicken strips- Chicken salad, home-cooked chicken
- Sour cream, yogurt - Natural milk
- Noodles, macaroni, pastas, pizza crust, white bread, ravioli- Home-made noodles, whole grains, local rice
- Muffins, sugary cereal - Fruits, natural berries, banana, pineapple, coconut, peacans, whole grains,
- Snack, cookies, cakes, muffins, chocolates -Fruits, cow milk
- Soda, beverages -Fruits, water (Kumari et al., 2021).

10. Control Measures to Combat Excessive Intake of Empty Calories or Effects

- **Nutritional counseling**

People suffering from diseases such as obesity, diabetes, cardiovascular disease are supposed with educated talks, to halt empty calories consumption, because consumption increase the problems. They are encouraged to take organic food combinations that are in tandem with their health status. Students (especially youngsters) are supposed to be guided by specialists (teachers) on the steps to consume only healthy foods (Edris, 2004).

- **Nutritional therapy**

There are experts that specialized in foods and nutrition at hospitals, therefore, any patient who has nutritional problems should be helped by exports to take foods that are good for health improvement (The Regents of the University of Michigan, 2012).

- **Medication**

People having nutritional problems such as nutrients deficiency (anemia due to iron deficiency) could be treated using drug therapy such as folate administration. People with iodine deficiency can be treated also by specific drugs.

- **Cooking at home or schools or offices**

People should be exhorted to cook their foods using organic materials at their destinations such as homes, schools, office. This ideal will invariably reduce overdependence on fast foods that are unhealthy

- **Physical activity**

People should be exhorted to allocate time for engaging in physical activities to exhaust the harmful accumulated calories. Actions that support physical activity should be encouraged such as use of public transportation, walking, bicycling, praying (salat) (WHO, 2018).

- **Consciousness on labelling of foods**

Companies should be adequately labelled the types of foods they sell, and their specific ingredients in a manner that is conspicuously comprehended by the laymen, and the public should be educated on ways to discerning food labels and compositions in order to make rational choices Associate Parliamentary Food and Health Forum (2007).

- **Consumption of nutrients rich foods**

People should try to always consumer organic (natural) foods, because they are nutritious and healthy. Rich foods including whole grains, lean proteins, fruits, vegetables, and relations contain fiber, minerals, antioxidants, carbohydrates, phytochemicals, etc required for optimal growth and health (Herforth et al., 2019).

- **Education and awareness**

People should be taught at schools about proper nutrition, and at home, people should be campaigned on risks and harms of unhealthy foods, and ways to combat to the raising prevalence of unhealthy foods in our environment. Every person, especially youngsters should abide by followings:

- ✓ Buy and consume fresh organic foods, such as fruits, vegetables, fewer meats, consume lean meats
- ✓ Avoid microwaving or heating of foods in materials (such as plastics) that cause migration of harmful chemicals

- ✓ Always clean hands frequently before and after touching or eating foods or other items
- ✓ Read labels properly to make rational choices (Edris, 2004; Oo et al., 2019).

11. Conclusion

In conclusion, the consumption of empty calories has severe and far-reaching implications for the health and wellbeing of school youngsters. The evidence suggests that reducing empty calories consumption is crucial for promoting healthy lifestyles, improving academic performance, and enhancing social wellbeing. Therefore, it is essential that policymakers, educators, and healthcare professionals work together to develop and implement comprehensive interventions that promote healthy eating habits and reduce the consumption of empty calories among school youngsters.

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