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An Analysis of Milk, Dairy Products, and Their Functional Effects in Humans

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ABSTRACT: ***Milk is a commonly used beverage that is necessary in the diets of many millions of people across the globe because it contains vital macro- and micronutrients. Because of its composition, milk is regarded as beneficial throughout infancy and adolescence; nevertheless, its relatively high saturated fat content raises concerns about possible negative consequences, particularly on the cardiovascular system. The most current research on dairy and human health is evaluated in this review, which is framed by epidemiologic, experimental, and biochemical data. The effects of milk (particularly skimmed milk) on body weight, for example, seem to be well established, and the overwhelming majority of published research conclude that dairy intake does not raise cardiovascular risk or the prevalence of certain malignancies. Despite the lack of convincing data, several research indicate that milk and its derivatives may be advantageous to some demographic groups. Although further research on the role of milk and dairy products in human health is needed, their inclusion in a balanced diet should be explored unless there are obvious contraindications.***

KEYWORDS: ***body weight, cheese, Dairy, fat, milk.***

1. INTRODUCTION

Milk is an important part of the nutrition of almost 6 billion people. Milk output in the globe has reached 730 million tons per year. Humans in many parts of the globe drink milk throughout their lives, despite the fact that animals make milk to nourish their young. However, it should be noted that lactose intolerance is common throughout the globe, and thus a significant part of the world's population would be unable to benefit from milk's purported advantages. Several dairy products, including cream, butter, yogurt, kefir, and cheese, have been made and eaten for millennia, in addition to milk. As a result, the effect of milk and dairy products on human health is quantitatively significant, and many studies have been conducted on both entire products and isolated components. The fat element of milk (which is primarily made up of SFAs) and some of its smaller components, such as calcium and oligosaccharides, are being studied for their possible health benefits. This study covers the most current research on milk and human health, as well as critically examines the potential effects of milk and the main dairy components[1].

1.1 Effects on Body Weight:

Calcium and vitamin D have been researched the most of all the bioactive milk components for their effects on body weight and fat tissue. These chemicals have been studied as separate molecules as well as components of milk and dairy products. Thermogenesis and lipid oxidation (which are aided by calcium and vitamin D) as well as increased lipid fecal excretion are among the proposed targets. Other milk components and their possible effects on body weight have been the subject of research in recent years. Dairy proteins, for example, have been proposed as adipose mass (specifically, visceral fat) and body weight reducers, in addition to calcium and vitamin D. These effects have been seen in both healthy people and overweight,

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obese, and diabetic individuals. Whey protein, in addition to casein, seems to be very beneficial, and their effects appear to be mediated by a number of pathways, including enhanced satiety and reduced hunger[2].

Randomized clinical trials and meta-analyses are among the most current research in this field. After four months on a hypocaloric diet that included milk and dairy products, 90 overweight and obese premenopausal women had a significant decrease in adipose tissue and an increase in lean mass. The visceral fat tissue, in particular, was severely damaged. The weight-loss benefit of milk and dairy products when included into hypocaloric diets was verified in a recent meta-analysis (45), which looked at the results of 29 randomized clinical trials with a total of 2101 patients. Long-term research and trials without calorie restriction, on the other hand, found no benefit of increasing dairy intake on body weight and fat reduction, raising concerns about attributing slimming qualities to milk[3].

1.2 Diabetes:

Observational studies have linked dairy intake to a reduced prevalence of type 2 diabetes and metabolic dysfunction, but the possible mechanisms responsible for these benefits have yet to be explored. The Women's Health Study, a prospective 10-year study of 37,185 women, found an inverse relationship between milk and dairy intake and the incidence of diagnosed diabetes. This link was greater for skimmed goods, resulting in a 4% risk decrease for each extra serving/day. Higher insulinemic responsiveness, reduced glycemic fluctuations, and increased secretion of GIP and GLP-1 induced by milk proteins, as mentioned above, and FAs such as transpalmitoleic acid, may theoretically explain these effects[4].

A recent research found a significant improvement in glycemic indicators on a mechanistic level (i.e., fasting glycemia and hematic concentrations of glycated hemoglobin in type 2 diabetic patients who consumed fermented dairy and yogurt with added vitamin D, with or without calcium). Finally, data from the EPIC (European Prospective Investigation into Cancer and Nutrition) study, which included 16,835 healthy and 12,403 diabetic participants from eight European countries (part of a larger 340,234 participant cohort), confirmed the inverse relationship between cheese and fermented dairy consumption and diabetes incidence. The consumption of 55 grams of cheese and yogurt per day was linked to a 12% decrease in the prevalence of type 2 diabetes[5].

1.3 Cholesterol Concentrations:

Cholesterol (80 mg/100 g) and saturated fat (15 g/100 g) are both present in milk and dairy products. As a result, consuming these items may potentially have a negative impact on cholesterol levels. However, the role of dietary cholesterol in cardiovascular risk is debatable, and it is likely to rely on an individual's proclivity to manufacture vs absorb cholesterol. Saturated fat's function in the start and progression of cardiovascular disease (CVD) is also being reexamined; SFAs are unlikely to be classified under a single rubric and should instead be evaluated separately[6].

One research evaluated the effects of isoenergetic (20 percent of total calories, adjusted for lactose and casein) supply of milk (2164 mL), cheese (305 g), and butter (93 g) given in three

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separate sessions over the course of three weeks (85). Cheese had the smallest impact on LDL cholesterol levels, while whole milk raised LDL cholesterol levels in a comparable way to butter. Biong et al. corroborated these findings, reporting that cheese intake resulted in a smaller rise in cholesterol concentrations than an equal quantity (42 g) of fat from butter in a controlled dietary trial including 9 men and 13 women aged 23–54 years. A difference in calcium content has been suggested as a possible reason for the difference in effect.

Several theories have been suggested to explain why cheese and butter have distinct effects on cholesterolemia. One theory is that calcium, which is found in greater quantities in cheese than in butter, interacts with FAs in the gut and produces insoluble detergents, as shown by increased fat fecal excretion in the cheese vs butter groups. Cheese's increased protein and probiotic content may possibly play a role in its almost neutral impact on plasma cholesterol. As a cautionary note, Tholstrup et al. found no change in the cholesterolemic impact of diets including whole milk and butter in their research. To put it another way, whole milk, like butter, increased LDLcholesterol levels, and its usage by hypercholesterolemic individuals should be approached with care[7].

1.4 MetS:

Inflammation and oxidative stress play significant roles in the genesis and progression of MetS and its components. The presence of central obesity and at least two of the following four additional criteria is required for MetS diagnosis: high TGs, low HDL cholesterol, high blood pressure, or high fasting plasma glucose

1.5 Cardiovascular Health:

Several scientific organizations and regulatory agencies (for example, the International Society for the Study of Fatty Acids and Lipids, the FAO, and the European Food Safety Authority all propose optimum FA consumption profiles. Even though no agreement has been established and such recommendations are continuously modified based on new information, certain numbers are agreed upon. Most cultures agree that adults should consume >500 mg/d of long-chain omega-3 fatty acids and that saturated fat should be limited to less than 8% of total calories[8].

1.6 Alzheimer's Disease (AD):

Breastfeeding mothers were shown to have a reduced chance of getting Alzheimer's disease than non-breastfeeding mothers. Breastfeeding is thought to regulate hormone exposure in mothers and increase insulin sensitivity, lowering the incidence of Alzheimer's disease. Linoleic acid, linolenic acid, conjugated linoleic acid, stearic acid, and oleic acid are among the fatty acids found in milk. Oleamide is made from the milk fatty acid oleic acid during the fermentation of dairy products. Alzheimer's disease (AD) is a progressive neurodegenerative illness in which intercellular amyloid (A) plaques and intracellular neurofibrillary tangles are two major pathogenic characteristics in the brain. Furthermore, post-mortem brain examinations of people with Alzheimer's disease have shown higher expression of inflammatory mediators. Anti-inflammatory medications have been shown to reduce the risk of Alzheimer's disease in epidemiological studies. These findings indicate that inflammation

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in the brain is a major mediator of Alzheimer's disease. A recent research using a rat model of Alzheimer's disease found that consuming dairy products fermented with Penicillium candidum lowers amyloid- (A) buildup and hippocampus inflammation while also increasing hippocampal neurotrophic factors. In vitro, oleamide (100–1000 nM) promotes A1–42 microglial phagocytosis in a concentration-dependent manner, while oleic acid has no impact[9].

1.7 Parkinson's disease:

When there is an overabundance of free radicals or a reduction in antioxidant levels, oxidative stress develops. Increases in oxidative stress indicators have been found in Alzheimer's disease, Huntington's disease, and both familial and sporadic Amyotropic Lateral Sclerosis (ALS). Unsaturated fatty acids and iron are abundant in the neurological system. Because the nerve tissue has a high lipid content, it has a greater metabolic activity, which makes it more susceptible to oxidative injury. The loss of neurons in the substantia nigra, a brain area, is a major pathogenic characteristic of Parkinson's disease (PD). Antioxidant deficiency is often linked to tissue deterioration in the substantia nigra.

Patients with Parkinson's disease have lower antioxidant levels and higher levels of oxidative stress. Vitamin D and casein in milk products may assist to decrease oxidative stress in the brain system, and therefore may have neuroprotective effects by replenishing anti-oxidant levels. Meanwhile, a recent research found that dairy product consumption is linked to a greater incidence of Parkinson's disease, especially in males. There were 1,083 PD cases among 304,193 individuals in a meta-analysis of prospective cohort studies on dairy food consumption and risk of PD from three countries (USA, Finland, and Greece). For every 200g of milk consumed per day, the risk of Parkinson's disease rose by 17%, and for every 10g of cheese consumed per day, the risk climbed by 13%[10].

1.8 Autism spectrum disorders:

Autism spectrum disorders (ASDs) are a set of disorders defined by social interaction impairment, communication impairments, and limited repetitive interests and behaviors. ASDs are caused by a combination of genetic and environmental factors. Autism is becoming more common at an alarming pace, with a current incidence rate of approximately 1% across different demographic cohorts. In 2005, a connection between autism and gut microbiota was discovered. The composition of human gut microbiota in people with ASD differs significantly from the healthy population, according to fecal flora study using the Fluorescent In Situ Hybridization (FISH) method. Clostridium histolyticum (C. histolyticum) was found in abundance in samples from ASD patients, indicating a link between Clostridium and the development of some autistic characteristics. As previously stated, oxidative stress is linked to a variety of neurological diseases, including ASD. The intake of camel milk for two weeks substantially boosted anti-oxidant biomarkers in autistic youngsters, according to research (by assessing levels of glutathione, superoxide dismutase, and myeloperoxidase). As a result, camel milk has been proposed as a way to decrease oxidative stress in children with autism by increasing anti-oxidant biomarkers. The intake of camel milk, which raises anti-oxidant

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markers to combat oxidative stress, was believed to be responsible for improvements in behavior of children with autism, as measured by the Childhood Autism Rating Scale (CARS).

1.9 Other brain related disorders:

Cerebral hypoxia-ischemia (HI) is a form of brain damage that is often seen in preterm babies who go on to have neurodevelopmental problems. Lactoferrin, found in human milk, has antioxidant, anti-inflammatory, and antibacterial effects. Lactoferrin supplementation in maternal diet during breastfeeding has been proven to have a neuroprotective impact and is a hot topic of study for pre-term brain neuroprotection. Because chronic immunological activation of the microglia (central nervous system resident macrophages) is prevalent in neurodegeneration, including Alzheimer's disease, anti-inflammatory and anti-oxidant-rich diets may be helpful in avoiding neurodegenerative illness. Because human milk includes lactoferrin, which has anti-inflammatory properties, it is yet unknown if breastfeeding reduces the risk of neurological disorders (chronic immune activation) in the children of nursing women later in life. The link between breastfeeding length and the risk of neurodegenerative disorders may lead to new research directions.

1.10 Child growth:

Vitamins A, D, and E are fat-soluble vitamins found in milk, and the amounts of these vitamins are reduced in low fat and skimmed milk. Vitamin A is essential for healthy growth, development, immunity, and vision. In a retrospective study of African-American teenagers, it was shown that a high maternal consumption of dairy products resulted in a substantial increase in the foetal femur length. A further research found a link between high maternal milk and protein consumption and increased head circumference, biparietal diameter, and belly circumference in children, as well as increased femur length. This is believed to be because milk is high in macronutrients, micronutrients, and minerals. Milk contains all of the nutrients needed for a newborn's development and growth. During the early days of breastfeeding, human colostrum, which is milk produced up to eight days after birth or milk produced at the start of casein production on the third day of lactation, is an important source of hormones, nutrients, and antibodies. Milk is also high in Vitamin D, which is necessary for calcium absorption and bone mass development, as well as osteoporosis prevention.

1.11 Effect of milk on allergy:

Lactose intolerance and cow milk allergy are two common side effects of milk consumption. Lactose intolerance may be avoided by avoiding milk and/or eating alternative lactose-free dairy products like yoghurt and cheese. Individuals with a cow milk protein allergy should avoid all cow milk products or transition to alternative animal milk sources, such as camel milk, which is free of the two major allergens in cow milk, beta-lactoglobulin and beta casein. With a frequency ranging from 2% to 7.5 percent, cow milk allergy is the most prevalent food allergy in children. The allergy is caused by an immune response to cow milk protein, which may develop during infancy or the first few years of life, but is uncommon in adulthood.

2. DISCUSSION

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As milk's components are complex, it should be processed using a mix of thermal and non-thermal methods to preserve its health advantages. Milk stability benefits from high-intensity pulsed electric fields with heat exposure. In this review article, the biological advantages of various milks such as cow, camel, and human milk were addressed. Camel milk enhanced anti-oxidant biomarkers in autistic youngsters, reducing oxidative stress and therefore improving autistic behavior. Anti-inflammatory chemicals are produced by fermented dairy products like camembert cheese, which may have therapeutic advantages in Alzheimer's disease. The relationship between whole milk and blood lipid concentrations in connection to cardiovascular risk is also discussed in this article; the milk did not cause substantial changes in blood cholesterol. Moderate consumption of whole milk may be beneficial to one's health since it inhibits the activity of the mechanistic target of rapamycin complex 1, which is responsible for cancer cell development. Milk, Dairy Products, and Their Functional Effects on Humans were also addressed in this review article.

3. CONCLUSION

Milk and its derivatives are suggested as beneficial diets at all stages of life, but especially during childhood and adolescence, when its calcium, protein, phosphorus, and other micronutrients may aid skeletal, muscular, and neurologic development. However, their relatively high saturated fat content, compared to the rest of the fats, which are mainly short- and medium-chain FAs and oleic acid, has raised concerns about them being potentially harmful foods, particularly in terms of cardiovascular health. The overwhelming majority of epidemiologic and intervention research conducted in recent years have shown that dairy products have no negative impact on surrogate indicators of CVD and cardiovascular prognosis. Indeed, several research indicate that SFAs from milk and its derivatives, particularly shorter-chain SFAs, are anti-inflammatory and may even be advantageous to certain demographic segments.

The evidence suggests that calcium does not play a significant role in coronary calcification at least from an epidemiologic standpoint: randomized clinical trials are inconclusive and calcium intake is inversely related to blood pressure, whereas its potential contribution to prostate cancer development is still debatable. As a result, the proposed link between calcium consumption and cardiovascular risk is presently unsupported by scientific data, and the opposite may be true. Furthermore, some milk components such as trans fatty acids [which may have different physiologic actions than industrial ones, butyric acid which may be beneficial for the trophism of the intestinal mucosa, conjugated linoleic acid even though the jury is still out on its putative health effects, there are efforts to increase its concentrations in bovine milk , phospholipidic acid which may be helpful for the trophism of the intestinal mucosa , phospho Furthermore, since milk fat seems to be widely distributed in very tiny micelles, milk has been demonstrated to be an effective vehicle for lipid-soluble nutrient absorption.

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