Berkala Ilmu Kedokteran
Vol. 40, No. 1, Maret 2008: 38-41

Effect of vitamin C and vitamin E supplemantation on lipid peroxide of lactating woman

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ABSTRACT

Prasetyastuti, Endang Sri Sunarsih - ***The effect of vitamin C and vitamin E supplementation on lipid peroxide of lactating woman***

Background: Vitamin C and vitamin E are antioxidants that trapp free radical that is continuously formed in aerobic organism as an effect of aerobic respiration in mitochondria and substrate oxidation. The quantity and quality of breast feeding (ASI) are influenced by nutritional status and health of the mother. The ASI vitamin C level is very much related to everyday intake and plasma vitamin C of the mother.
Objective: To know the effect of vitamin C and vitamin E supplementation on peroxide lipid (MDA) of lactating women.
Methods: This was pretest and post test experimental design. The subjects were twenty three lactating women who live in Pakem District, Sleman 19-38 year olds they received 75 mg vitamin C and 2 mg vitamin E every two days for a period of one month. Blood sample was taken from cubit vein before and after supplementation. Determination of vitamin E level used spectrofluorometer, whereas vitamin C and MDA level were determined by spectrophotometer. The data was analyzed with Pearson correlation test
Results: the correlation of vitamin C vs MDA; vitamin E vs MDA and vitamin C together with vitamin E vs MDA were r – 0.528; r square 0.276 and p = 0.05; r -0.671, r square 0.451, p = 0.009 and r -0.690; r square 0.476 and p= 0.028, respectively
Conclusion: the effect of vitamin E to MDA was stronger than vitamin C

Keywords: vitamin C - vitamin E - peroxide lipid - free radical - lactating mother

ABSTRAK

Prasetyastuti, Endang Sri Sunarsih – ***Pengaruh suplementasi vitamin C dan vitamin E terhadap kadar MDA darah ibu menyusui.***

Latar Belakang: Vitamin C dan vitamin E merupakan antioksidan yang dapat menangkap radikal bebas yang terbentuk secara terus menerus pada organisme erobik akibat respirasi erobik di dalam mitokondria dan oksidasi substrat. Kualitas dan kuantitas ASI dipengaruhi oleh status gizi dan kesehatan ibu. Kadar vitamin C dalam ASI sangat berhubungan dengan asupan sehari-hari dan kadar vitamin C plasma ibu.
Tujuan: Mengetahui pengaruh suplementasi vitamin C dan vitamin E terhadap kadar malondialdehid plasma ibu menyusui.
Bahan dan cara: Desain penelitian ini adalah eksperimental pretest dan post test desain. Subyek penelitian adalah 23 ibu menyusui di Kecamatan Pakem Kabupaten Sleman, yang berusia antara 19- 38 tahun yang mendapat vitamin C 75mg dan vitamin E 2mg setiap dua hari sekali selama satu bulan. Sample darah iambil dari vena kubiti sebelum dan setelah suplementasi. Kadar vitamin E ditentukan dengan spektrofluorometer, kadar vitamin C dan MDA ditentukan dengan spektrofotometer. Data dianalisa dengan uji korelasi Pearson.
Hasil: korelasi antara vitamin C vs MDA , vitamin E vs MDA dan antara vitamin C bersama vitamin E vs MDA berturut-turut sebagai berikut r – 0,528; r square 0,276 and p = 0,05; r -0,671, r square 0,451, p = 0,009 and r -0,690; r square 0,476 and p= 0,028 .
Simpulan: korelasi vitamin E vs MDA lebih kuat dibanding vitamin C vs MDA.

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INTRODUCTION

Breast milk (ASI) is very necessary food for baby. ASI contains protein, lactose, fat, mineral and vitamin in a well-balanced composition and a very suitable to physiology of baby. The quantity and quality of ASI are influenced by nutritional status and health of mother. Vitamin C requirement of lactating mother is 95mg per day in the first six-months and 90mg per day in the six-month after[1]. The ASI vitamin C level is very much related to daily intake and plasma vitamin C of the mother[2]. Vitamin C can increase iron absorption as reductor that can reduce ferri to ferro state[1]. It is a water soluble antioxidant that can regenerate oxidized-vitamin E to reduced-vitamin E . Vitamin E is a fat soluble antioxidant that can prevent lipid peroxidation. Therefore vitamin C supplementation has an effect to improve antioxidant status at part of lipid and aqueous of body.[3]

Free radicals are formed in various biochemical reactions and cellular functions (such as mitochondria metabolism). The steady-state formation of pro-oxidants (free radicals) is normally balanced by a similar rate of neutralization by antioxidants.

Free radical is continuously formed in aerobic organism as an effect of aerobic respiration in mitochondria and substrate oxidation. Body has protective system against free radicals played by antioxidants such as vitamin. The free radical is atom or atom bunch having electron which does not pair at external orbit and usually represent intermediate substance that very reactive and high energy. Free radical is always formed such as superoxide (O_2°), hydroxyl radical (OH °), and hydrogen peroxide (H_2O_2). Free radical is very reactive and can damage of DNA, protein and non saturated fatty acid-like cell membrane[4]. Superoxide occurs when one electron is added to O_2. Superoxide is normally produced in the body by enzymatic and non-enzymatic processes such as electron transport in mitochondria and hydrolase reaction at endoplasmic reticulum. The superoxide will be changed to H_2O_2 by superoxide dismutase in mitochondria and microsome. Actually H_2O_2 is not a free radical but can be inisiator forming of free radical. In high O2 concentration the production of H_2O_2 is increased, and in this condition it is able to penetrate cell membrane. H_2O_2 can form hydroxyl radical in the existence of transition metal like Ferro ion (Fe++). The hydroxyl radical oxidizes cell, H_2O_2 through Fenton and Haber Weiss reaction. Most of all molecules in the body can be destroyed by hydroxyl radical i.e. free radical chain reaction which loses one hydrogen atom. In protein, free radical disturb the fold of polypeptide structure, if it is open protein will lose the biologic activity. DNA can undergoes chain break or cross link and otherwise repaired can produce various substances like timin, glycol, metal hydroxy of urasil[5] and can cause negative defect, and 8-hydroxy guanosine as marker of oxidative damage. In lipid, free radical can cause peroxidation which triggers autocatalytic process [6].

Lipid peroxidation is continuous chain reaction that yields free radicals so that next peroxidation reaction occurs.The end product of the lipid peroxidation is peroxide lipid. One of the lipid peroxidation products is malondialdehyde (MDA)[7], so that its plasma level is often used as parameter of lipid peroxidation. In the body hydroxyl radical reacts with PUFA yielding radical of lipid (L°) and then the lipid radical reacts with oxygen and produces peroxyl radical (LOO°). The next reaction is between peroxyl radical with other PUFA yielding lipid peroxide (LOOH). Vitamin C can react with lipid radical (L°) & peroxyl radical (LOO°) so that it can prevent further damage of cell membrane. Therefore the imbalanced of free radical production with antioxidant results in oxidative stress that produces MDA[8]

Antioxidants are molecules or compounds that act as free radical scavengers. Most antioxidants are electron donors and react with the free radicals to form innocuous end products such as water. These antioxidants bind and inactivate free radicals. Thus, antioxidants protect against oxidative stress and prevent damage of cells. There are many examples of antioxidants: i) Intracellular enzymes: superoxide dismutase (SOD), glutathione peroxidase, ii) Endogenous molecules: glutathione (GSH), sufhy-dryl groups, alpha lipoic acid, CoQ 10, thioredoxin, ii) Essential nutrients: vitamin C, vitamin E, selenium, N-acetly cysteine (NAC), iv) Dietary compounds: bioflavonoids, proanthocyanidans

Vitamin C is an ideal antioxidant, it has low one electron redox potential in both ascorbic and ascorbil radical forms. Ascorbil radical has stable and low reactivity[9].

Vitamin C is a reductor substance, the hydrogen potential is + 0.08V, so vitamin C can reduce molecular oxygen[10]. The current daily recommended dietary allowance (RDA) of vitamin C is 75mg for woman and 90 mg for man, based on the vitamin's role as an antioxidant as well as for protection from deficiency.

Vitamin E is a protector of "polyunsaturated fatty acid" (PUFA) at cell membrane [11,12]. Free radical catalyzes PUFA peroxidation at cell membrane. Vitamin E reacts with free radical to prevent damage of cell membrane. In its activity as antioxidant, vitamin E is changed into a radical and then this radical will be reduced by vitamin C[10].

The body needs external antioxidant like vitamin C and vitamin E if antioxidant in the body is insufficient to oppose oxidative stress. Based on the above information this research aimed to study the effect of vitamin C and vitamin E supplementation on MDA.

METHODS

This was a pre test–post test experimental design held in Pakem, Sleman. It was conducted using 23 subjects. The inclusion criteria were lactating women healthy, 19-38 years age, at least live one year lived in research location. Subjects received vitamin C 75mg and vitamin E 2mg every two days in the period of one month. Research sample was 6ml venous blood, taken from anterior cubiti vein entered into heparin tube (1.5 mg/ml) before and after supplementation. Spectrofluorometer was used to analyse blood plasma vitamin E level (Abe & katsui method, cit Wang et al)[14] whereas vitamin C level and MDA level were analyzed by spectrophotometer (yagi method)[13]. Pearson correlation was used to test the relation between vitamin C vs MDA, vitamin E vs MDA and vitamin C together with vitamin E vs MDA

RESULTS AND DISCUSSION

Twenty-three subjects fulfilled the criteria were choosen Correlation test between vitamin C, vitamin E and MDA are shown in TABLE 1.

TABLE 1. Correlation test between vitamin C, vitamin E and MDA in plasma lactating woman

Variable	r	r square	p
Vitamin C vs MDA	- 0.528	0.279	0.05
Vitamin E vs MDA	- 0.671	0.451	0.009
Vitamin C and vitamin E vs MDA	- 0.690	0.476	0.028

The coefficient correlation (r) for vitamin C to MDA in the studied subjects was 0.528 and r square is 0.279. it is indicated a strong correlation as the value is between 0.40-0.60. Therefore, it can be interpreted that there was a strong negative correlation between vitamin C and MDA in the subjects, meaning that the higher the vitamin C level the lower the MDA level. From the value of r square it is know that, only 27.9% MDA is influenced by vitamin C while the other (72.1%) can be explained influenced by other factors. The p value was 0.05, indicating that the relation there was significant. The vitamin C plasma is influenced by intake of vitamin C because the human body cannot produce vitamin C so that intake from outside is needed [15]. The result of Steinberg research[16] on supplementation of 600mg vitamin C for 8 weeks improved vitamin C plasma level equal to 29.9%. Vitamin C and vitamin E combination can decrease significantly the lipid peroxide in smoker, the decrease is not significant if only vitamin E is given.[17]

The coeficient correlation value (r) for vitamin E with MDA was 0.671 and r square was 0.451.The r value shows a very strong negative correlation as it is situated between 0.60-0.80. Therefore, it can be interpreted that there was a very strong negative relation between vitamin E and MDA in the subjects, meaning that the higher the vitamin E the lower the MDA level. Since the r square value was 0.451, it can be concluded that the influence of

vitamin E was 45.1% in relation with MDA while 54.9 can explained by other factors. The p value was 0.009, indicating a significant relation between vitamin E and MDA.Vitamin C can regenerates oxidized-vitamin E to reduced-vitamin E

The coefficient correlation value (r) for vitamin C plus vitamin E with MDA was 0.690 and r square was 0.476. The r value showed a very strong negative correlation as it is situated between 0.60-0.80. Therefore, it can be interpreted that there was a very strong negative relation between vitamin C plus vitamin E with MDA in subjects, meaning that the higher the vitamin C plus vitamin E the lower the MDA level. Since the r square value was 0.476, it can be concluded that the influence of vitamin C plus vitamin E was 47.6% to MDA, while 52.4% can be explained by other factors. The p value of 0.028 indicated that the relation between vitamin C plus vitamin E with MDA was significant

CONCLUSION

There were significant correlations between vitamin C and vitamin E with MDA plasma lactating woman proved after vitamin C and vitamin E supplementation. The relation of vitamin E with MDA was stronger than vitamin C with MDA.

REFFERENCES

1. Barness LA, Curran JS. Chapter VI Nutrition, In: Behrman RE, Kliegman RM, Arvin AM (eds), Ilmu Kesehatan Anak Nelson edit 5. Penerbit, Buku Kedokteran EGC, Jakarta, 2000.
2. De Maeyer EM. A Collaborative Study on Vitamins, Minerals, and trace elements in breast milk. In: Berger H. Vitamin and Minerals in Pregnancy and Lactation New York, Raven Press, 1988.
3. Benzie, Iris and Strain, JJ. Effect of Vitamin C and Vitamin E in Fasting plasma. Asia Pacific J Clin. Nutr.1999; 8(1): 207-210
4. Boedhi-Darmojo R. Trends in dietary habits of the elderly: The Indonesian case, Asia Pasific J Clin Nutr, Volume 11, 2002: 351-54.
5. Halliwel B and Gutterridge JMP.Free Radicals in Biology and Medicine. Pp 147- 54 Oxford Clarendom Press, New York, 2000.
6. Marks, Dawn B, Allan D, Smith, Colleen M., Basic medical Biochemistry a Clinical Approach, Baltimore, USA,1996.
7. Baynes JW. Oxygen and life. In: Baynes, JW, Dominiczak MH: Medical Biochemistry 2nd ed. Philadelphia: Elsevier Mosby, 2005: 497-505
8. Yoshikawa, T and Naito, Y. What is Oxidative Stress? JMAJ, 2002; 45(7): 271-76
9. Silalahi, Jansen. Free rradicals and antioxidant vitamins in degenerative disease Maj Kedokt Indones, 2001; 51 (11) :16-20
10. Mayes PA, Bender.DA, Vitamins & Minerals in Harper's Illustrated Biochemistry, 26th edit McGraw-Hill Education , 2003 : pp 486-87
11. Krebs NF, Primar LE. Pediatric Nutrition and Nutritional Disorder In: Kliegman RM, Marcdante KJ, Jenson HB, Behrman RE.(eds) Nelson Essential of Pediatrics 5th edit Philadelphia : Elsevier Raunders , 2006: 150-51
12. MC Cormick DB, Klee GG. Vitamins. In: Burtis CA and Ashwood, editors. Tietz Texbook of Clinical Chemistry 5th ed. Philadelphia : Saunders, 2001 : 543-550
13. Yagi K. Lipid peroxides and human diseases Chem Physic Lipids , 1987; 45: 337-51
14. Wang Y, Walsh CW, Guo J, Zhang J. The maternal level of prostacyclin, thromboxane, vitamin E and lipid perokxides throught normal pregnancy AM J Obstet Gynecol, 1991; 165: 1690- 94
15 Wildman REC and Medeiros DM.,. Vitamin, in advanced Human Nutrition, RCR Press, Florida, 2000: 182-86.
16. Steinberg F, Chait A,. antioxidant vitamin supplementation and lipid peroxidation in smoker. Am Clin Nutr 1998; 68: 319-27
17. Reilly M, Delanty N, Lawson JA. Modulation of Oxidant Stress in vivo in Chronic Cigarette Smokers. American Heart Assosiation, Inc, 1996: 19-25.