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Fruits and Vegetables Diet Improves Kidney Functions and Electrolyte Status in Non-Insulin Dependent Diabetes Mellitus (N.I.D.D.M) Subjects

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ABSTRACT

Kidney failure and electrolyte imbalance are some of the complications associated with diabetes mellitus, if prompt treatment is not instituted it may lead to renal disease and dietary influence has been established on the prognosis of many diseases. Thus effects of fruits and vegetables diet were investigated on kidney functions and electrolyte status of some selected Non-Insulin dependent diabetic subjects at the cardiovascular clinic of Olabisi Onabanjo University Teaching Hospital, Sagamu, Nigeria.

The patients with mean fasting blood glucose (FBG) 7.84± 0.95 mmol dl^{-1} were placed on 300 g of fruits and vegetables per day in addition to their normal drugs and food intake for eight weeks. Standard laboratory methods were employed for biochemical assay; while the data were analyzed using analytic and descriptive statistics.

A significant difference ($p < 0.05$) was noticed between baseline and eighth week's values in the following parameters: plasma creatinine, 3.48± 0.095 to 1.79±0.57 $mgdL^{-1}$; urea, 39.05±2.04-23.20±1.50 and uric acid 5.37± 0.27-2.50±0.59 $mgdL^{-1}$. No significant difference ($p > 0.05$) was observed in plasma electrolyte values when the baseline value were compared with the eighth week's values. After the eight weeks, the fruits and vegetables rations were stopped for two weeks and the parameters were measured again. Significant difference($p<0.05$) were observed in all the values by comparing week eight with week ten values; plasma creatinine, 1.79±0.52 to 3.01± 0.68 $mgdl^{-1}$,plasma urea, 39.05± 2.40 to 23.20± 1.50 $mgdl^{-1}$ and plasma uric acid 2.50±0.59 to 3.61±0.50 mgd^{-1}, however no significant difference ($p> 0.05$) was observed in serum electrolyte.

Our results showed that fruits and vegetables consumption improved kidney function and did not affect plasma electrolytes adversely.

KEY WORDS: Diabetes mellitus, kidney functions, creatinine, urea, uric acid fruits and vegetables

1. INDRODUCTION

Diabetes mellitus is a metabolic disease, when not properly treated may led to some complications (1). Some of the complications in diabetes mellitus are kidney malfunctions and other biochemical derangements such as electrolytes imbalance. Nephropathy, malfunction of kidney may lead to renal failure which is associated to high mortality.

In developed countries dialysis and kidney transplants may be used in alleviating and treatment during this stage. However such services are not relatively accessible to people in developing countries. Aside from these, the relative difficulties in assessing kidney status by biopsy method in developing countries like Nigeria makes it inevitable to utilize other relatively simple method that would be used to determine the functionality so as to institute early treatment(s) before renal failure. Some of the biochemical parameters that can be used in detection of early nephropathy are; serum creatinine (2); serum urea (3) and serum uric acid (4). Also some of the complications in the diabetes mellitus may be as a result of derangement in the plasma electrolytes which can be monitored by sodium, potassium, chloride and bicarbonate ions (5).

While dietary habits have been implicated in the aetiology, aggravation and complication of many diseases (6-8), consumption of fruits and vegetables has been shown to have beneficial effects in the treatment and management of some of these diseases (9-11). In view of the above we therefore set to investigate the effects of fruits and vegetables consumption on these parameters so as to determine the improvement or deterioration in kidney functions and serum electrolytes status of Non-Insulin dependent diabetes mellitus subjects.

2. MATERIALS ANE METHODS

Thirty N.I.D.D.M. subjects were randomly selected from the cardiovascular clinic of Olabisi Onabanjo Hospital (OOUTH). The subjects that had been on diabetic drugs for over one year, were educated on the purpose of the research work and they all consented. The average nutrient taken by the subjects were calculated using estimated food record (12), two weeks after the first contact blood and urine specimen were taken and other parameter were measured for analysis to serve as baseline.

2.1 Diet Preparation

Edible portion of fairly ripe fruits (orange, pawpaw, grape fruit, tangerine and pineapple) were diced and mixed in equal weights (fruits salad). Two servings of fruits salads (each serving measuring 100 g) were given per day. Edible portion of given leafy vegetable: Fluted pumpkin leaf, spinach and water leaf diced and given in portion of 100 g per day to be cooked by the subjects. The feeding regiment was given for eight weeks and later stopped for two weeks to serve as control.

2.2 Analytical Methods

After the baseline measurements, specimen were taken and parameters were measured every forth-night for a period of eight weeks. Fasting blood glucose was determined by one touch Life Scan basic Glucometer and life Scan one touch test strip Code 10, while plasma urea creatinine, and uric acid were determined by enzymatic method using kits supplied by Random laboratories, U.S.A. Potassium, sodium were analyzed by using flame photometer (Sherwood M410). Serum bicarbonate was determined by back titration method (13) while the method of Schales and Schales (14) was used to determine chloride ion concentration.

2.3 Statistical Analysis

The experimental design was completely randomized. The data were analyzed using analysis of variance procedure of Gomez and Gomez (15) while statistical differences between treatment means were established using Duncan's multiple range test at 5% level of probability (16).

3. RESULTS AND DISCUSSION

Our previous findings have shown moderating effect of fruits and vegetable diet on biomarkers associated with diseases such as hypertension and diabetes mellitus (9-11). This study demonstrated the beneficial effect of fruits and vegetables on parameters associated with nephropathy and other biochemical derangements such as electrolyte imbalance.

Figure 1 showed falling trend of serum creatinine, a significant different ($p< 0.05$) was observed in baseline value when compared with week- eight value with percentage different of -49.28. Also significant increase ($p<0.05$) was observed when tenth- week value was compared with the eight- week value (table 1). Though the eight- week value was still higher than the normal value (table 1), however drastic improvement was observed with eight weeks of feeding fruit and vegetable supplementation diet. The possible reason could be increase in dietary fiber as this has been shown to reduce creatinine level (3, 17)

In figure 2 plasma urea was shown to be descending with a significant difference ($p<0.05$) when baseline value 39.05± 2.40 $mgdL^{-1}$ was compared with week eight value 23.20± 2.40 $mmgdL^{-1.}$ Also significant increase ($p<0.05$) was observed while tenth week was compared with eight week value (23.20± 1.50 and 34.01± 1.70 $mgdL^{-1}$) indicating the effect of fruits and vegetables. The improvement in blood urea (-40.59%) shown in table 1 could be attributed to high fiber present in fruits and vegetables (3, 17) This could also be due to reduction in body dehydration which may be as a result of decrease in fasting blood glucose which may reverse renal lesions and also may be due to slight decrease in the protein content of the diet (18) and probably slight reduction in animal protein as shown in own previous studies (9).

Shown in figure 3 is the falling trend in plasma uric acid; significant decrease ($p<0.05$) when baseline was compared with eight- week value (5.37±0.27 and 2.50±0.59 $mgdL^{-1}$). Also significant increase ($p< 0.05$) was noticed when eight -week value was compared with tenth week value (2.50±0.59 $mgdL^{-1}$ and 3.61±0.50±0.59 $mgdL^{-1}$). Diet high in meat, sucrose and flour product has been shown to increase plasma uric acid level (19), whereas fruits and vegetables diet may decrease uric acid level probably due to high concentration of antioxidants which may lead to decrease in the synthesis of endogenous antioxidant of which uric acid belongs (20). Though the drastic reduction in plasma urate may be worrisome, however the decrease is not detrimental due to the fact that hypouriceamia sets in when blood urate is less than 2.4 $mmgdL^{-1}$

Table two shows plasma electrolyte status in diabetic subjects fed fruits and vegetables supplementation diet, no significant difference ($p.>0.05$) was observed in sodium, potassium, bicarbonate and chloride levels in the plasma. The results indicated that values are within normal range. Thus it implies that fruits and vegetable diet might not have adverse effect on plasma electrolyte in IDDM subjects

4. CONCLUSION

Inclusion of fruit and vegetable diet improves renal health by reducing plasma creatinine, urea and uric acid and has no adverse effect on plasma electrolyte status.

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Table1 Comparison of kidney function parameters of baseline and eight- week values

Parameter ($mgdL^{-1}$)	Baseline	Eight week value	%change	Normal range
Serum creatinine	3.48±0.59	1.79±0.57	-49.28	0.6-12
Serum urea	39.05±2.40	23.20±1.50	-40.59	7-20
Serum uric acid	5.37±0.27	2.50±0.59	-53.45	3.6-8.3

Table 2: Serum electrolytes (Na^+ K^+ HCO^3 and Cl^-) in NIDDM Subjects

Electrolytes ($mmol^{-1}$)	*Baseline*	*Week 2*	*Week 4*	*Week 6*	*Week 8*	*Week 10*
Na^+	137.05 ±1.24	139.94±0.88	136.88±0.71	138.23 ± 0.75	137.05 ± 0.75	136.17±0.54
K^+	3.82 ± 0.02	3.88 ± 0.02	3.72 ± 0.03	3.60 ± 0.11	3.68 ± 0.01	3.75 ± 0.02
HCO^3	25.05 ± 0.65	25.05 ± 0.60	25.52 ± 0.43	24.82 ± 0.40	24.00 ± 0.41	24.94 ± 0.47
Cl^-	99.41 ± 0.71	100.70 ± .56	99.52 ± 0.58	100.05 ± 0.54	98.94 ± 0.70	98.64 ± 0.42

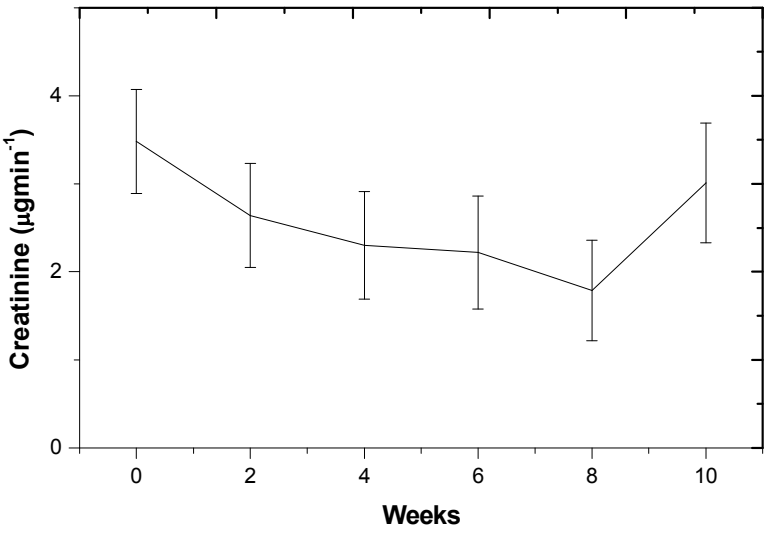

Figure1: Trends in plasma creatinine level of NIDDM subjects

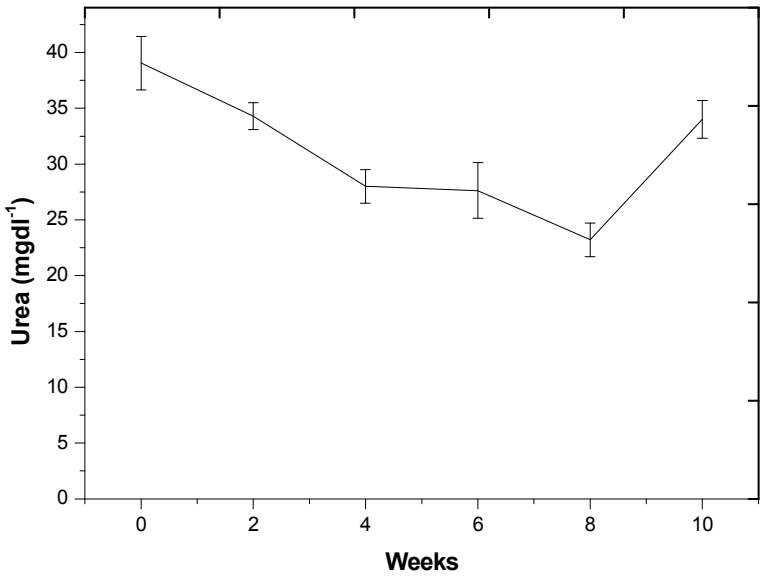

Figure 2: Trends in plasma urea level of NIDDM subjects

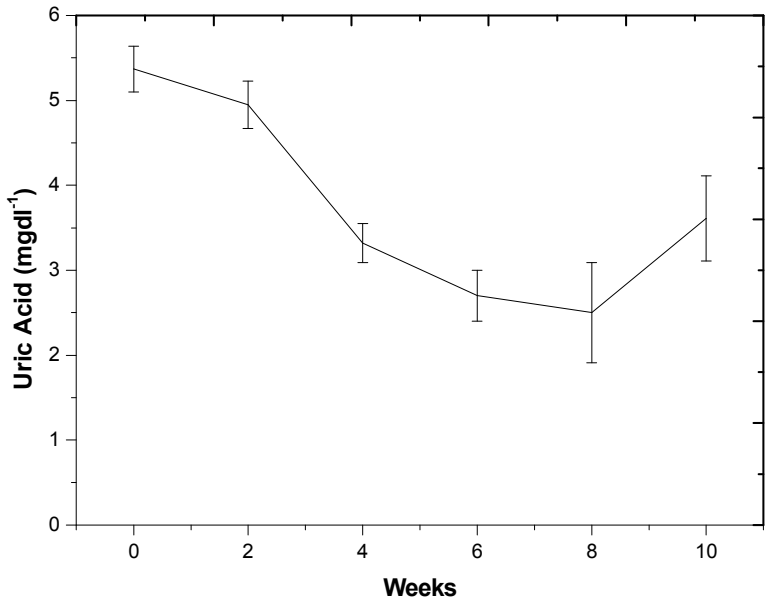

Figure 3: Trends in plasma uric acid level of NIDDM subjects

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