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# Dairy Product Consumption Effects on Increasing Salivary pH, Flow, and Calcium Ion

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***Abstract****: Dairy product is processed milk products using technology that has additional nutrition tambahan (Stanton et al, 2013), which are milk, and other processed products like cheese and yoghurt (Ferrazano et al, 2007). Dairy products is rich in important micronutrients for the body like calcium, phosphor, magnesium, zinc, potassium, vitamin D, vitamin $B_{12}$, protein, essential and non-essential fat. The objective of this study is to understand dairy product effectivity towards increase in calcium ion, pH, and salivary glow before and after three and sever days on dairy product consumption. This is an experimental study with pre and post test group design with 75 respondents classified into three groups which are milk, cheese, yoghurt, each has 25 correspondents. The study result shows that consumption of cheese, milk and yoghurt increases salivary pH, flow, and calcium ion concentration saliva ($p<0.01$). The biggest average difference on pH is found on respondents consuming yoghurt before and after three days consuming around 0,20±0,12. Biggest average difference on salivary flow is respondents consuming yoghurt on the third and seventh day after consuming 0,65±0,69. The biggest average difference calcium ion is respondents consuming cheese in the third and seventh day 0,84±1,11. Yoghurt effectively increases salivary pH and flow, while cheese increases salivary calcium ion concentration.*

***Keyword****: dairy product, salivary pH, flow rate, ion calcium*

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## I. Introduction

Saliva has an important role in lubricating, antimicrobial action, maintaining mucosa integrity, cleansing, and ion reservoir (calsium, phosphor, dan fluoride) to remineralize enamel and maintain microbe inside the oral cavity (Fejerskov, et al 2008, Walsh 2008). Normal salivary pH ranges between 6,0-7,5. Saliva prevents caries (Fejerskov, et al 2008).[1] Caries is considered as a primary problem in dentistry. It is a multifactorial disease involving demineralization process caused by microorganism activity that forms acid and causes damage in the tooth structure (Siswosubroto, 2011). Researches tries to find an alternative on caries prevention, one of it is by anticariogenic food. Substrate or diet is one of the causing factors for caries, but it can also prevent caries, one way to do it is by consuming dairy products. Dairy products is processed milk products done by technology and has additional nutrition (Stanton et al, 2013), for example milk and other processed products like cheese and yoghurt (Ferrazano et al, 2007). As processed milk product, dairy products is rich in important micronutrients for the body like calcium, phosphor, magnesium, zinc, potassium, vitamin D, vitamin $B_{12}$, protein, essential and non-essential fat.

Poureslami ‘s study described a significant difference in consuming yoghurt and espar on salivary calcium ion ($p<0,01$) (Poureslami et al, 2013).[2] This is also true for Murugesh, consuming yoghurt affects salivary flow (Murugesh et al, 2015).[3] Srivastava et al found that there is an increase in salivary pH from 7,35 ± 0,42 to 7,58 ± 0,40 after seven days consuming yoghurt (Srivastava, 2014).[4]

## II. Materials and Method

The design for this study is experimental by pretest-posttest control group design. This study is done at Muhammadiyah Tj. Rejo Medan secondary school. Salivary calcium ion, pH, and flow measurements is done at PTKI Medan Pharmacy laboratory. The research population is aged 12-15 years old. This study is done on 25 respondents that fulfils inclusion and exclusion criteria, which is children aged 12-15, maximum DMFT, 1, is mentally and physically healthy. The exclusion criteria is allergic reaction towards milk or products that contains milk and is consuming medicine affection salivary flow (antibiotics, antidepressants).

## III. Results

In this study, most of the respondents are 13 years, which amounts to 57,3%. By gender, most of the respondent is male, 52% the female respondents are up to 48%.

**Table 1.** Respondent Characteristics

| Respondent Characteristics | n | % |
|---|---|---|
| **Age** | | |
| 12 | 0 | 0 |
| 13 | 43 | 57,3 |
| 14 | 26 | 34,6 |
| 15 | 5 | 8,1 |
| **Total** | **75** | **100** |
| **Gender** | | |
| Male | 39 | 52 |
| Female | 36 | 48 |
| **Total** | **75** | **100** |

Research results shows that there are no significant difference on salivary pH, flow, and calcium ion concentration on milk, cheese and yoghurt respondents each amounts to p > 0,05 (Tabel 2).

**Tabel 2.** Mean of salivary pH, flow, and calcium ion concentration Before Milk, Cheese and Yoghurt consumption.

| Dairy Products | n | Mean ($\bar{X}$ ±SD) pH | p | Mean ($\bar{X}$ ±SD) Salivary flow (ml/minute) | p | Mean ($\bar{X}$ ±SD) Calcium ion Concentration (mmol/L) | p |
|---|---|---|---|---|---|---|---|
| Milk | 25 | 6,91±0,13 | 0.068 | 0,82±0,33 | 0.063 | 0,46±0,35 | 0.054 |
| Cheese | 25 | 7,05±0,08 | | 0,42±0,26 | | 0,64±0,60 | |
| Yoghurt | 25 | 7,01±0,08 | | 0,49±0,31 | | 0,40±0,44 | |

Research results shows that after three days of consuming milk, cheese and yoghurt, highest salivary pH mean for yoghurt is 7,22±0,12. Highest flow and calcium ion concentration is on milk group which is 1,03±0,30 and 1,16±0,59 (Table 3).

**Tabel 3**. Mean of salivary pH, flow, and calcium ion concentration after three days consuming milk, cheese and yoghurt.

| Dairy Products | n | Mean salivary pH ($\bar{X}$ ±SD) | | |
|---|---|---|---|---|
| | | pH | Salivary flow (ml/minute) | Calcium ion Concentration (mmol/L) |
| Milk | 25 | 7,07±0,10 | 1,03±0,30 | 1,16±0,59 |
| Cheese | 25 | 7,13±0,10 | 0,54±0,23 | 0,84±0,63 |
| Yoghurt | 25 | 7,22±0,12 | 0,61±0,28 | 0,41±0,33 |

Research results shows that after three days of consuming milk, cheese and yoghurt, highest salivary pH and flow mean for yoghurt is 7,31±0,15 and 1,26±0,68. Highest calcium ion concentration is on Cheese group 1,69±0,79 (Table 4).

**Tabel 4.** Mean of salivary pH, flow, and calcium ion concentration after seven days consuming milk, cheese and yoghurt.

| Dairy Products | n | Mean ($\bar{X}$ ±SD) | | |
|---|---|---|---|---|
| | | pH | Salivary flow (ml/minute) | Calcium ion Concentration (mmol/L) |
| Milk | 25 | 7,25±0,12 | 1,20±0,25 | 1,29±0,58 |
| Cheese | 25 | 7,14±0,09 | 0,64±0,24 | 1,69±0,79 |
| Yoghurt | 25 | 7,31±0,15 | 1,26±0,68 | 1,18±0,54 |

The results shows that there are significant difference on salivary pH between milk, cheese and yoghurt before, three and seven days of consumption. Each is amounted to p<0,05 (Table 5).

**Tabel 5.** Effectivity of Milk, Cheese, and Yoghurt consumption on salivary pH.

| Dairy Products | n | Salivary pH difference before and after consumption ($\bar{X}$ ±SD) | p | Salivary pH difference before and after seventh day of consumption ($\bar{X}$ ±SD) | p | Salivary pH difference between third and seventh day of consumption ($\bar{X}$ ±SD) | p |
|---|---|---|---|---|---|---|---|
| Milk | 25 | 0,16±0,17 | 0.004* | 0,17±0,14 | 0,0001* | 0,18±0,02 | 0.0001* |
| Cheese | 25 | 0,07±0,10 | | 0,01±0,10 | | 0,01±0,01 | |
| Yoghurt | 25 | 0,20±0,12 | | 0,09±0,13 | | 0,09±0,03 | |

The result shows that there are no significant difference in salivary flow between milk, cheese, and yoghurt group before and on the third day of consumption. Each scored p= 0,382 (Table 6).

**Tabel 6.** Effectivity of consuming Milk, Cheese and Yoghurt on salivary flow

| Dairy Products | n | Salivary flow after third day of consumption ($\bar{X}$ ±SD) | p | Salivary flow before and after seventh day of consumption ($\bar{X}$ ±SD) | p | Salivary flow on third and seventh day of consumption ($\bar{X}$ ±SD) | p |
|---|---|---|---|---|---|---|---|
| Milk | 25 | 0,20±0,31 | 0.382 | 0,38±0,08 | 0,0001* | 0,16±0,18 | 0.0001* |
| Cheese | 25 | 0,12±0,10 | | 0,22±0,02 | | 0,20±0,10 | |
| Yoghurt | 25 | 0,11±0,47 | | 0,77±0,37 | | 0,65±0,69 | |

Results shows significant difference in pH between the three groups before, after three days and seven days of consumption, each with an amount of p<0,05 (Tabel 7).

**Tabel 7.** Effectivity of consuming Milk, Cheese and Yoghurt on calcium ion concentration

| Dairy Products | n | Salivary Calcium Ion difference before and after third day of consumption ($\bar{X}$ ±SD) | p | Salivary Calcium Ion before and after seventh day of consumption ($\bar{X}$ ±SD) | p | Salivary Calcium Ion third and seventh day of consumption ($\bar{X}$ ±SD) | p |
|---|---|---|---|---|---|---|---|
| Milk | 25 | 0,69±0,35 | 0.005* | 0,83±0,23 | 0,0001* | 0,12±0,89 | 0.0001* |
| Cheese | 25 | 0,64±0,6 | | 1,05±0,11 | | 0,84±1,11 | |
| Yoghurt | 25 | 0,40±0,44 | | 0,78±0,1 | | 0,76±0,51 | |

## IV. Discussion

Mean average of salivary pH before and after the third day consuming the products is on yoghurt group which is 0,20 ± 0,12. Yoghurt contains probiotic bacterias which increases salivary pH through direct and indirect interaction. Direct interaction causes probiotic baterias to interfere biofilm formation, fighting off bad microorganisms, and produces a chemical material, lactic acid to kill off harmful bacterias. Indirectly, probiotic has a role on killing harmful bacteria by maintaining normal conditions on the oral cavity, increasing immune function of the body on local conditions and maintains non-immunologic systems.[1]

Highest average mean on salivary pH between and after third and seventh day of consuming dairy products is on the milk group, 0,18±0,02. Statistically milk is more effective on increasing salivary pH after seven days of consumption (p<0.05). Milk contains antioxidants and high protein compared to yoghurt and cheese. The high antioxidant in milk is anticariogenic an antibacterial and will decrease carbohydrate to lactic acid and aspartic acid breakdowns by bacteria so that salivary pH increases. The protein in milk can increase salivary pH because it produces ammoniac based substances which increases salivary pH (Yadav, 2014)..

Highest difference in mean of salivary flow and calcium ion before and after three days consuming dairy product is found on milk group 0,20±0,31 ml/minute and 0,69±0,74 mmol/L. Milk contains higher antioxidant compared to cheese and yoghurt which affects carbohydrate breakdown into lactic and aspartic acids. Acids that are produced is considered taste bud stimulus which acts as a chemical stimuli to activate central nerve system, after receiving the stimuli, the brain is designed to excrete saliva by releasing neuro transmitters, norepinephrine or noradrenaline which then bonds to adrenergic type salivary gland secreting cells receptors. Through this receptors, salivary glands are stimulated to excrete more amounts saliva that are watery.[6] Milk increases calcium ion because it contains calcium packed in micelles on casein components. When casein molecules are formed, they wil form a rounded micelles structure so that casein protein can depend without limit on milk. With casein protein inside the micelles, important milk minerals such as calcium and phosphor is also bonded inside the misel.[3,4]

Highest mean difference on flow after three and seven days consuming dairy products is shown on the yoghurt group, 0,65±0,69. Statistically yoghurt is more effective on increasing salivary flow after seven days of consumption ($p<0.05$). Yoghurt has a systemic effect as an immunomodulatory that sparks salivary flow.

Highest mean difference of salivary calcium ion between third and seventh day of dairy product consumption is found on cheese group, 0,84±1,11mmol/L. Cheese contains calcium and inorganic phosphate that decreases enamel demineralization by protein absorbed in casein phosphopeptide. Casein phosphopeptide released by cheese proteolysis will form casein phosphopeptide-amorphous calcium phosphate (CPP-ACP) which increases calcium. CPP-ACP helps remineralization process by combining calcium ion diffusion with phosphate from saliva to teeth plaque to prevent caries from happening. [5-7]

## V. Conclusion

Milk and other products that contains milk has a biologic and physical property that are needed in salivary components. Calcium, phosphate, casein, and fat can maintain oral health by balancing salivary pH saliva, preventing demineralization and increasing remineralization.

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