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CARIOSTATIC EFFECT OF DAIRY PRODUCTS - A REVIEW

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ABSTRACT

The study reviews the effect of intake of dairy products on the risk of dental caries. Dental caries (tooth decay) are a major health problem that is common all around the world, Milk and dairy products have been identified to possess anti - cariogenic activity. Milk products tend to reduce the influence of acids produced by the bacteria, due to their high buffering capacity, inorganic salts and proteins. The calcium in cheese, the calcium and phosphates in milk and other dairy products, help bring back minerals your teeth might have lost due to other foods and help rebuild tooth enamel. The various dietary sources of dairy products and their health benefits draws a conclusion that the sugar present in milk-lactose is least damaging to teeth. Several evidence suggests that milk and dairy product sources are "tooth friendly" and they help in making teeth and jaw bone stronger. Dietary sources like fresh cream, butter, cheese, milk, ghee have improved the health of the developing dentition and reduced the risk of childhood caries as well. It is believed that the healthy bacteria found in yogurt helps protect your gums and teeth from disease and decay, as well as decreasing the oral levels of hydrogen sulfide which can lead to bad breath. This review emphasises on its cariostatic activity including all forms of dairy products like milk, butter, cheese, cottage cheese.

INTRODUCTION

Food and nutrition has a very strong and a direct impact on the oral health of humans. Recently, consumption of soft drinks, acidic foods, fruit juices have increased worldwide and have been correlated with the most common and rising problem recently, dental caries. (1).

A person with a healthy, proper and balanced diet can be expected to have healthy teeth. Vitamins D, A and C, proteins, minerals, mainly calcium and phosphorus are essential for the development of teeth. Protein and energy malnutrition may also cause myoplasias, caries and other dental defects which may eventually lead to tooth decay. A strategy on nutrition for preventing dental Problems is essential. Milk and dairy products constitute one of the main food groups that help complete a balanced diet, as they provide significant amounts of micronutrients like Calcium and phosphorus. Recent revelations now have dentists raving yogurt as a superfood, healthy bacteria found in yogurt helps protect your gums and teeth from disease and decay, as well as decreasing the oral levels of hydrogen sulfide which can lead to bad breath. A diet with adequate amounts of calcium and vitamin D prevents gum related disease and protects against tooth loss and caries, flavoured milk (such as chocolate milk) is a liquid, it doesn't stay in the mouth very long or stick to teeth. It is therefore less likely to cause cavities than sticky or chewy sweet foods that help in the progression of bacteria on the tooth surface. the lactic acid in milk and other products can kill the bacteria that cause tooth decay. (2,3)(4)

Dairy products and milk have been identified to have cariostatic factors. The anticariogenic effect of milk and dairy products might be due to their high contents of Calcium and phosphorus Ions, its high buffering capacity, and CPPS (caseinphosphopeptides). Casein phosphopeptide forms nanoclusters with amorphous calcium phosphate thus providing a pool of calcium and phosphate which can maintain the supersaturation of saliva. Since CPP-ACP can stabilize calcium and phosphate in the solution, it can also help in the buffering of plaque pH and so calcium and phosphate level in plaque is increased. Therefore calcium and phosphate concentration within the subsurface lesions is kept high which results in remineralization.

Sufficient amount of data was observed and available to elaborate on the bioactive role of dairy products. Most published research focuses on the factors like Proteins, LPPS, hydrolysates, whole casein, some protease peptone fractions of milk and dairy Products to have a cariostatic effect. Proteins have also been known to have anti-cariogenic factors. Milk proteins, such as bovine and human caseins and lactoferrin, inhibit initial attachment of Cariogenic mutans streptococci to the hydroxyapatite with saliva on purified saliva host ligands. (5-7)

Non-sweetened dairy products, which are proven anticariogenic, on containing specific bioactive components from alike sources might prove to help with the anticariogenic effect.

Prevention and treatment need, besides traditional implementation of oral hygiene, sugar restriction, use of fluoride, balanced diet, are cost-effective strategies. Some studies have confirmed that a low PH level is a driving force for caries development. Bacteria such as mutans streptococci increase the adhesion capacity in the biofilm. Other bacteria, such as streptococcus sanguinis and species of actinomyces are considered protective against caries development. Dental research has shown the importance of calcium and phosphate ions in the remineralization process. Longbottom C. et al., proposed

in 2009 that an ideal caries preventive material should release calcium and phosphate in the oral environment.(8,9)(10)

As milk and dairy contain protective factors, they are considered anti - cariogenic and have also proven beneficial for dentition, oral health. This study reviews and describes the potential role of milk and dairy components in oral health promotion with emphasis on dental caries .

MATERIALS AND METHODS

The study reviewed literature and related articles accurate to the emphasised factors regarding dairy products and its cariostatic effect . Search engines like google Scholar and Pubmed were used for collection of data. The article search ranged from 1993- 2020. Articles that show data irrelevant to the subject were excluded. Studies pertaining to Milk and dairy products, caries, prevention were included in this study .

Dairy products - dietary sources

Dairy products or milk products are food Produced from or food that contains milk of mammals . Primarily produced from mammals Such as cattle, buffaloes, goats, sheep, camels. Milk can be broken down into several different categories including: - cream, butter, cheese, yogurt and infant formula. Some of the major dietary sources include: yogurt, cheese, butter, milk and milk products. (11,12)

Other sources of dairy products include : - mustard, Ice creams, gelato, ice milk, frozen stand , frozen yogurt, cottage cheese, Junket, ricotta , Cream cheese, fresh cheeses and curd , ghee, chhena , Quark, faisselle , clarified butter , sour cream, clotted cream, Kaymak, Smetana, Lassi, Leben, ayran , matzoon , mursik , cultured buttermilk, clabber , kumis , malai, whey and other various types of milk like : Skimmed milk, condensed milk, evaporated milk, baked milk powdered milk, khoa , infant formula, milk skin. Fermented milk products include : soured milk, vili, Kefir, Amasi. These products can also be further processed and modified with flavours and processing to obtain dishes, dips, desserts, Shakes, and other preparations. Various beneficial properties of dairy products are shown in [table 1]. (13)(14)(15)

Dental health and dairy products

Studies have suggested that milk, plain yogurt and other dairy products help rebuild tooth enamel. The calcium in cheese, the calcium and Phosphates in milk and other dairy products help put back minerals to the teeth that might have lost due to consuming other foods like : acidic foods, soft drinks, fruit juices and other foods that contain corrosive properties or low PH. (16)(17,18)

Drinking milk can definitely make teeth stronger and protect tooth enamel. Its calcium and phosphorus contents and a natural sugar lactose helps keep natural teeth longer and also helps to fight tooth decay. Milk can also help

strengthen jaw bone, remineralised bone structure, and keeps teeth healthy, especially for the developing dentition. Certain forms of dairy products can be harmful for oral health. These include processed forms of dairy products that may contain sugared flavours, artificial essence, flavouring agents, preservatives and taste enhancers. Proper oral hygiene practices must be followed after consuming dairy products. Negligence like bottle feeding of milk for long duration can be harmful and cause tooth decay on the upper anterior teeth. Dairy products can have immense benefits if consumed in adequate quantities and proper cleaning and rinsing of teeth after consumption is followed (17,19)(17,19,20)

Table 1: Health benefits of dairy products

Study	Dairy product	Role in dental health
Woodward M et al ,2020 (1)	Milk Yogurt / curd	Drinking cow's milk rich in calcium and phosphate can help strengthen your teeth and protect against cavity-causing tooth decay Healthy bacteria present in yogurt helps reduce caries and tooth decay and also decreases oral hydrogen sulphide levels
O'Brien NM et al , 1993 (5)	Cheese Butter	The protein in cheese called casein coats the teeth with a protective film that helps fend off acid that would normally attach tooth enamel. Butter is also a good source of the fat-soluble vitamins A, vitamin D, and vitamin K2. Butter is a very important part of an oral health diet.

(16)	Cottage cheese	Cottage cheese is an excellent source of calcium, a mineral that plays a major role in tooth and bone health
	Whey	Whey contains a good amount of nutrients and all essential amino acids beneficial for teeth and metabolism.
	Fresh/sour cream	Fresh cream , sour cream or whipped cream loaded with bioactive peptides , can be obtained by processing cows milk that can provide the necessary calcium for maintaining healthy teeth

Table 2: Anticariogenic effect of dairy products

Study	year	significance of study	relevance of study
Sheiham A et al (21)	2001	Effect of dairy products on dental caries	Relating to protective effect of dairy products on teeth
Comelli EM et al(22)	2002	Cariostatic effect of milk	Properties and proteins in milk that show anticariogenic activity

Johansson I(23)	2002	Milk and dairy products improving dental health	Calcium and phosphorus content contributing to stronger and healthy teeth
Van Loveren C(13)	2012	Anticariogenic mechanism of dairy products and milk	Mechanism of CPPs and prevention of caries progression
Yeung CA(24)	2015	Dairy products and fluoridated milk in preventing caries	Diet and nutrition having anticariogenic effect
Twetmen S et al(24,25)	2012	Health , diet , hygiene in caries prevention	Oral hygiene practices , healthy diet and incorporation of milk for

Tooth decay is generally caused by bacteria which are present on the tooth surface, fermenting sugars provided by diet to produce acid. The acid then dissolves the tooth enamel causing loss of minerals and eventually leading to tooth decay. Studies recognised as shown in [table 2] that milk and dairy products like cheese, butter etc exhibit anti-caries activity, lowering the incidence of caries. (25)(26)(27)

Experiments have been demonstrated showing the potential of milk to remineralise carious enamel. Various components of milk such as calcium, phosphates, proteins, protease-peptones, lactoferrin, lactose-peroxidase and lysozyme help protect against the demineralisation process. Evidence suggests that milk fat could prevent caries by either a physical mechanism, in which adherence of food to tooth is minimised and a microbiological mechanism in which, bacteriostatic properties of medium chain length fatty acids, C_{12} are involved. Extensive literature also suggests that cheese is probably the most anticariogenic food of all. Mastication of cheese activates salivary secretion, calcium and phosphorus are released from cheese. Cheese also contains CPPs which enhance remineralisation and prevent caries. (28)(23,29)

Cariostatic mechanism

CPPs and amp contents have been known to potentially be cariostatic. Glycomacropeptide (GMP), a casein-derived, has biological activities that reduce causes. GMP has a protective effect against dental Corrosion. These factors help buffering PM levels and thereby reduce the incidence of cavities. CPPs Prevent Ca and phosphate solubilisation hydroxyapatite. CPPs have been known to bind with Ca, Mg, Fe, and in and exhibit anti - cariogenic effect via inhibition of Cavies lesion by re-calcification of the dental enamel. (22,30)

They can form soluble organophosphates salts and lead to enhanced Calcium absorption by limiting the precipitation of calcium . Findings suggest that CPPs are involved in a mechanism that forms a Protective coat of APPS over the mineral Particle surfaces. Additionally, CPPS form nano-clusters with amorphous calcium phosphate at footer surface to provide Calcium and phosphate ion reservoir to maintain a supersaturation with respect to tooth enamel. This process buffers PH and provides protection. (21)(24)

Prevention of dental caries

Dental cavities are still the predominant cause of tooth loss among the population worldwide . Dental cavities involve the demineralisation of tooth enamel, which mainly consists of crystalline calcium phosphate embedded in the protein matrix . The demineralisation is brought about by the action of acids. Tooth decay ,demineralisation can occur either directly due to consumption of acidic foods or indirect as a result of fermentation by plaque bacteria and residual food particles stuck between the teeth or adhering to plaque. Initial demineralisation is generally produced by acids created by the bacteria which then leads to cavitation .(31)(32)(33)

Hence foods that increase the calcium and phosphate content on the tooth biofilm, on foods that counteract colonisation of cariogenic bacteria may reduce caries . However, several foods and supplements that have anti-cariogenic potential like cheese, milk derived cariostatic factors involved must be focused on in diet. Personal hygiene shall also contribute to caries prevention. (34)(34,35)(36)(37)

CONCLUSION

Multi-favoured analysis of literature has shown that milk and milk products reduce the risk of caries . From the evidence, a conclusion can be drawn that milk is considered anti carcinogenic and in fact is beneficial for healthy teeth. Lactose being the least cariogenic of dietary sugars has a potent and significant role in protecting teeth . The protective note of casein, calcium, phosphates helps improve dental health by remineralising enamel and strengthening dentition . Hence, consumption of anti- cariogenic foods which mainly include dairy products and milk must be incorporated in the diet .These sources of food are beneficial for the teeth, developing dentition, inhibition of carries and also for the overall health

REFERENCES

1. Woodward M, Rugg-Gunn AJ. Chapter 8: Milk, Yoghurts and Dental Caries [Internet]. Monographs in Oral Science. 2020. p. 77–90. Available from: <http://dx.doi.org/10.1159/000455374>
2. Blostein FA, Jansen EC, Jones AD, Marshall TA, Foxman B. Dietary patterns associated with dental caries in adults in the United States [Internet]. Vol. 48, Community Dentistry and Oral Epidemiology. 2020. p. 119–29. Available from: <http://dx.doi.org/10.1111/cdoe.12509>
3. Magno MB, Nadelman P, de Abreu Brandi TC, Python MM, Fonseca-Gonçalves A, da Cruz AG, et al. The Effect of Dairy Probiotic Beverages on Oral Health [Internet]. Milk-Based Beverages. 2019. p. 521–56. Available from: <http://dx.doi.org/10.1016/b978-0-12-815504-2.00015-3>
4. Ramamoorthi S, Nivedhitha MS, Divyanand MJ. Comparative evaluation of postoperative pain after using endodontic needle and EndoActivator during root canal irrigation: A randomised controlled trial. *AustEndod J*. 2015 Aug;41(2):78–87.
5. O'Brien NM, O'Connor TP. Milk, cheese and dental caries [Internet]. Vol. 46, International Journal of Dairy Technology. 1993. p. 46–9. Available from: <http://dx.doi.org/10.1111/j.1471-0307.1993.tb00859.x>
6. Dairy Products and Dental Caries [Internet]. Vol. 18, Nutrition Reviews. 2009. p. 49–51. Available from: <http://dx.doi.org/10.1111/j.1753-4887.1960.tb01684.x>
7. Ramanathan S, Solete P. Cone-beam Computed Tomography Evaluation of Root Canal Preparation using Various Rotary Instruments: An in vitro Study [Internet]. Vol. 16, The Journal of Contemporary Dental Practice. 2015. p. 869–72. Available from: <http://dx.doi.org/10.5005/jp-journals-10024-1773>
8. Aimutis WR. Dairy products and oral health [Internet]. Functional Dairy Products. 2007. p. 134–62. Available from: <http://dx.doi.org/10.1533/9781845693107.1.134>
9. Siddique R, Sureshbabu NM, Somasundaram J, Jacob B, Selvam D. Qualitative and quantitative analysis of precipitate formation following interaction of chlorhexidine with sodium hypochlorite, neem, and tulsi. *J Conserv Dent*. 2019 Jan;22(1):40–7.
10. R R, Rajakeerthi R, Ms N. Natural Product as the Storage medium for an avulsed tooth – A Systematic Review [Internet]. Vol. 22, Cumhuriyet Dental Journal. 2019. p. 249–56. Available from: <http://dx.doi.org/10.7126/cumudj.525182>
11. Visioli F. Dairy Products: Dietary and Medical Importance [Internet]. Encyclopedia of Food and Health. 2016. p. 352–5. Available from: <http://dx.doi.org/10.1016/b978-0-12-384947-2.00214-2>
12. Rajendran R, Kunjusankaran RN, Sandhya R, Anilkumar A, Santhosh R, Patil SR. Comparative Evaluation of Remineralizing Potential of a Paste Containing Bioactive Glass and a Topical Cream Containing Casein Phosphopeptide-Amorphous Calcium Phosphate: An in Vitro Study [Internet]. Vol. 19, Pesquisa Brasileira em Odontopediatria e Clínica Integrada. 2019. p. 1–10. Available from: <http://dx.doi.org/10.4034/pboci.2019.191.61>

13. van Loveren C, Broukal Z, Oganessian E. Functional foods/ingredients and dental caries [Internet]. Vol. 51, *European Journal of Nutrition*. 2012. p. 15–25. Available from: <http://dx.doi.org/10.1007/s00394-012-0323-7>
14. dairy products [Internet]. Available from: <http://dx.doi.org/10.18578/bnfc.899171369>
15. Kumar D, Delphine Priscilla Antony S. Calcified Canal and Negotiation-A Review [Internet]. Vol. 11, *Research Journal of Pharmacy and Technology*. 2018. p. 3727. Available from: <http://dx.doi.org/10.5958/0974-360x.2018.00683.2>
16. Reynolds EC. HEALTH ASPECTS OF DAIRY PRODUCTS | Caries Prevention and Oral Health [Internet]. *Encyclopedia of Dairy Sciences*. 2002. p. 1306–13. Available from: <http://dx.doi.org/10.1016/b0-12-227235-8/00723-9>
17. Tanaka K, Miyake Y, Sasaki S. Intake of dairy products and the prevalence of dental caries in young children. *J Dent*. 2010 Jul;38(7):579–83.
18. Ravinthar K, Jayalakshmi. Recent Advancements in Laminates and Veneers in Dentistry [Internet]. Vol. 11, *Research Journal of Pharmacy and Technology*. 2018. p. 785. Available from: <http://dx.doi.org/10.5958/0974-360x.2018.00148.8>
19. Noor SSSE, S Syed Shihaab, Pradeep. Chlorhexidine: Its properties and effects [Internet]. Vol. 9, *Research Journal of Pharmacy and Technology*. 2016. p. 1755. Available from: <http://dx.doi.org/10.5958/0974-360x.2016.00353.x>
20. Konde S, Raj S, Beena JP, Chinnappa A, Konde H. Probiotics for future caries control: A short-term clinical study [Internet]. Vol. 24, *Indian Journal of Dental Research*. 2013. p. 547. Available from: <http://dx.doi.org/10.4103/0970-9290.123363>
21. Sheiham A. Dietary effects on dental diseases. *Public Health Nutr*. 2001 Apr;4(2B):569–91.
22. Comelli EM, Guggenheim B, Stingle F, Neeser J-R. Selection of dairy bacterial strains as probiotics for oral health. *Eur J Oral Sci*. 2002 Jun;110(3):218–24.
23. Johansson I. Milk and dairy products: possible effects on dental health [Internet]. Vol. 46, *Scandinavian Journal of Nutrition*. 2002. p. 119–22. Available from: <http://dx.doi.org/10.1080/11026480260363242>
24. Yeung CA, Albert Yeung C, Chong LY, Glennly A-M. Fluoridated milk for preventing dental caries [Internet]. *Cochrane Database of Systematic Reviews*. 2015. Available from: <http://dx.doi.org/10.1002/14651858.cd003876.pub3>
25. Twetman S. Are we ready for caries prevention through bacteriotherapy? [Internet]. Vol. 26, *Brazilian Oral Research*. 2012. p. 64–70. Available from: <http://dx.doi.org/10.1590/s1806-83242012000700010>
26. Lin T-H, Lin C-H, Pan T-M. The implication of probiotics in the prevention of dental caries [Internet]. Vol. 102, *Applied Microbiology and Biotechnology*. 2018. p. 577–86. Available from: <http://dx.doi.org/10.1007/s00253-017-8664-z>
27. Ramesh S, Teja K, Priya V. Regulation of matrix metalloproteinase-3 gene expression in inflammation: A molecular study [Internet]. Vol.

- 21, *Journal of Conservative Dentistry*. 2018. p. 592. Available from: http://dx.doi.org/10.4103/jcd.jcd_154_18
28. Janani K, Palanivelu A, Sandhya R. Diagnostic accuracy of dental pulse oximeter with customized sensor holder, thermal test and electric pulp test for the evaluation of pulp vitality - An in vivo study [Internet]. Vol. 23, *Brazilian Dental Science*. 2020. Available from: <http://dx.doi.org/10.14295/bds.2020.v23i1.1805>
29. Bradshaw DJ, Lynch RJM. Diet and the microbial aetiology of dental caries: new paradigms. *Int Dent J*. 2013 Dec;63 Suppl 2:64–72.
30. Jose J, P. A, Subbaiyan H. Different Treatment Modalities followed by Dental Practitioners for Ellis Class 2 Fracture – A Questionnaire-based Survey [Internet]. Vol. 14, *The Open Dentistry Journal*. 2020. p. 59–65. Available from: <http://dx.doi.org/10.2174/1874210602014010059>
31. Kashket S, DePaola DP. Cheese Consumption and the Development and Progression of Dental Caries [Internet]. Vol. 60, *Nutrition Reviews*. 2002. p. 97–103. Available from: <http://dx.doi.org/10.1301/00296640260085822>
32. Çağlar E, Kuşcu ÖÖ. The Role of Diet in Caries Prevention [Internet]. Evidence-Based Caries Prevention. 2016. p. 87–106. Available from: http://dx.doi.org/10.1007/978-3-319-40034-1_6
33. Manohar M, Sharma S. A survey of the knowledge, attitude, and awareness about the principal choice of intracanal medicaments among the general dental practitioners and nonendodontic specialists [Internet]. Vol. 29, *Indian Journal of Dental Research*. 2018. p. 716. Available from: http://dx.doi.org/10.4103/ijdr.ijdr_716_16
34. Heløe LA, König KG. Oral Hygiene and Educational Programs for Caries Prevention [Internet]. Vol. 12, *Caries Research*. 1978. p. 83–93. Available from: <http://dx.doi.org/10.1159/000260368>
35. Nasim I, Nandakumar M. Comparative evaluation of grape seed and cranberry extracts in preventing enamel erosion: An optical emission spectrometric analysis [Internet]. Vol. 21, *Journal of Conservative Dentistry*. 2018. p. 516. Available from: http://dx.doi.org/10.4103/jcd.jcd_110_18
36. Nasim I, Hussainy S, Thomas T, Ranjan M. Clinical performance of resin-modified glass ionomer cement, flowable composite, and polyacid-modified resin composite in noncarious cervical lesions: One-year follow-up [Internet]. Vol. 21, *Journal of Conservative Dentistry*. 2018. p. 510. Available from: http://dx.doi.org/10.4103/jcd.jcd_51_18
37. Website [Internet]. [cited 2020 Jun 5]. Available from: <https://www.scopus.com/inward/record.url?eid=2-s2.0-85071307044&partnerID=40&md5=ef0e25bc67730732dd0f8fecacb7b64d>