

## Effect of vitamin C supplementation on gingival bleeding

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### ABSTRACT

**Introduction:** Periodontitis is a multifactorial disease caused by an imbalance between environmental factors such as periodontal pathogens, and the host defence. Host defence mechanisms may be influenced by genetic factors, hormones and nutrition. One of the nutrition is vitamin C. The aim of this study was to evaluate the influence of vitamin C supplementation on gingival bleeding. **Methods:** As much as ninety-eight patients with chronic periodontitis consisted of 42 males and 56 females, aged 30 - 59-years-old participated in this study. Gingival bleeding was assessed before and after three months of vitamin C supplementation. Gingival bleeding criteria based on Van der Velden with tooth selection based on Ramfjord teeth. **Result:** Gingival bleeding before vitamin C supplementation that showed high was 4 patients (4.1%), middle was 36 patients (36.7%) and low was 58 patients (59.2%). After 3 months of vitamin C supplementation, gingival bleeding that showed high was 2 patients (2%), middle was 16 patients (16.3%), and low was 80 patients (81.6%). **Conclusions:** There was an effect of vitamin C supplementation on gingival bleeding.

**Keywords:** Chronic periodontitis, vitamin C supplementation, gingival bleeding

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### INTRODUCTION

Periodontitis is an inflammatory disease of periodontal tissue triggered by plaque bacteria that cause periodontal pockets with clinical features characterized by red gum colour, oedema, changing contours, loss of gum attachment, tooth agitation, increased number of inflammatory exudates, and gum consistency transformed into soft and easily bleed either spontaneously or

lightly stimulated as when racing the probe on pocket wall.<sup>1,2</sup>

Gum bleeding occurs due to dilated capillaries and contains much blood, blood vessel walls or endothelial becomes brittle and pressed by fluid and inflammatory cells to the surface. Also, thinning of the sulcular epithelium and degeneration resulting microulceration. When exposed to probe friction at the time of probing, blood capillaries break easily.<sup>3</sup>

Periodontitis is a multifactorial disease caused by an imbalance between environmental factors and the causes of periodontal disease and host defence. Periodontitis can occur because of the role of bacteria in plaque that induces pathological changes in the tissues directly or indirectly. The host defence mechanism can be influenced by genetic factors, hormones, and nutrients. Nutritional factors that support one of them is vitamin C.<sup>4</sup> Vitamin C is involved in the synthesis of intracellular substances and collagen fibres in various connective tissues. Therefore, it is possible if a lack of vitamin C intake can cause diseases including periodontitis.<sup>5</sup>

Multiple studies on vitamin C has been done, and the result states that there is a relationship between vitamin C and periodontitis, i.e. the less vitamin C in plasma then the more the occurrence of periodontal tissue damage.<sup>5-8</sup> The result of Vogel & Wechsler's research in 1979 suggested that vitamin C deficiency causes gingivitis.<sup>9</sup> Another study conducted by Blignaut & Grobler in 1992 stated that vitamin C deficiency caused pocket  $\geq$  4 mm.<sup>10</sup> While the results of research Vaananen in 1993 also stated that the lack of vitamin C causes pocket  $\geq$  4mm.<sup>11</sup> A longitudinal study for 3 years by Amalya et al., in the subjects of untreated periodontitis patients, showed a more natural tendency for gum attachment loss in patients with vitamin C8 deficiency.<sup>8</sup> The condition indicates that subjects with vitamin C deficiency will be susceptible to gum inflammation.<sup>8</sup>

Based on previous studies and research, the authors wanted to know the effect of vitamin C supplementation on gum bleeding. This study was aimed to determine the effect of vitamin C supplementation on gum bleeding.

## **METHODS**

The research type was quasi-experimental with pre-post test design with research population was the tea farmers in tea plantation of Malabar/ Purbasari, West Java, Indonesia. The sample of the study was the subject that had been the study sample in 2002 and 2005.

This research took place at Pasir Junghun Hospital PT. Perkebunan Nusantara VIII Purbasari/ Malabar in West Java from 28 March 2011 to July 2011. Clinical parameters to be examined

were gingival bleeding using the Van der Velden index<sup>12</sup> through pocket wall search by the probe. The research procedure performed is as follows: Charging informed consent; Examination of gingival bleeding on teeth 16,21,24,36,41,44 (Ramsfjörd teeth) by looking at the presence or absence of gingival bleeding with assessment criteria according to Van der Velden<sup>12</sup>, namely: 0: no bleeding occurs, 1: bleeding occurs as a point after 30 seconds, 2: bleeding in the form of a line after 30 seconds.

After a clinical periodontal examination, each subject was given 90 tablets of vitamin C 320 mg for 3 months. Each respondent was instructed to consume 1 vitamin C tablet daily after breakfast. In the third month, the same gingival bleeding examination procedure was performed with the initial examination.

## **RESULT**

This research was conducted at Pasir Junghun Hospital PT. Perkebunan Nusantara VIII Purbasari/ Malabar in West Java from March 2011 until July 2011. The number of research subjects was as much as 98 people whom all suffer from chronic periodontitis. This study was a continuation of research in 2002 and 2005, so the selection of research subjects still involved the same respondents but decreased the amount due to business and not willing to follow the research again. Each study subjects received the same treatment, namely: bleeding gum examination and vitamin C supplementation (Ester C) 320mg 1 tablet per day after breakfast for 3 months. Examination of gingival bleeding using Van der Velden technique<sup>12</sup> on the teeth 16,21,24,36,41,46 (Ramsfjörd teeth).

General characteristics of research subjects based on age, sex and smoking status can be seen in Table 1. Based on sex the study subjects consisted of 42 men and 56 women with a range of age 30 years to 59 years, with an average of 32.67 years. The age group of 40-49 years is 73 people, the most age group with the percentage of 74%, followed by the age group 50-59 years with the number of 15 people and the percentage of 15% while the age group 30-39 years has the least amount of 10 people with a percentage of 10%. The number of subjects who do not smoke is

Table 1. General characteristics of research subjects

Characteristics		n	%
Gender	male	42	43%
	female	56	57%
Age	30-39 yo	10	10%
	40-49 yo	73	74%
	50-59 yo	15	15%
	$\bar{x}$	32.67	
	SD	35.02	
Smoking status	Non-smoker	51	52%
	Former smoker	3	3%
	Smoker	44	45%
	$\bar{x}$	32.67	
	SD	25.93	
Type of cigarette	Cigarette	7	15%
	Clove cigarette	39	83%
	Tobacco	1	2%
	$\bar{x}$	15.67	
	SD	20.43	

Table 2. Gingival bleeding status before and after vitamin C supplementation

Category	Before		After	
	f	%	f	%
High	4	4.1	2	2
Medium	36	36.7	16	16.3
Low	58	59.2	80	81.6
Total	98	100	98	100

the most with 51 people with the percentage of 52% followed by the subject of smokers as many as 44 people with a percentage of 45% and former smokers as much as 3 people with a percentage of 3%.

The majority of smokers who smoke the type of clove cigarettes is the highest number of 39 people with the percentage of 83% followed by the number of cigarette smokers as much as 7 people with a percentage of 15%, while the tobacco smokers subjects amounted to at least 1 person with a percentage of 2%.

Table 2 shown that gingival bleeding before vitamin C supplementation is high as much as 4 people (4.1%), medium 36 people (36.7%) and low 58 people (59.2%). After 3 months of vitamin C supplementation, 2 (2%) had high gingival bleeding, 16 (16.3%) and low 80 (81.6%). This

result suggested that after supplementation of vitamin C for 3 months there was a decrease in gingival bleeding.

Table 3 shows differences before and after vitamin C supplementation in smokers, former smokers, and non-smokers. Table 3 shown that 44 people (44.9%) are smokers, 3 (3.1%) ex-smokers and 51 people (52.0%) do not smoke. This result indicated that most subjects are non-smokers. High total gum bleeding before vitamin C supplementation in smokers, former smokers and non-smokers as much as 4 people (4.1%), but after vitamin C supplementation totalled to 2 people (2%). While the total amount of gum bleeding was before the supplementation of vitamin C as many as 36 people (36.7%), but after supplementation of vitamin C for 3 months the number became as many as 16 people (16.3%). In the low gum bleeding group prior to vitamin C supplementation, the total number was 58 people (59.2%), but after vitamin C supplementation the number increased to 80 people (81.6%). These results suggested that in smokers, former smokers and non-smokers have decreased gum bleeding after vitamin C supplementation for 3 months.

Comparison of gum bleeding before vitamin C supplementation and after vitamin C supplementation was performed to see whether or not there was a significant difference between gum bleeding before vitamin C supplementation and after vitamin C supplementation (Table 4).  $H_0$ : There was no difference in gum bleeding before vitamin C supplementation with gum bleeding after vitamin C supplementation.  $H_1$ : There was a difference in gum bleeding before vitamin C supplementation with gum bleeding after vitamin C supplementation.  $\alpha = 5\%$ . Test Criteria: 1. Accept  $H_0$  if P-Value (sig) >  $\alpha$  or Accept  $H_0$  if -Z table < Z arithmetic < Z table. Reject  $H_0$  if P-Value (sig)  $\leq \alpha$  or Reject  $H_0$  if Z count > Z table and -Z arithmetic < - Z table.

Calculation results obtained the average of gingival bleeding before vitamin C supplementation is equal to 0.4866. While the average gingival bleeding after vitamin C supplementation is 0.2134, this result indicated that there is a significant change in gingival bleeding after vitamin C supplementation.

Based on the calculation results obtained p-value (sig) of 0.000. Since the p-value (sig)

Table 3. Differences before and after vitamin C supplementation in smokers, former smokers, and non-smokers

Gingival bleeding		Smokers		Former smokers		Non smokers		Total	
		Before	After	Before	After	Before	After	Before	After
High	f	2	0	0	0	2	2	4	2
	%	2	0	0	0	2	2	4.1	2
Medium	f	6	3	1	0	29	13	36	16
	%	6.1	3.1	1	0	29.6	13.3	36.7	16.3
Low	f	36	41	2	3	20	36	58	80
	%	36.7	41.8	2	3.1	20.4	36.7	59.2	81.6
Total	f	44	44	3	3	51	51	98	98
	%	44.9	44.9	3.1	3.1	52	52	100	100
	SD	18.58	22.85	1.00	1.73	13.75	17.35	27.15	41.59

Table 4. Differences of gingival bleeding before and after vitamin C supplementation for 3 months with average differential test

Gingival bleeding	Mean	Z	Z Tabel	p-value (sig)	Description
Before Supplementation of Vitamin C	0.4866	-7.911	-1.645	0.000	H <sub>0</sub> was rejected
After Supplementation of Vitamin C	0.2134				

<0.05, then H<sub>0</sub> is rejected. Therefore, it can be concluded that there is a difference of gingival bleeding before vitamin C supplementation and after vitamin C supplementation.

**DISCUSSION**

This study is a continuation of research conducted by Amalya et al. in 2002 and 2005 with the same subject.<sup>8</sup> The number of subjects in the study in 2005 was 123, but in this study, the number of subjects who are willing to follow the research is as many as 98 people. Subjects in this study had never received any scaling treatment by the dentist. Therefore the role effect of vitamin C supplementation can be seen clearly on gingival bleeding without any scaling treatment or root planing.

The results of this study indicated a decrease in bleeding index in subjects after vitamin C supplementation for 3 months. This reduced bleeding is due to the presence of vitamin C in the formation of collagen, reducing the permeability of gummy mucosa and improving neutrophil function.<sup>13</sup> Vitamin C deficiency can lead to the failure of collagen structure formation. The non-hydroxylated collagen is unstable and can not form the triple helix required for normal subcutaneous, cartilage, bone and tooth tissue formation. Failure

of triple helix formation of collagen will cause the deposition of collagen fibres of intercellular substances impaired, then wound healing will be inhibited. Also, osteoblasts are unable to form a new bone matrix thus inhibiting ossification that can lead to bone fractures and delayed grafting/new bone formation. In the blood vessel wall, lack amount of vitamin C causes a deficiency of intercellular matrix and collagen fibrils, resulting in capillary wall fragility characterised by petechiae, purpura, ecchymosis, mucosal lesion, subperiosteal and visceral haemorrhage. Collagen fibres are the main structures that form gum bundle tissues and periodontal ligaments and are the most important components of the periodontal tissue. Collagen fibres are formed by fibroblasts, cementoblasts, and osteoblasts. The smallest unit of the collagen molecule is the tropocollagen, composed of three polypeptide chains that are interwoven to form a helix. Each chain consists of 1000 amino acids. A third part is glycine, and 20% is proline and hydroxyproline. The tropocollagen molecule will extend longitudinally into protofibrils; then protofibrils will accumulate in parallel to form collagen fibrils. Collagen fibres will form from collagen fibril bundles.<sup>13</sup>

Vitamin C plays an important role in the synthesis of collagen fibres, so it can be understood that vitamin C deficiency can trigger the occurrence

of periodontitis disease. Histologically, vitamin C deficiency leads to collagen formation failure due to disruption of proline and glycine hydroxylation and increased permeability of the epithelial layer against bacterial endotoxin. Periodontal troop itself is a true lesion or wound so that vitamin C deficiency can inhibit the healing process or repair of a periodontal pocket and easy bleeding in the gingiva.<sup>13</sup>

The results of this study were also consistent with research conducted by Staudhe et al. in 2005 stated that by eating grapes were able to reduce the index of gingival bleeding although not reduce the depth of the pocket.<sup>14</sup> The occurrence of improved gum health as found in the study is due to vitamin C supplementation through grapes.<sup>14</sup>

Supplementation of vitamin C in this study with a dose of 320 mg per day was quite effective in improving gum health. However, this is contrary to previous research ever conducted by Parfitt & Hand in 1963 who found that a daily dose of 500 mg vitamin C does not affect gum health.<sup>15</sup> Also, according to Vogel et al. In 1986, there is no effect of vitamin C supplementation on the development of gingivitis when taking vitamin C daily 1500 mg.<sup>9</sup>

Based on smoking status data, it can be seen that the prevalence of the biggest gum bleeding after vitamin C supplementation was dominated by non-smoking subjects. The results of this study are not in line with research Marc Schatzel in 2010 who explained that after the age of 35 years on smoker gums had seen much bleeding on probing.<sup>16</sup> However, the results of this study were consistent with the findings of Bergstrom and Floderus Myrhed in 1983 suggested that gingival bleeding in smokers less than nonsmokers.<sup>17</sup> Also supported by the results of research Yoshihiro Shimazaki in 2006 who explained that heavy smokers, former heavy smokers, and former light smokers have a lower risk for the occurrence of bleeding on probing than subjects who never smoked.<sup>18</sup> The condition of this smoker's gum according to Palmer in 1987, caused by vasoconstriction of blood vessels of the gums and can also be caused by the keratinisation of heavy gums.<sup>19</sup> Besides, the reduction of the vascularisation component may reduce the availability of serum protection factors such as antibodies and decreased travel of leukocytes to periodontal tissues. On the results of this study, gingival bleeding in smokers

also decreased after vitamin C supplementation; this condition was also supported by the role of vitamin C in immunity that helps leukocytes to play an active role, regulate antibody levels, help complement synthesis, help synthesis interferon and help synthesis prostaglandin.<sup>20</sup>

Vitamin C used in this study is the ester group and has been widely circulated in the market. Although vitamin C can be easily obtained through food and beverages on the market, the main reason for the use of vitamin C ester group in this study is because the ester group is very safe to be consumed by people who have stomach disease and more quickly absorbed. However, unfortunately, the price of vitamin C ester group is higher than ordinary vitamin C.<sup>21</sup>

According to research conducted by Amalya et al. In 2007, the occurrence of periodontal tissue damage was also influenced by low levels of vitamin C in plasma.<sup>8</sup> This finding was consistent with the results of this study that vitamin C supplementation for 3 months leads to increased levels of vitamin C in plasma so that it can reduce the occurrence of gingival bleeding.<sup>8</sup>

## CONCLUSION

Based on the results of this study can be concluded that there was an effect of vitamin C supplementation on gingival bleeding.

## REFERENCES

1. Newman MG, Takei HH, Carranza FA. Carranza's clinical periodontology. 10<sup>th</sup> ed. Philadelphia: Saunders-Elsevier; 2006. p. 494-5.
2. Reddy S. Essentials of clinical periodontology and periodontics. 2<sup>ed</sup>. New Delhi: Jaypee Brothers Medical Publishers (P) Ltd.; 2008. p. 112-3.
3. Daliemunthe SH. Pengantar periodonsia. Medan: USU Press; 2008. p. 99-100.
4. Tomofuji T, Ekuni D, Sanbe T, Irie K, Azuma T, Maruyama T, et al. Effects of vitamin C intake on gingival oxidative stress in rat periodontitis. *Free Radic Biol Med*. 2009;46(2):163-8. DOI: [10.1016/j.freeradbiomed.2008.09.040](https://doi.org/10.1016/j.freeradbiomed.2008.09.040).
5. Nagata H. Role of Vitamin C and Vitamin E in Periodontal Disease. In: Ekuni D, Battino M, Tomofuji T, Putnins E. *Studies on Periodontal*

- Disease. Oxidative stress in applied basic research and clinical practice. New York: Humana Press; 2014. p. 307-27.
6. Staudte H, Sigusch BW, Glockmann E. Grapefruit consumption improves vitamin C status in periodontitis patients. *Br Dent J.* 2005;199(4):213-7. DOI:[10.1038/sj.bdj.4812613](https://doi.org/10.1038/sj.bdj.4812613).
  7. Blignaut JB, Grobler SR. High fruit consumption and the periodontal status of farm workers. *Clin Prev Dent.* 1992 Mar-Apr;14(2):25-8.
  8. Amaliya, Timmerman MF, Abbas F, Loos BG, van der Weijden GA, van Winkelhoff AJ, et al. Java Project on periodontal diseases: the relationship between vitamin C and the severity of periodontitis. *J Clin Periodontol.* 2007;34(4):299-304. DOI:[10.1111/j.1600-051X.2007.01053.x](https://doi.org/10.1111/j.1600-051X.2007.01053.x).
  9. Vogel RI, Wechsler SM. Nutritional survey of patients with moderate to severe periodontitis. *Clin Prev Dent.* 1979;1(5):35-8.
  10. Blignaut JB, Grobler SR. High fruit consumption and the periodontal status of farm workers. *Clin Prev Dent.* 1992 Mar-Apr;14(2):25-8.
  11. Vaanaen MK, Markkanen HA, Tuovinen VJ, Kullaa AM, Karinpaa AM, Kumpusalo EA. Periodontal health related to plasma ascorbic acid. *Proc Finn Dent Soc.* 1993; 89(1-2):51-9.
  12. van der Velden U. Probing force and the relationship of the probe tip to the periodontal tissues. *J Clin Periodontol.* 1979;6:106-14. DOI: [10.1111/j.1600-051X.1979.tb02189.x](https://doi.org/10.1111/j.1600-051X.1979.tb02189.x).
  13. Amaliya A, Laine ML, Delanghe JR, Loos BG, Van Wijk AJ, Van der Velden U. Java project on periodontal diseases: periodontal bone loss in relation to environmental and systemic conditions. *J Clin Periodontol.* 2015; 42(4):325-32. DOI: [10.1111/jcpe.12381](https://doi.org/10.1111/jcpe.12381)
  14. Staudte H, Sigusch BW, Glockmann E. Grapefruit consumption improves vitamin C status in periodontitis patients. *Br Dent J.* 2005;199(4):213-7. DOI: [10.1038/sj.bdj.4812613](https://doi.org/10.1038/sj.bdj.4812613).
  15. Nishida M, Grossi SG, Dunford RG, Ho AW, Trevisan M, Genco RJ. Dietary Vitamin C and the Risk for Periodontal Disease. *J Periodontol.* 2000;71(8):1215-23. DOI: [10.1902/jop.2000.71.8.1215](https://doi.org/10.1902/jop.2000.71.8.1215).
  16. Schätzle M, Loe H, Ramseier CA, Bueglin W, Ånerud Å, Boysen H. Clinical course of chronic periodontitis: effect of lifelong light smoking (20 years) on loss of attachment and teeth. *J Invest Clin Dent.* 2010;1(1):8-15. DOI: [10.1111/j.2041-1626.2010.00008.x](https://doi.org/10.1111/j.2041-1626.2010.00008.x).
  17. Amarasena N, Ekanayaka AN, Herath L, Miyazaki H. Association between smoking, betel chewing and gingival bleeding in rural Sri Lanka. *J Clin Periodontol.* 2003;30(5):403-8.
  18. Levita J, Muchtaridi, Purnamasari A. The excretion profiles of vitamin C from vitamin C and ester-C tablets in human urine. [Presentation] Bandung Institute of Technology. 1<sup>st</sup> Nov 2007.