Effect of Supplementation of Vitamin A on the Nutritional Profile of Male Smokers

Tejinder Gulati, Anita Kochhar* and Simmerpreet

Department of Food and Nutrition, College of Home Science, Punjab Agricultural University, Ludhiana, Punjab, India

ABSTRACT Twenty five male smokers in the age group of 25-40 years with similar smoking habits and physical activity pattern were selected from Ludhiana to study the effect of supplementation of vitamin A by food on their dietary, blood lipid, antioxidant profile and anthropometry. The intake of cereals, green leafy vegetables and fruit intake was increased significantly (P≤0.05) whereas root and tubers, meat and eggs, fats and oils, sugar and jaggery decreased after vitamin A supplementation. The protein, carbohydrate, total and visible fat intake decreased significantly. The vitamin A, vitamin C and vitamin E, folic acid and iron intake increased significantly (P≤0.05) after supplementation. The decrease in blood pressure was not significant. Blood glucose level decreased and blood haemoglobin level increased but not significantly after supplementation of vitamin A. The anthropometric indices of smokers did not vary significantly before and after nutratherapy of vitamin A. Antioxidant vitamin A lowers the blood cholesterol and change other blood parameters of smokers towards better side, so smokers are advised to consume the foods rich in vitamin A in their daily diet.

INTRODUCTION

In India, heart diseases are twice as common in smokers than in non smokers. It is estimated that 30-50 percent coronary heart disease is due to smoking (Chuttani, 1996). A study shows that if smokers stop smoking, risk of having heart disease will come down to 64 percent (Gupta, 1998).

The antioxidant vitamins available in abundance from a variety of fruits and vegetables and may relieve the smokers from oxidant stress. The antioxidant vitamin A available in fruits and vegetables, protect the human body from many diseases. Vitamin A in the form of carotene is abundantly available through orange fruit, vegetables, spinach, broccoli, green beans and peppers. In normal healthy human, free radicals which are formed are quenched and removed by antioxidant defence mechanism but in smokers, this removal of peroxy radicals is disturbed because of depletion of antioxidant nutrient of smoke (Gautam and Malhotra, 1997). Thus, with the hypothesis that dietary antioxidant may help to prevent the development of atherosclerosis, the study was planned with the objective of observing the effect of antioxidant supplementation of vitamin A by food on dietary, blood lipid, antioxidant profile and anthropometry of male smokers.

*Address all Correspondence to: Dr. (Mrs.) Anita Kochhar

MATERIAL AND METHODS

A group of 25 smokers aged 25-40 years, belonging to upper middle socio-economic group having similar physical activity pattern and smoking habits were selected purposively from Ludhiana City for the study. General information and dietary habits of the smokers was collected using questionnaire-cum-interview method. Selected subjects were observed for a period of 1 month in which no antioxidant were supplied. After that food rich in vitamin A were supplied to their existing diets for 3 months. Approximately 3000 μg of β carotene was supplied daily by food. The food and nutrient intake were calculated from the value per 100g of edible portion by MSU Nutriguide (Song et al., 1992). Haemoglobin estimation was determined by cyanmethaemoglobin method of Dacie and Lewis (1975). Glucose was estimated by the Glucose Oxidase Methods of Trinder (1969). The concentration of total cholesterol and triglycerides were analyzed by Enzymatic Calorimetric Method of Allian et al (1974). HDL by method given by Lopes Virella et al. (1977). LDL-C and VLDL-C were estimated by using method given by Friedewald et al. (1972). Serum β carotene was measured by methods of Carr and Price (1971), serum ascorbic acid by Varley (1989). The data obtained was then analysed statistically by applying one way analysis of variance, (ANOVA).

RESULTS AND DISCUSSION

Among smokers supplemented with vitamin A, the cereals, green leafy vegetables and fruit intake increased significantly (p≤0.05) whereas that of roots and tubers-meat and egg, fats and oil and sugar and jaggery decreased after vitamin A supplementation (Table 1). The protein, carbohydrate, total and visible fat intake decreased significantly (p≤0.05) and fibre intake increased (Table 2).

The consumption of vitamin A as β carotene increased significantly as a consequence of supplementation of vitamin A (β carotene) rich roods. The increase was significant (p≤0.05) because of the amount of vitamin A supplemented was in addition to the intake of smokers for the rest of the daily diet. The intake of vitamin A was 1385.61±128.30 μg/day before supplementation and 3398.43±132.14 μg/day after supplementation period which was higher than RDA of 2400 μg/day (ICMR, 1992). This was in accordance with the report of Castenmiller et al (2000) which suggested that an intake of more than 3000 μg/day is essential for β carotene to

function as an antioxidant in the body of smokers. The intake of folic acid increased from 50.16±10.03 μg/day to 102.63±9.68 μg/day when smokers were supplemented with food rich in β carotene (GLV) and yellow orange fruits (Table 3). Vitamin C intake increased significantly (p≤0.5) from baseline 31.21±3.05 μg/day to 55.63±3.98 μg/day, which is more than RDA of young lady (ICMR, 1992). This is in tune with findings of Lykkesfeldt et al. (2000) that ascorbic acid is depleted by supplementation of about 50 μg ascorbic acid/day in the diet of smokers.

The intake of vitamin E increased significantly (p≤0.05) from 68.21±0.26 mg/day to 89.36±0.15 mg/day after supplementation. This was nearly 9 times the RDA of 10 mg/day (ICMR, 1997). Also similar findings were reported by Meydani et al (1998) that although requirement of vitamin E in the body is very less but for vitamin E to function as a potential antioxidant the intake should be more than equal to 100 mg/day. After supplementation of vitamin A, the iron intake increased from 24.51±2.10 mg/day to 42.91±2.05 mg/day. This was due to

Table 1: Average daily food intake of smokers before and after vitamin A supplementation.

Food Groups (g/day)	Before supplementation (n=25)	After supplementation (n=25)	Suggested intake	t-value
Cereals	385.15 ± 32.1	456.04 ± 30.16	420	16.43*
Pulses and Legumes	45.14 ± 0.72	49.76 ± 0.73	60	0.36
Green Leafy Vegetables	59.82 ± 22.31	108.92 ± 22.61	100	2.35**
Other Vegetables	62.24 ± 5.61	63.81 ± 5.53	100	12.25**
Roots and Tubers	144.81 ± 1.56	74.31 ± 1.53	200	2.51**
Fruits	83.37 ± 9.90	108.21 ± 9.63	100	13.21**
Milk and Milk Products	235.96 ± 0.36	256.24 ± 0.32	300	0.75
Meat and Eggs	49.82 ± 1.91	42.64 ± 1.93	30	0.75
Fats and Oils	63.38 ± 7.21	42.28 ± 7.01	20	17.18*
Sugar and Jaggery	51.21 ± 2.35	35.72 ± 2.39	25	20.01*

Vitamin A (β carotene) was supplemented by food 1. ICMR, 1999 2., Gopalan et al., 1987
* Significant at p≤0.05 ** Significant at p≤0.01

Table 2: Average daily nutrient intake of smokers before and after vitamin A supplementation.

Nutrients (per day)	Before supplementation (n=25)	After supplementation (n=25)	RDA[1]	t-value
Energy (Kcal)	2773 ± 71.1	2536 ± 69.31	2425	0.79
Protein (g)	76.32 ± 2.44	69.69 ± 2.31	60	10.03 *
Carbohydrates (g)	506 ± 6.2	391 ± 6.01	-	7.368
Total fat (g)	71.43 ± 0.39	49.38 ± 0.42	40	12.36 *
Visible fat (g)	32.50 ± 0.62	29.12 ± 0.59	20	8.75 *
Fibre (g)	3.69 ± 0.31	8.93 ± 0.40	40 [2]	2.35 **

Values are mean ± SE 1. ICMR, 1999 Vitamin A (² carotene) was supplemented by food 2. Ghafoorunissa, 2000
* significant at p≤0.05 ** significant at p≤0.01

the fact that food source rich in β carotene are also potential source of iron, which were supplemented to the smokers (Table 3).

Serum β carotene and ascorbic acid levels increased significantly (p≤0.05) after

was supplemented to smokers by food, some amount of vitamin C was also being supplemented along with it as food source in Vitamin A were also good sources of Vitamin C. Blood glucose level decreased and blood

Table 3: Average daily vitamin and mineral intake of smokers before and after vitamin A supplementation.

Nutrients (per day)	Before supplementation (n=25)	After supplementation (n=25)	RDA[1]	t-value
Vitamins				
Vitamin A (μg) (²carotene)	1385.61 ±128.30	3398.43 ±132.14	2400	28.95*
Thiamine (B₁), mg	1.21 ± 0.03	1.26 ± 0.21	1.2	0.98
Riboflavin (B₂), mg	1.38 ± 0.13	1.42 ± 0.12	1.4	0.10
Niacin (B₃), mg.	16.61 ± 2.10	17.41 ± 2.36	16.0	0.62
Folic acid, μg	50.16 ± 10.03	102.63 ± 9.68	100	2.61**
Vitamin C, mg	31.21 ± 3.05	55.63 ± 3.98	40	16.38*
Vitamin E, mg	68.21 ± 0.26	89.36 ± 0.15	10²	23.26*
Minerals				
Calcium, mg	371.83 ± 8.3	423.41 ± 9.2	400	38.82*
Phosphorus, mg	401.03 ± 20.8	431.21 ± 20.1	400	0.73
Iron, mg	24.51 ± 2.10	42.91 ± 2.05	28	12.62

Values are mean ± SE 1. ICMR, 1999 Vitamin A (²carotene) was supplemented by food 2. Ghafoorunissa, 2000
* significant at p≤0.05 ** significant at p≤0.01

Table 4: Blood antioxidant status of smokers before and after vitamin A supplementation.

Parameters	Before supplementation (n=25)	After supplementation (n=25)	Normal range	t-value
Serum (β carotene) (vitamin A) μg/100m	62.28±2.51	107.71±2.36	40-110	12.39*
Serum ascorbic acid (vitamin C) mg/l	7.23±3.15	18.23±2.86	8-24	18.95*
Serum tocopherol (vitamin E) mg/100 ml.	0.98±0.21	1.12±0.31	0.8-1.2	0.38

Values are mean ± SE 1. DMCandH (1997) Vitamin A (²carotene) was supplemented by food
* significant at p≤0.05

Table 5: Blood glucose, haemoglobin and lipid profile of smokers before and after vitamin A supplementation.

Parameters	Before supplementation (n=25)	After supplementation (n=25)	Normal range	t-value
Blood Glucose	90.62 ± 2.04	89.15 ± 2.01	70-110²	1.16
Blood Haemoglobin	11.53 ± 0.62	12.59 ± 0.61	>12.01	0.43
Total Cholesterol	232.58 ± 12.13	212.10 ± 11.52	<200	23.6*
LDL-C	149.01 ± 10.51	133.31 ± 10.21	30	2.53*
VLDL-C	32.16 ± 0.25	29.53 ± 0.30	20-40	1.38
HDL-C	32.15 ± 1.23	43.25 ± 1.25	>50	0.19
Triglycerides	182.37 ± 14.31	173.42 ± 14.20	<150	0.26

Values are mean ± SE Vitamin A (²carotene) was supplemented by food
* significant at p≤0.05 ** Significant at p≤0.5
LDLC-C = Low Density Lipoprotein Cholesterol VLDL-C = Very Low Density Lipoprotein Cholesterol HDL-C = High Density Lipoprotein Cholesterol 1. WHO (1972)

supplementation (Table 4). Increase in β carotene was helpful as the β carotene would function as an antioxidant in the body of smokers. The serum ascorbic acid increased because of increased vitamin C intake in conjugation with β carotene intake. Thus, it was observed that as β carotene

haemoglobin level increased but not significantly after vitamin A supplementation. Schectman et al. (1989) also found that supplementation of Vitamin A to smokers did not bring about significant changes in blood glucose level of smokers.

Table 6: Average blood pressure count of smokers before and after vitamin A supplementation.

Parameters	Before supplementation (n=25)	After supplementation (n=25)	Reference value[1]	t-value
Systolic (Mm Hg)	143.21 ± 40.01	141.31 ± 40.04	<140	0.23
Diastolic (Mm Hg)	86.28 ± 0.13	83.21 ± 0.11	<90	0.18

[1]Values are mean ± SE Vitamin A (β carotene) was supplemented by food Ghafoorunissa, 2000

Table 7: Average anthropometric indices of smokers before and after vitamin A supplementation.

Parameters	Before supplementation (n=25)	After supplementation (n=25)	Reference value[1]	t-value
Height (cms)	168.20 ± 0.31	168.20 ± 0.31	-	0.38
Weight (cms)	81.13 ± 0.21	74.32 ± 0.10	60[1]	1.82
BMI (kg/mt^2)	28.06 ± 0.43	26.35 ± 0.41	20-25[2]	0.13
MUAC (cms)	32.13 ± 0.62	32.12 ± 0.61	32.2[2]	1.38
TSFT (mm)	13.50 ± 1.21	12.21 ± 1.27	12.0[3]	1.25

[1]Values are mean ± SE Vitamin A (β carotene) was supplemented by food
* Significant at p≤0.05
MUAC = Mid Upper Arm Circumference TSFT = Triceps Skinfold Thickness BMI = Body Mass Index (Derived value) 1. ICMR, 2000, 2. Garrow, 1981, 3. NCHS Standards, 1987

Total cholesterol and LDL-C decreased significantly after vitamin A supplementation because of decrease in total fat intake and marked increase in the fibre intake by the smokers (Table 5). Similar findings were reported by Waters et al in 1996. An increase in dietary fibre and decrease in total cholesterol and triglycerides would decrease the risk of CHD and other diseases among smokers (Tavani and Vecchia, 1999). The decrease in blood pressure was not significant (Table 6). The anthropometric indices of smokers did not vary significantly before and after supplementation of vitamin A (Table 7).

CONCLUSIONS

It was observed that supplementation of vitamin A by food improved the status of vitamin C in the body. Antioxidant lower the blood cholesterol and changes other blood parameters towards better side. So, smokers are advised to consume the foods rich in vitamin A.

REFERENCES

Allian, C.C., Roon, L.S., Chan, C.S. Richmand and Fu, P.C.: Enzymatic determination of total serum cholesterol. *Clin. Chem*., **20**: 470 (1974).

Carr, A. and Price, M.: Clinical vitaminology. In: *Methods and Interpretation*. Herman Baker and Oscar Frank (Eds.). Inter Science Publishers, New York (1981).

Castenmiller, J.J.M., Lauridsen, S.T., Dragsted, L.O., Van Let Hof, K., Linsesen, J.P.H. and West, C.E.: **²** carotene does not change markers of enzymatic and non enzymatic antioxidant activity in human blood. *Nutrition. Org*., **12**: 2162 (2000).

Chuttani, P.M.: World Cigarette Pandemic. *The Tribune,* May 31: 15 (1996).

Dacie, J.V. and Lewis, S.M. (Eds.): *Practical Haematology*. Churchhill Livingstone, London (1975).

Dayanand Medical College and Hospital: Normal reference values for biochemical estimations. Manual, **III:** 26-75 (1997).

Friedwald, W.T., Levy, R.L. and Fredrickson, D.S.: Estimation of the concentration of low density lipoprotein cholesterol in plasma, without use of the preparative ultracentrifuge. *Clin. Chem*., **18**: 499-502 (1972).

Garrow, J.S.: *Treat Obesity Seriously. A Clinical Manual.* Edinburgh Church Hill Livingstone (1981).

Gautam, C.S. and Malhotra, S.: Vitamins role of antioxidants. *The Tribune,* Sept.3, pp.16 (1997).

Ghafoornissa and Krishnaswamy, K.: *Diet And Heart Disease.* NIN, Hyderabad (2000).

Gopalan, C., Ramashastri, B.V. and Balasubramanium, S.C.: *Nutritive Value of Indian Foods*. NIN, Hyderabad (1987)

Gupta, P.C., Murti, P.R. and Bhonsle, R.B.: Epidemiology of cancer by tobacco products and the significance of TSNA. *Crit Rev Toxicol.,* **26**: 183-198 (1998).

ICMR: *Dietary Guidelines for Indians*. NIN, Hyderabad (1999).

ICMR: *Nutrient Requirement and Dietary Allowances for Indians,* NIN, Hyderabad (2000).

Lopes-Virella, M.F., Stone, P., Ellis, S. and Colvell, J.A.: Determination of HDL-C. *Clin. Chem.,* **23**: 882-84 (1977).

Lykkesfeldt, J., Christen, S., Wallock, L.M., Chang, M.M., Jacob, R.A. and Ames, B.N.: Ascorbate is depleted by smoking and repleted by moderate supplementation. A study in male smokers and non smokers with matched dietary antioxidant intakes. *Am. J. Clin. Nutr.,* **71**: 530-36 (2000).

Meydani, S.N., Meydani, M., Blumberg, J.B., Lekad, S., Pedrosa, M., Diamond, R. and Schaefer, E. J.: Assessment of the safety of supplementation with different amounts of vitamin E in healthy older adults. *Am. J. Clin. Nutr.,* **68**: 311-18 (1998).

NCHS: Anthropometric reference data and prevalence of overweight. U.S. 1976-80. *Vital and Health Statistics Series,* III No. 238 (1987).

Schectman, G., Byrd, J.C. and Gruchow, H.W.: The influence of smoking on vitamin C status in adults. *Am. J. Pub. Health.,* **79**: 158-62 (1989).

Song, W.O., Mann, S.K., Sehgal, S., Devi, P.R., Gurdaru, S. and Kakarala, N.: *Nutriguide: Asian Indian Foods. Nutritional Analysis Computer Programme.* Michigan State University, USA (1992).

Tavani, A. and Vecchia, C.: β carotene and risk of coronary heart disease. A review of observational and interventional studies. *Biochemical Pharmacother*, **53**: 409-16 (1999).

Trinder: Colorimetric analysis of sugars. *Methods in Enzymology*, **IV**: 85-87 (1969).

Varley, M.: *Practical Chemical Biochemistry*. New Delhi. 313-14 and 632-35 (1989).

Water, S.D., Lesperance, J., Gladstone, P., Baccuzzi, S.J., Cook, T., Hudgin, R., Krip, G. and Migginsen, L.: Effect of cigarette smoking on the angiographic evolution of coronary. *Atherosclerosis Circulation,* **94**: 614-21(1996).

WHO: Nutritional anaemia, World Health Organization. Geneva. *Tech. Ref. Ser*., **503**: 21(1972).