To Assessed the Ph Change in Saliva on Consumption of Plain/Flavored Milk in 7-14 Yr Old Children

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Abstract

Background: Dental caries is an irreversible microbial disease of the calcified tissues of the teeth, characterized by demineralization of the inorganic portion and destruction of the organic substance of the tooth, which often leads to cavitation.

Methods: This study was conducted by the Department of Paediatric and Preventive Dentistry, Rajasthan dental college and Hospital, Jaipur. The present study was designed to assess the pH change in saliva and dental plaque on consumption of plain/flavored milk in 7-14 yr old children and to evaluate the antioxidant activities of them.

Results: The difference in Mean at Baseline between groups I and II, I and III, I and IV, I and V, II and III, II and V, III and IV, III and V, and IV and V was recorded to be 0.03,0.01,0.05,0.03.0.048,0.06,0.04,0.017, and 0.02 respectively. On application of Tukey HSD test, the same showed it to be statistically insignificant (p>0.05), whereas the same between group II and IV was found to be statistically significant (p≤0.05) with difference in Mean being 0.09.

Conclusion: The present study determines that milk when added with sugar as did not pose a risk as there was no decrease of pH below the limit of critical pH of 4.5 to 5.5. Hence, milk alone or milk with sugar can be recommended as a part of diet.

Introduction

Dental caries is an irreversible microbial disease of the calcified tissues of the teeth, characterized by demineralization of the inorganic portion and destruction of the organic substance of the tooth, which often leads to cavitation.[1]

There are practically no geographic areas in the world whose inhabitants do not exhibit some evidence of dental caries. It affects persons of both genders in all races, all socioeconomic strata and every age group.[1] It develops both in the crown and roots of teeth, and can arise in early

childhood as an aggressive dental caries that affects the primary teeth of infants and toddlers.[2] In baby teeth it affects about 620 million people or 9% of the population.[3] World Health Organization estimates that nearly all adults have dental caries at some point of time. The disease is most common in the developed world and less common in the developing world due to greater simple sugar consumption, and in India prevalence of caries is estimated to be 55.50% in 7-13yrs of age.[3]

Saliva, called the "Mirror of the body fluids", is vital for the maintenance of healthy hard (teeth) and soft (mucosa) oral tissues. It is a biologic fluid in the oral cavity and plays a key role in prevention of oral infection and dental caries.[4]

In most countries, cow's (or bovine) milk is the most common milk consumed. Cow's milk contain about 4-5% of the disaccharide lactose which in aqueous solution is metabolized by plaque organisms to organic acids with a consequent fall in plaque pH, although to a lesser extent than sucrose. However, Cow's milk produces a negligible fall in plaque pH in the oral cavity and balance of evidence from animal and human studies suggest that cow's milk is non-cariogenic.[5]

Milk and milk products, if devoid of added sugars, are safe and possibly beneficial for teeth. Milk is considered a suitable vehicle for substances beneficial to oral health, principally fluoride, probiotics and possibly vitamin D. [6]

Dairy products are perceived to be important for one's general health. Frequent sipping/ chewing of dairy products may satisfy the need to lubricate and moisten the mouth, while at the same time providing caries protection to highly susceptible individuals.

Materials and Methods

Study design and Study population

This study was conducted by the Department of Paediatric and Preventive Dentistry, Rajasthan dental college and Hospital, Jaipur. The present study was designed to assess the pH change in saliva and dental plaque on consumption of plain/flavored milk in 7-14 yr old children and to evaluate the antioxidant activities of them.

Following ethical clearance from the concerned committee of the institute, (Annexure) written permission was obtained from the Helping Hand School (Annexure) which harbored around 300 children between the age group of 5 to 15years.

Sterilization

30 sets of mouth mirror, probe, explorer and tweezer were autoclaved in the department before every visit to the school. Spot disinfection was carried out as and when required during the course of the study using chemical disinfecting solution.

Sample selection

Following case history recording on the Proforma (Annexure), research participants were screened for oral health problems and/or injuries. 70 children between the age group of 7 to 14 years were selected for our study based on the inclusion and exclusion criteria designed for the study following which written consent was obtained from the Custodian/school authorities (Annexure).

Inclusion criteria

1. Children in the age group of 7-14 yrs.
2. Willing to take part in the study
3. Healthy and co-operative children
4. Teeth free from restoration on labial, buccal and lingual surface
5. Mentally and physically fit children capable of following and performing the given instructions.

Exclusion criteria

1. Xerostomia
2. Cracked and/or Fissured oral mucous membrane
3. Atrophic tongue
4. Lactose intolerance

5. Allergic to milk
6. DMFT/dmft of >3
7. Undergoing Orthodontic treatment
8. Children on antibiotic therapy in the past 1 month

Methodology

Grouping of subjects: 70 subjects considered for our study according on the inclusion and exclusion criteria designed were grouped into 5 based on the study material used with 14 subjects in each group as shown below.

Group-I	Rose Milk
Group-II	Chocolate Milk
Group-III	Kesar Milk

Group-IV	Badam Milk
Group-V	Plain Milk (Control)

Different kind of flavored milk evaluated, exhibited the same nutritional and ingredient information except for the respective added flavors. In case of plain milk (control) both the nutritional and ingredients information exhibited was different from the study materials.

Care was taken that the study materials were fit for consumption and that the date of manufacture was the same for all the study materials except for the plain milk which was used as and when required which displayed the date on the day it was used.

Observation

Table 1: Comparison of Mean salivary pH recorded in different Groups at various Study Time intervals

Time Interval	Group (Mean)		Difference in Mean	p value*
Baseline	Rose (6.88) (I)	Chocolate (6.84)	0.03	1.000 (NS‡)
		Kesar (6.89)	0.01	1.000(NS‡)
		Badam (6.93)	0.05	0.98(NS‡)
		Plain Milk (6.91)	0.03	1.000(NS‡)
	Chocolate (6.84) (II)	Kesar (6.89)	0.048	0.86(NS‡)
		Badam (6.93)	0.09	0.03 (S†)
		Plain Milk (6.91)	0.06	0.21(NS‡)
	Kesar (6.89) (III)	Badam (6.93)	0.04	0.99(NS‡)
		Plain Milk (6.91)	0.017	1.000(NS‡)
	Badam (6.93) (IV)	Plain Milk (6.91)	0.02	0.97(NS‡)
Immediately	Rose (6.63) (I)	Chocolate (6.46)	0.17	< 0.001 (S††)
		Kesar (6.63)	0.00	NS‡
		Badam (6.56)	0.072	0.05 (S†)
		Plain Milk (6.601)	0.031	1.000(NS‡)
	Chocolate (6.46) (II)	Kesar (6.63)	0.17	< 0.001 (S††)
		Badam (6.56)	0.10	0.002 (S†)
		Plain Milk (6.601)	0.14	< 0.001 (S††)
	Kesar (6.63) (III)	Badam (6.56)	0.07	0.10(NS‡)
		Plain Milk (6.601)	0.02	1.000(NS‡)

	Badam (6.56) (IV)	Plain Milk (6.601)	0.04	1.000(NS‡)
5 Minutes	Rose (6.37) (I)	Chocolate (6.14)	0.23	< 0.001 (S††)
		Kesar (6.34)	0.02	1.000(NS‡)
		Badam (6.18)	0.18	< 0.001 (S††)
		Plain Milk (6.42)	0.05	0.708(NS‡)
	Chocolate (6.14) (II)	Kesar (6.34)	0.202	< 0.001 (S††)
		Badam (6.18)	0.04	1.000(NS‡)
		Plain Milk (6.42)	0.28	< 0.001 (S††)
	Kesar (6.34) (III)	Badam (6.18)	0.16	< 0.001 (S††)
		Plain Milk (6.42)	0.07	0.06(NS‡)
	Badam (6.18) (IV)	Plain Milk (6.42)	0.24	< 0.001 (S††)
10 Minutes	Rose (6.00) (I)	Chocolate (5.81)	0.19	< 0.001 (S††)
		Kesar (6.00)	0.00	NS‡
		Badam (5.80)	0.20	< 0.001 (S††)
		Plain Milk (6.04)	0.04	0.99(NS‡)
	Chocolate (5.81) (II)	Kesar (6.00)	0.19	< 0.001 (S††)
		Badam (5.80)	0.007	1.000(NS‡)
		Plain Milk (6.04)	0.23	< 0.001 (S††)
	Kesar (6.00) (III)	Badam (5.80)	0.20	< 0.001 (S††)
		Plain Milk (6.04)	0.04	0.98(NS‡)
	Badam (5.804) (IV)	Plain Milk (6.04)	0.23	< 0.001 (S††)
15 Minutes	Rose (5.97) (I)	Chocolate (5.75)	0.22	< 0.001 (S††)
		Kesar (5.95)	0.02	0.99(NS‡)
		Badam (5.81)	0.16	< 0.001 (S††)
		Plain Milk (6.01)	0.04	1.000(NS‡)
	Chocolate (5.75) (II)	Kesar (5.95)	0.201	< 0.001 (S††)
		Badam (5.81)	0.06	0.41(NS‡)
		Plain Milk (6.01)	0.26	< 0.001 (S††)
	Kesar (5.95) (III)	Badam (5.81)	0.14	< 0.001 (S††)
		Plain Milk (6.01)	0.06	0.37(NS‡)
	Badam (5.81) (IV)	Plain Milk (6.01)	0.204	< 0.001 (S††)
20 Minutes	Rose (6.48)(I)	Chocolate (6.15)	0.33	< 0.001 (S††)

		Kesar (6.46)	0.01	1.000(NS‡)
		Badam (6.23)	0.24	< 0.001 (S††)
		Plain Milk (6.55)	0.07	0.98(NS‡)
	Chocolate (6.15) (II)	Kesar (6.46)	0.31	< 0.001 (S††)
		Badam (6.23)	0.08	0.51(NS‡)
		Plain Milk (6.55)	0.40	< 0.001 (S††)
	Kesar (6.46) (III)	Badam (6.23)	0.23	< 0.001 (S††)
		Plain Milk (6.55)	0.09	0.41(NS‡)
	Badam (6.23) (IV)	Plain Milk (6.55)	0.32	< 0.001 (S††)
30 Minutes	Rose (6.87) I	Chocolate (6.79)	0.08	0.08(NS‡)
		Kesar (6.89)	0.02	1.000(NS‡)
		Badam (6.91)	0.04	1.000(NS‡)
		Plain Milk (6.91)	0.04	1.000(NS‡)
	Chocolate (6.79) (II)	Kesar (6.89)	0.102	0.01 (S†)
		Badam (6.91)	0.12	0.001 (S†)
		Plain Milk (6.91)	0.12	0.001 (S†)
	Kesar (6.89) (III)	Badam (6.91)	0.02	1.000(NS‡)
		Plain Milk (6.91)	0.02	1.000(NS‡)
	Badam (6.91) (IV)	Plain Milk (6.91)	0.00	NS‡

*Tukey HSD

$p \leq 0.05$=Significant (S†)

$p<0.001$= highly significant (S††)

$p>0.05$=Not significant (NS‡)

The difference in Mean at Baseline between groups I and II, I and III, I and IV, I and V, II and III, II and V, III and IV, III and V, and IV and V was recorded to be 0.03,0.01,0.05,0.03.0.048,0.06,0.04,0.017, and 0.02 respectively.

On application of Tukey HSD test, the same showed it to be statistically insignificant ($p>0.05$), whereas the same between group II and IV was found to be statistically significant ($p \leq 0.05$) with difference in Mean being 0.09. Similarly, the difference in Mean immediately on use of study material between groups I and III, I and V, and III and IV was noted to be 0.00,0.031,and 0.07 respectively,

whereas the same between groups III and V, and IV and V was recorded to be 0.02 and 0.04 respectively.

On application of Tukey HSD test, the same was found to be statistically insignificant ($p>0.05$), whereas the same between groups I and II, II and III, and II and V was found to be statistically highly significant ($p<0.001$) with difference in Mean being 0.17, 0.17, and 0.14 respectively. However, the same between groups I and IV and II and IV was noted to be statistically significant ($p \leq 0.05$) with difference in Mean being 0.072 and 0.10 respectively.

At 5 minutes time interval, difference in Mean between groups I and III, I and V, II and IV, III and V was recorded to be 0.02,0.05,0.04, and 0.07 respectively which

was found to be statistically insignificant (p>0.05) on application of Tukey HSD test.

Application of the same test between group I and II, I and IV, II and III, II and V, III and IV, and IV and V was found to be statistically highly significant (p<0.001) with the difference in Mean being 0.23,0.18,0.202,0.28,0.16, and 0.24 respectively.

The difference in Mean was found to be 0.00,0.04,0.007, and 0.04 between groups I and III, I and V, II and IV, and III and V respectively at 10 minutes time interval which was also found to be statistically insignificant (p>0.05) on application of Tukey HSD test, whereas it was statistically highly significant (p<0.001), between groups I and II, I and IV, II and III, II and V, III and IV, and IV and V where the difference in Mean recorded was 0.19, 0.2,0.19,0.23,0.2, and 0.23 respectively.

At 15 minutes time interval, difference in Mean between groups I and III, I and V, II and IV, and III and V was recorded to be 0.02,0.04,0.06, and 0.06 respectively and the same was found to be statistically insignificant (p>0.05) on application of Tukey HSD test.

On application of the same between groups I and II, I and IV, II and III, II and V, III and IV, and IV and V it was found to be statistically highly significant (p<0.001) with the difference in Mean being 0.22, 0.16,0.201,0.26, 0.14, and 0.204 respectively.

The difference in Mean was found to be 0.01,0.07,0.08, and 0.09 between groups I and III, I and V, II and IV, and III and V respectively at 20 minutes time interval which was also found to be statistically insignificant (p>0.05) on application of Tukey HSD test, whereas it was statistically highly significant (p<0.001), between groups I and II, I and IV, II and III, II and V, III and IV, and IV and V where the difference in Mean recorded was 0.33,0.24,0.31,0.4 ,0.23, and 0.32 respectively.

At 30 minutes time interval, difference in Mean between groups I and II, I and III, I and IV, I and V, III and IV, III and V, and IV and V was recorded to be 0.08,0.02,0.04,0.04,0.02,0.02, and 0.00 respectively and analysis of the same showed it to be statistically insignificant (p>0.05).

0.102,0.12, and 0.12 which was noted to be the difference in Mean between groups II and III, II and IV, and II and V respectively was found to be statistically significant on application of Tukey HSD test (p≤0.05)

Discussion

Dental caries is an irreversible microbial disease of the calcified tissues of the teeth, characterized by demineralization of the inorganic portion and destruction of the organic substance of the tooth, which often leads to cavitation.[1]

The problem with dental caries is age and with modernization and the impact of western world, the problem of dental erosion seems to be on the advancing front. Even though dentistry has advanced on a very large scale, the problem of dental caries still persists with it increasing every year in the developing world. India is no exception to this problem, with almost 80% of children and 60% of adults suffering from this disease with almost no dental restorative help available, particularly in rural and deprived areas.[4]

Dental caries forms through a complex interaction over a period of time between acid-producing bacteria and fermentable carbohydrate and many other host factors, including teeth and saliva.

In most countries, cow's (or bovine) milk is the most common milk consumed. Cow's milk contain about 4-5% of the disaccharide lactose which in aqueous solution is metabolized by plaque organisms to organic acids with a consequent fall in Plaque pH, although to a lesser extent than sucrose.[7]

Jenkins G N and Ferguson D.B. et al (1966)[8], in their study have observed a negligible fall in Plaque pH in the oral cavity after consumption of cow's milk and suggested it to be non-cariogenic. The anti-cariogenicity of milk lies within its high buffering capacity, its components i.e. calcium, phosphate, protein and phospho-proteins and its antioxidant level. Milk proteins are reported to have a protective role by absorbing onto the enamel surface, whereas enzymes reduces the growth of acidogenic plaque bacteria.

Conclusion

The present study determines that milk when added with sugar as did not pose a risk as there was no decrease of pH below the limit of critical pH of 4.5 to 5.5. Hence, milk alone or milk with sugar can be recommended as a part of diet.

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