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Effect of Dietary Antioxidants on the Lipid and Anthropometric Profile of at Risk Coronary Heart Subjects

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INTRODUCTION

Coronary artery disease is the most deadly of cardiovascular disease as 50 per cent of cardiac deaths result from CHD all over the world. Of the 10 million Indians who die each year, one million do so because of heart disease. According to WHO, by 2010 India will have 60 per cent of world's heart patients and by year 2015, coronary heart disease will emerge as the biggest killer in Punjab (Nayar, 2002). Emerging new causative factor for the coronary heart disease is oxidative stress i.e. generation of excessive free radicals in the tissues. Free radicals lead to modification of LDL particles, which leads to formation of atherosclerotic plaque. Plaques stiffen the arteries and obstruct the flow of blood through them and oxygen delivery to heart muscles thus causing first sign of heart attack i.e. angina (pain in chest). A complex antioxidant defence system (comprising of β-carotene, lycopene, vitamin E and vitamin C) protect our mammalian cells from the injurious effects of free radicals. Risk of CHD can be lower to 20-40 per cent among those with high dietary intake or serum levels of antioxidant vitamins (Duell, 1996). Scanty information is available on the intake of dietary antioxidants in Punjabi population. Therefore, the present study was undertaken to study the effect of dietary antioxidants on the lipid and anthropometric profile of the subjects.

MATERIALS AND METHODS

The study was conducted on 60 male subjects (30-50 years) at risk of coronary heart disease, attending OPD at Delta Heart Centre, Satluj Hospital and other local hospitals in Ludhiana district. Subjects mostly belonged to upper middle class. Information regarding antioxidant intake was calculated by computer programme 'MSU' Nutriguide (Song et al., 1992) and anthropometric measurements were taken by standard methods given by Jelliffee (1966) during the conduct of study. Blood pressure was measured by sphygomanometer. Blood samples were drawn to analyse triglycerides total cholesterol, HDL, blood glucose by using standard methods. Nutrition education was imparted for 4 months. Special emphasis was placed on intake of dietary antioxidants. In order to meet the requirement of vitamin E (200-400 IU) they were advised to have 10g of corn oil, 20g of soyabean oil and 1 tbsp of rice bran oil along with 15 g of wheat germ (½ katori). Depending on the seasonal availability they were advised to take oranges (2), amla (6 in no.), 1 glass of lime juice, mango (2 in no.), papaya (1 slice), tomatoes (2), 1 glass of orange juice in order to meet the requirements (½ to 4g) for vitamin C. In order to meet the requirement of b-carotene set by Heart Health Organisation for heart patients (20-50 mg) they were advised to include 2 mangoes and 5 slices of papaya.

RESULTS

The results of study indicated that ascorbic acid and b-carotene of the subjects were found to be 103.30±11.65 mg and 3360±854.21mg, respectively. This intake was mainly attributed to cabbage, tomato, mustard leaves, spinach, potatoes, green chillies, guava, orange and papaya, yellow pumpkin and cruciferous vegetables. It was found to be lower than requirements set for heart patients by Pauling (2002). After nutrition education significant increase was observed in the intake of ascorbic acid and β-carotene i.e. 154±16.87 mg and 8163±1269.56. It was still found inadequate to meet the standards. Increase was attributed to seasonal availability of lemon, mango, papaya, tomatoes, amla, muskmelon, green chillies. Loria et al. (2000) reported that vitamin C plays an important role in preventing CVD by scavenging free radicals. Chandrasekhar et al. (2000) also reported pumpkin as richest source of β-carotene. β-carotene intake was positively associated with serum cholesterol. Similar findings were given by Wallstrom et al. (2001). The intake for vitamin E was found to be significantly ($P \leqslant 0.01$) improved from 9.00±1.34 mg to

19.00±2.45 mg after the nutrition education in the present study. This intake was mainly from vegetable cooking oils and sweet potatoes in the dietaries of the subjects. Feki et al. (2000) and Haidari et al. (2001) also reported that occurrence of enhanced susceptibility of LDL to oxidation decreases vitamin E concentration.

In present study the most potent determinant was total cholesterol i.e. 215±36.54 mg%. Dietary factors such as reduced intake of calories from fat, refined carbohydrates and high intake of dietary antioxidants resulted in the significant (P≤0.01) decrease of cholesterol 195.06±31.62 mg%. The cholesterol level of the subjects was found to be decrease by 9.27 per cent after the nutrition education and it met the standards set by Ghafoornissa and Krishnamurthy (1994). Oxidation of low density lipoprotein by free radicals is considered to be more atherogenic. LDL at beginning of study was found to be 144±13.95 mg%. Antioxidants from fruits and vegetables provides the electrons that helps in scavenging the free radicals, so high intake of dietary antioxidants decreased LDL-C significantly (P≤0.01) to 123±11.3 mg%. Percentage of decrease was 15.58 per cent.

After nutrition education significant (P≤0.01) reduction was also observed in VLDL-C, TC : HDL, LDL-C : HDL-C and triglycerides from 35.1±6.95 mg%, 5.39±2.96, 4.29±2.13 and 199.5±34.11 to 30.06±4.23, 4.54±2.84, 2.32±1.09 and 176.1±2.955, respectively. Significant (P≤0.01) increase was observed in HDL-C i.e. 35.87±6.41 to 42±8.34 mg% with per cent increase of 17.08.

Effect of dietary antioxidants on the anthropometric profile of the subjects is depicted in Table 3. The mean weight of subjects at beginning was 76.04±8.84 kg. Improved physically activity

Table 1: Intake of dietary antioxidants (Mean±S.D.)

Category	*Beginning of the study*	*End of the study*	*Paired t-value*	*Desired ranged*
Antioxidants				
Ascorbic acid (mg)	103.30 ± 11.65	154.00 ± 16.87	16.84***	½ - 4g
β-carotene (mg)	3360 ± 854.21	8163 ± 1269.56	26.48***	50 mg
Vitamin E (mg)	9.00 ± 1.34	19.00 ± 2.45	19.81***	200-400 IU

** Significant at 5% level *** Significant at 1% level Pauling (2002)

Table 2: Effect of dietary antioxidants on lipid profile of the subjects (Mean±S.D.)

Parameters	*Beginning of the study*	*End of the study*	*% decrease*	*Period t-value*	*Standard*
Total cholesterol (mg%)	215.00 ± 36.54	195.06 ± 31.62	9.27	4.39***	<200
LDL-C (mg%)	144.03 ± 13.95	123 ± 11.37	14.58	7.11***	<130
VLDL-C (mg%)	35.10 ± 6.95	30.06 ± 4.23	14.35	4.89***	<40
HDL-C (mg%)	35.87 ± 6.41	42 ± 8.34	17.08	5.21***	>50
Total cholesterol : HDL-C	5.39 ± 2.96	4.54 ± 2.84	15.76	1.86^{NS}	
LDL : HDL	4.29 ± 2.13	2.32 ± 1.09	45.33	5.54***	
Total triglycerides (mg%)	199.5 ± 34.11	176.1 ± 29.55	11.7	4.64***	<150

*** Significant at 1% level NS Non-significant Ghafoorunissa (1994)

Table 3: Effect of dietary antioxidants on the anthropometric profile of the subjects (mean±S.D.)

Parameters	*Beginning of the study*	*End of the study*	*Period t-value*	*Standard*
Weight (kg)	76.04 ± 8.84	72.23 ± 7.43	4.21***	-
Height (cm)	172 ± 19.77	172 ± 18.84	NS	-
Body mass index (kg/m^2)	25.86 ± 4.22	24.41 ± 4.36	1.73^{NS}	18 - 25
Waist to hip ratio	0.94 ± 0.11	0.89 ± 0.09	3.78***	0.8 - 1
Mid upper arm circumference (cm)	30.34 ± 5.06	28.06 ± 4.31	3.92***	32.2
Tricep skinfold thickness (mm)	20.02 ± 3.88	19.32 ± 3.92	1.86^{NS}	12.5

*** Significant at 1% level NS Non-significant NCHS Standards (1985)

Table 4: Effect of dietary antioxidants on the blood pressure and blood glucose of subjects (Mean±S.D.)

Parameters	*Beginning of the study*	*End of the study*	*Period t-value*	*Standard*
Systolic blood pressure (mmHg)	172 ± 23.45	162 ± 19.54	3.69***	<140
Diastolic blood pressure (mmHg)	120 ± 16.44	102 ± 10.15	6.34***	<90
Fasting blood glucose (mg%)	94.10 ± 8.66	85.16 ± 7.43	5.09***	<120

*** Significant at 1% level NS Non-significant Ghafoorunisa (1994)

and increased intake of fibre and antioxidants resulted a significant (P⩽0.01) decrease in weight i.e. 72.23±7.43 kg. Body weight reduction also resulted in decrease of BMI from 25.86±4.2 to 24.41±4.36 but this decrease was not found significant. WHR was also significantly (P⩽0.01) decreased from 0.94±0.11 to 0.89±0.9 and this decrease was within the recommended standards. Weight reduction in subjects resulted in significant (P⩽0.01) decrease of MUAC to 28.06±4.81 cm. Not much significant decrease was observed in TSFT and it was not adequate to meet the standards given by NCHS standards.

Table 4 depicts the effect of dietary antioxidants on blood pressure and blood glucose of the subjects. In the present study the systolic blood pressure of the subjects was found to be higher than normal i.e. 172±23.45 mmHg. Significant decrease was found in systolic BP i.e. 162±19.57 mmHg (P⩽0.01) after nutrition education. But still it was not found in the desirable range. Similarly diastolic blood pressure was also reduced from 120±16.44 mmHg to 102±10.15 mgHg (P⩽0.01). Improvement was observed due to increased intake of antioxidants coupled with physical activity and decreased intake of salt, decreased BMI, WHR and weight. Significant reduction in blood glucose was also observed from 94.10±8.66 to 85.167 mg% (P⩽0.01) due to increased intake of complex CHO, fruits, vegetables, less intake of refined sugars.

Correlation between anthropometric and clinical profile with dietary antioxidants is depicted in Table 5. BMI was negatively and significantly correlated to vitamin C and positively and significantly (P⩽0.05) to vitamin E. Weight was negatively and significantly (P⩽0.01) correlated to vitamin C. WHR was negatively and significantly (P⩽0.05) correlated to vitamin C and positively and significantly (P⩽0.01) to vitamin E. TG was negatively and significantly (P⩽0.05) correlated to β-carotene LDL was negatively and significantly (P⩽0.05) correlated to vitamin C.

Table 5: Correlation of anthropometric and clinical profile with dietary antioxidants

	Vit C	*β-carotene*	*Vit E*
BMI	-0.257**	-	0.269**
Weight	-0.314**	-	-
MUAC	-	-	-
TSFT	-	-	-
WHR	-0.261**	-	0.315**
TG	-	-0.263**	-
TC	-	-	-
HDL-C	-	-	-
LDL-C	-0.264**	-	-
VLDL-C	-	-	-
SBP	-	-	-
DBP	-	-	-

Critical value of 'r' at 5% = 0.254
Critical value of 'r' at 1% = 0.330

DISCUSSION

According to Broekmans (2000) at least 5-6 servings of yellow fruits like papaya, mango and other fruits should be encouraged along with GLV and other seasonal vegetables. Although increase in intake of each dietary antioxidants was observed after nutrition education but it was not found adequate to meet the desired range set by Pauling (2002). It also resulted in significant decrease in per cent of total cholesterol, LDL-C, VLDL-C, TC : HDL, LDL:HDL and total triglycerides i.e. 9.27, 14.58, 14.35, 15.75, 45.33 and 11.7, respectively. It is assumed that if the subjects consumed the desirable intake of dietary antioxidants more significant reduction was expected in the lipid profile of the subjects. Anthropometric profile of the subjects was also significantly decreased and it was within the range set by NCHS standards except for TSFT. Systolic and diastolic blood pressure also decreased but did not come upto standards given by Ghafoornissa and Krishnamurthy (1994). Slight reduction was also observed in fasting blood glucose. It was statistically proved that negative and significant correlation were observed between dietary antioxidants and anthropometric and clinical profile of the subjects.

Though the inclusion of oranges (2), amla (6 in no.), 1 glass of lime juice, mango (2 in no.), tomatoes (2), 1 glass of orange juice, 10g of corn oil, 20g of soyabean oil and 1 tbsp of rice bran oil along with 15 g of wheat germ (½ katori), 2 mangoes and 5 slices of papaya help in raising dietary antioxidant status of the subjects yet the intake was below the desirable levels of dietary antioxidants set by Pauling (2002) for heart patients. Inclusion of these dietary antioxidants helped in reducing the cholesterol level by 9.28 per cent and LDL-C by 15.58 per cent and a significant increase of HDL-C by 17.08 per cent. The nutrition counselling had also effect on reduction in body weight, BMI and WHR. Dietary antioxidants also helped in lowering the blood pressure and blood glucose level. In the light of the present discussion, at risk coronary heart subjects are advised to consume at least 5-6 servings of fruits and vegetables. This will help in overcoming the problem of CHD which is afflicting Punjabi population at faster pace.

KEY WORDS Anthropometric Measurements. Coronary Heart Disease. Dietary Antioxidants. Lipid Profile. Nutrition Education.

ABSTRACT Sixty male patients in age group of 30-50 years belonging to upper middle class and who were at risk of CHD were selected. Information regarding dietary antioxidant intake, anthropometric measurements, blood pressure and blood glucose was recorded. Blood samples were drawn to analysis the lipid profile. Nutrition education was imparted with special reference to intake of dietary antioxidants. Results indicated the improvement in intake of antioxidants and its positive impact on lipid profile and anthropometric parameters but the intake did not come up to standards set by heart health organisation. Significant ($P \leqslant 0.01$) and negative correlation was also observed between intake of dietary antioxidants and lipid and anthropometric profile of the subjects.

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