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Fruits and Vegetables Diet Improves Some Selected Haemorheological Parameters Predisposing to Cardiovascular Disease in non Insulin Dependent Diabetes Mellitus NIDDM Subjects

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Abstract: Fruits and vegetables have been shown to contain vital components that moderate disease conditions. However, there is dearth of information of these effects in Africans diabetic subjects. Thus, we investigated the relative effect of fruits and vegetables on some selected heamorological factors associated with cardiovascular disease in diabetic subjects. Thirty diabetic subjects were selected at the cardiovascular clinic of Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria. The subjects with mean Fasting Blood Glucose (FBG) level of 7.8±0.95 mmold L^{-1} were placed on 300 g of fruits and vegetables per day, while they continued their normal medication and food intake. A significant difference ($p<0.05$) was noticed between baseline and eight week values in all the parameters, Fibrinogen 262.75±2.64 to 250.57±3.98 mg dL^{-1}, Blood viscosity, 5.96±0.21 to 4.82±0.23 m Pas; erythrocyte sedimentation rate 49.40±2.34 to 32.8±1.26 min h^{-1} and haematocrit 38.8±1.25 to 44.75±1.05%. At the eight week the fruits and vegetables were withdrawn for two weeks and the above parameters were reassessed (at the 10th week) which were compared with eight week values. Significant difference $p<0.05$ was noticed in E.S.R. 32.8±1.26 to 38.8±1.23. However no significant difference ($p>0.05$) was observed in haematocrit, 44.75±1.44 to 42.70±1.24, Fibrinogen, 254.5±3.98 to 250.57±3.16 mg dL^{-1}. The results showed that regular intake of fruits and vegetables by diabetic subjects may reduce cardiovascular risk factors.

Key words: Diabetics, vegetables, haemorheological, cardiovascular risk factors

INTRODUCTION

Individuals with diabetes mellitus both NIDDM and IDD are at an increases risk for cardiovascular morbidity and morality compared with non-diabetic subjects (Chattopadhyay and Bandyopadhyay, 2005; Lee *et al*., 1993; Tagourius, 1989). Various studies have shown that some haemorheological parameters such as fibrinogen (Madkour *et al*., 2006), blood viscosity (Lowe *et al*., 1997), erythrocyte sedimentation rate (Andresdottir *et al*., 2003) and haematocrit level (Lowe *et al*., 1993; Dintenfas, 1975) are predisposing factors to cardiovascular disease. Different approaches could be used to moderate these factors, among these are drugs, exercise and foods. Recently consumption of fruits and vegetables have been shown to have beneficial effects in many diseased condition (Osilesi *et al*., 1991; Salau *et al*., 2003; Adebawo *et al*., 2007).

Thus, we set to investigate the effects of fruits and vegetables consumption on some selected heamorological parameters associated with cardiovascular disease in Nigerians diabetic subjects.

MATERIALS AND METHODS

The study was carried out from August to December, 2008. Thirty NIDDM subjects were randomly selected from the cardiovascular clinic of Olabisi Onabanjo University Teaching Hospital (OOUTH). The subjects that had been on diabetic drugs for over one year were properly educated on the purpose of the research work and they consented to participate.

The average nutrient intake by the subjects using estimated food record (Olusanya, 1976) were calculated. Two weeks after the first contact with the subjects blood samples were taken for analysis to serve as the baseline.

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Edible portion of fairly ripe fruits (orange, pawpaw, grape fruits, tangerine and pineapple) were diced mixed together in equal weight (fruit salad) and two fingers of banana were also given. Two servings of these fruit (100 g each) were given per day. Edible portion of green leafy vegetables fluted pumpkin leaf, spinach, water leaf were diced and given in 100 g portion per day to be cooked by the subjects. The supplementation (fruits and vegetables) was used for eight weeks after which it was stopped for two weeks to serve as control.

Analytical method: After the baseline measurements blood specimen were taken and parameters measured at two weeks intervals for a period of eight weeks. Fibrinogen was determined by direct clot weight procedure as described by Ingram's method (Ingram, 1961). Blood viscosity was determined by modified method of Ugwu and Reid (1987). Erythrocyte Sedimentation Rate (ESR) was measured by Western green method (Westergreen, 1957).

Haematocrit i.e., Packed Cell Volume (PCV) was assessed using Dacie and Lewis method (Dacie and Lewis, 1984).

Statistical analysis: The experimental design was completely randomized. The data were analysed using analysis of variance procedure of Gomez and Gomez (1984) while statistical differences between treatment means were established using Duncan's multiple range tests at 5% level of probability (Duncan, 1955).

RESULTS

As shown in Table 1 is the fibrinogen level of diabetic subjects consuming fruits and vegetables. Significant difference ($p<0.05$) was observed in baseline value and the eight week value (262.75±2.84 and 250.70±2.16 mg dL^{-1}).However, no significant difference ($p>0.05$) was observed between eight week and tenth week values (250.70±2.16 and 254.50±3.98).

Table 2 revealed Blood viscosity of the diabetic subject whose diets were supplemented with fruits and vegetables significant reduction ($p<0.05$) was observed in baseline value 5.96±0.21 and eight week value 4.82±0.23, significant difference ($p>0.05$) was not observed between eight week value (4.82±0.23) and tenth week value (4.85±0.16).

In Table 3, significant difference ($p<0.05$) was observed in baseline value haeamatocrit level 38.8±1.25% and eight week value 44.75±1.0%, however no significant difference ($p>0.05$) was observed between eight week (44.75±1.0%) value and tenth week value 42.75±1.24.

As shown in Table 4 is the Erythrocyte sedimentation rate significant difference ($p<0.05$) was observed between the baseline value (49.4±2.34 mm hr^{-1}) and eight week value (32.8±1.26 mm h^{-1}). Also significant difference ($p<0.05$) was noticed in the eight week value (32.8±1.26 mm h^{-1}) and tenth week value (38.8±1.23 mm h^{-1}).

Table 1: Fibrinogen level of diabetic subjects fed with fruits and vegetable supplementation diet

Week	Fibrinogen (mg dL^{-1})	Percent change
0 (baseline)	262.50±2.64^{a}	0
2	260.05±5.63^{a}	-0.95
4	256.90±3.08^{ab}	-2.13
6	254.51±3.98^{ab}	-3.04
8	250.57±2.16^{b}	-4.54
10 (control)	254.24±4.88^{ab}	-3.02

Values are Mean±SD for 20 subjects, Values with different superscript are significantly different at $p<0.05$

Table 2: Blood viscosity of diabetic subjects fed with fruits and vegetable supplementation diet

Week	Blood viscosity	Percent change
0 (baseline)	5.96±0.21^{bc}	0
2	5.55±0.19^{ab}	-6.88
4	5.13±0.18^{ab}	-13.93
6	4.95±0.15^{a}	-16.95
8	4.82±0.23^{a}	-19.13
10 (control)	4.85±0.16^{a}	-18.62

Values are Mean±SD for 20 subjects, Values with different superscript are significantly different at $p<0.05$

Table 3: Haematocrit level of diabetic subjects fed with fruits and vegetable supplementation diet

Week	Haematocrit (%)	Percent change
0 (baseline)	38.80±1.25^{a}	0
2	38.83±1.23^{a}	0.08
4	39.91±1.31^{a}	2.92
6	40.30±1.03^{a}	3.87
8	44.75±1.01^{bc}	15.34
10 (control)	42.74±1.24^{ab}	10.15

Values are Mean±SD for 20 subjects, Values with different superscript are significantly different at $p<0.05$

Table 4: Erythrocyte sedimentation rate (ESR) level of diabetic subjects fed with fruits and vegetable supplementation diet

Week	ESR (mm h^{-1})	Percent change
0 (baseline)	40.41±2.34^{c}	0
2	43.00±2.28^{bc}	-12.97
4	43.44±2.69^{bc}	-12.08
6	39.95±1.63^{b}	-19.15
8	32.81±1.26^{a}	-33.60
10 (control)	38.88±1.23^{b}	-21.31

Values are Mean±SD for 20 subjects, Values with different superscript are significantly different at $p<0.05$

DISCUSSION

Various studies have established that some heamorrheological parameters are predisposing to cardiovascular risk factors (Madkour *et al*., 2006; Andresdottir *et al*., 2003; Lowe *et al*., 1993). Also some of these risk factors have been shown to be diet influenced (Salau *et al*., 2003, 2012; Adebawo *et al*., 2007; Ornish *et al*., 1990). The result of this study revealed

that supplementation of diabetic diet with fruits and vegetables improved some selected heamorrheological factors associated with cardiovascular disease.

Reduction in fibrinogen level of the subject could be attributed to the presence of dietary fibre, vitamin C and other complex carbohydrates (Landin *et al*., 1992; Mehrabian *et al*., 1990; Nilson *et al*., 1990) which enhance fibrinolytic activities by reducing plasminogen activator inhibitor activity among other things, the overall decrease indicate improvement and reduction in cardiovascular risk.

Increase in blood viscosity has been linked with cardiovascular disease (Lowe *et al*., 1997) while blood viscosity is also affected by fibrinogen and haemotocrit level. Diet containing fat, cholesterol and refined carbohydrate are implicated in raising blood viscosity (Lee *et al*., 1993). However, increase in fruits and vegetable decreased the blood viscosity significantly ($p<0.05$) 5.96±0.21 to 4.82±0.23 and this could be as a result of decrease in fibrinogen level occasioned by the presence of dietary fibre, vitamin C and complex carbohydrate in fruits and vegetable (Landin *et al*., 1992; Mehrabian *et al*., 1990; Nilson *et al*., 1990). Haemotocrit level 38.8±1.23 to 42.7±1.24 seems to be confounding however the increase is beneficial because level below 38% may indicate anaemia while level above 50% which is associated with increases risk of heart disease (Knottnerus *et al*., 1988). The increase in haemotocrit level may be as a result of high intake of fruits and vegetables which may increase intake of B complex vitamins and iron which may eventually increase erythropoiesis as reported by Fakoya *et al*. (1998).

Increase in erythrocyte sedimentation rate could be used as index of aggravation in many diseases such as diabetes mellitus, heart disease, vascular disease, malignancy and in these conditions, increase in fibrinogen level is usually observed (Sox and Liang, 1986). Conversely decrease in ESR could be used as improvement index (Fakoya *et al*., 1998) which was observed in this study.

CONCLUSION

In this study we are able to conclude that consumption of 300 g of fruits and leafy vegetable improved some selected heamorrheological factors associated with cardiovascular disease in type II diabetes mellitus subjects and this may help in delaying complications such as cardiovascular disease that are associated with diabetes mellitus subject.

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