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RESEARCH PAPER

EFFECT OF CUCUMBER CONSUMPTION ON PLASMA CREATININE, UREA, URIC ACID AND GLUCOSE LEVEL IN APPARENTLY HEALTHY STUDENTS OF COLLEGE OF HEALTH SCIENCES, NNAMDI AZIKIWE UNIVERSITY, NNEWI CAMPUS, ANAMBRA STATE, NIGERIA

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ABSTRACT

This study was designed to investigate the effect of oral intake of cucumber on plasma creatinine (Cr), urea, uric acid (Ua) and blood glucose in young apparently healthy students. A total of 29 subjects (14 males and 15 females) were recruited. Each subject was advised to abstain from cucumber and similar vegetables consumption for two weeks. Thereafter, they received 400 g of whole cucumber for 21days prior to their daily breakfast. 5mls each of baseline (day zero) and post consumption (day 22) samples were collected after overnight fast into fluoride oxalate and lithium heparin containers for glucose and other biochemical parameters respectively. Plasma glucose, urea, creatinine and uric acid were analyzed using standard methods. There was a significant decrease in the mean plasma glucose level in post cucumber consumption when compared to the pre-cucumber consumption (4.28±0.46 vs 4.68±0.35; $p<0.05$). However, plasma levels of urea, uric acid and creatinine did not differ significantly between pre and post–cucumber consumption. This study revealed hypoglycaemic effect of cucumber consumption with no harmful effect on the kidney. Therefore, cucumber consumption could be of importance in prevention and management of diabetes mellitus.

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Keywords: **Cucumber, urea, glucose, Uric acid, Creatinine.**

INTRODUCTION

The use of plants as source of remedies for the treatment of diseases can be traced back to the prehistoric times (Lawrence and Bennett, 1995; Evans, 2009; Ankita *et al*., 2012) and medicinal herbs are being increasingly studied by pharmacological researchers (Sinclair, 1998). Indian Ayurveda medicine used herbs as early as 1900BC describing about 700 medicinal plants (Aggarwal *et al*., 2007). According to the World Health Organization (WHO) more than 80% of the world's populations, rely on traditional medicine for their primary health care, majority of which use plants or their active principles (Gupta *et al*., 2005).

The use of plant resources mainly for herbal medicine, food, forages etc in Nigeria represents a long history of human interaction with the environment and their invitro and invivo properties to microbial pathogens have been widely reported (Hashish and Gomaa, 2003; Iwalokun *et al*., 2004). Cucumber (*Cucumis sativus*) belongs to the family cucurbitacae. In general, there are 118 genera and 825 species worldwide *(Rai et al., 2008)* among which 30 cucumis species are found in Asia and African. Plants of this family have many medicinal and nutritional benefits *(Gill and Bali, 2011)*. The medicinal value of these plants lies in some chemical substances that produce a definite physiological action on the human body (Edeoga *et al*., 2005). These chemicals are termed as phyto-chemicals. Egypt is the largest African producer. Research has shown the presence of the phytochemical called terpenoids in Cucumissativus extract (Ankita *et al*., 2012). Terpenoids are

known to possess medicinal potency against malaria, viral, bacterial and fungal agents (Malik *et al*., 2013; Egwaikhide, 2010; Akther , 2012).

Studies have shown the antioxidant effect of C. sativus in rats (Gill *et al*., 2009), substantial anti-inflammatory activity, anti-ulcer effect (Gill *et al*., 2009), saponins have heamolytic property, induced cytotoxicity effect (Rao and Sung,1995), antitumor and anti-mutagenic activities and can lower the risk of human cancers, by preventing cancer cells from growing (Nafiu *et al.,* 2011).

MATERIALS AND METHODS

Study Area: Nnamdi Azikiwe University, Okofia-Otolo, Nnewi campus comprises the college of Health Sciences having the faculties of Basic Medical Sciences, Health Sciences and Technology and Medicine. It is located in the suburb of Nnewi - a popular town in Anambra State Nigeria. The environment is poorly developed and lacking basic amenities such as housing, road, communication, electricity and potable water compared to campuses located in urban areas.

Study Design: A total of 29 subjects (14 males and 15 females) between 18 and 28 years old were recruited. The subjects were essentially medical students. Each subject was advised to abstain from cucumber and similar vegetables consumption for two weeks. Thereafter, they received 400g of whole cucumber for 21days prior to their daily breakfast. 5mls each of baseline (day zero) and post consumption (day 22) samples were collected after overnight fast into fluoride oxalate and lithium heparin containers for glucose and other biochemical parameters respectively. Plasma glucose, urea, creatinine and uric acid were analyzed using standard methods described by Bergmeyer and Bernt (1974); *Taylor, (1992);*Burtis and Carl, (2008) and Trivedi *et al*., (1978) respectively.

Ethical Consideration: Ethical approval was obtained from the Faculty of Health Sciences and Technology ethical committee, Nnamdi Azikiwe University, Nnewi campus, Anambra State, Nigeria for sample collection.

Inclusion and Exclusion criteria: Apparently healthy male and female Subjects that consume cucumber and are between 18-28years of age and non-diabetic and not on drugs (hypoglycaemic and diuretic drugs) were recruited for the study. Subjects younger than 18years or older than 28years old that do not consume cucumber and other similar vegetables that are on drugs and medications (hypoglycaemic and diuretic drugs) were excluded from this study.

RESULTS

The mean age(years), height(metres), weight(Kg) and body mass index(Kg/m^2) were (23.3 $\pm$ 2.24 years, 1.63 $\pm$ 0.88 m, 62.62 $\pm$ 11.11 Kg, and 23.34 $\pm$3.19 Kg/m^2) respectively. The subjects were from young and apparently healthy population. When the anthropometric parameters were compared between the male and female subjects, there were a significant difference in the mean age and height of the male than female subjects. However, there was no significant difference in the mean weight of both sexes and in general, no significant difference in mean body mass index (BMI) of the subjects compared. ($P<0.05$), (See Table 1).

The result showed that plasma concentrations of the renal parameters (creatinine, urea and uric acid) were similar pre- and -post cucumber consumption. However, the plasma glucose concentration was significantly decreased after 3weeks of cucumber consumption compared to the pre-consumption. (See table 2).

There were significant differences in the mean plasma creatinine and uric acid levels of the males when compared to female subjects before cucumber consumption. However, there were no significant difference in the mean plasma electrolyte levels, urea and glucose when compared before cucumber consumption ($p<0.05$). (See table 3 and 4).

There were no significant differences in the mean plasma levels of all parameters compared between both sexes, but there was significant positive correlation between all the parameters (uric acid, urea and creatinine compared in the post-cucumber consumption in the apparently healthy subjects ($p<0.05$). (See table 5 and 6).

Table 1 The Anthropometric Parameters of Subjects Studied (Mean+SD; n=29).

Parameters	All Subjects (n=29)	Male (n=14)	Female (n=15)	t-value	p-value
Age (year)	23.3+2.4	24+2.4	2 2.5+2.4	2.122	0.043*
Height (meter)	1.63+0.88	1.69+0.86	1.59+0.62	3.526	0.002*
Weight (Kg)	62.62+11.11	65.79+8.85	59.67+12.42	1.534	0.137
BMI (Kg/m^2)	23.34+3.19	23.6+2.59	23.51+3.57	0.296	0.770

*Statistically significant at P<0.05

Table 2 Renal parameters and fasting blood glucose before and after 3weeks of cucumber consumption.

Variables	Pre-cucumber Consumption	Post-cucumber Consumption	t-value	p-value
Plasma creatinine (umol/l)	67.22+22.46	63.05+42.46	0.976	0.337
Plasma urea (mmol/l)	4.04+0.81	4.14+1.43	0.660	0.515
Plasma uric acid (mmol/l)	222.31+69.59	232.61+53.81	0.370	0.715
Fasting blood Glucose (mmol/l)	4.68+0.35	4.28+0.46	3.770	0.001*

*Statistically significant at P<0.05

Table 3 Renal Parameters and Fasting Blood Glucose of male and female participants before cucumber consumption.

Variables	Males (n=14)	Females (n=15)	t-value	p-value
Plasma creatinine (umol/l)	76.62+20.80	58.20+20.89	2.347	0.027*
Plasma urea (mmol/l)	4.04+0.76	4.05+0.88	0.058	0.954
Plasma uric Acid (mmol/l)	253.40+59.59	193.29+67.22	2.522	0.017*
Fasting blood glucose (mmol/l)	4.71+0.35	4.65+0.36	0.451	0.656

*Statistically significant at P<0.05.

Table 4 Renal Parameters and Fasting Blood Glucose of participants after 3weeks of cucumber consumption.

Variables	Males (n=14)	Females (n=15)	t-value	p-value
Plasma creatinine (umol/l)	64.02+15.96	62.14+15.39	0.323	0.749
Plasma urea (mmol/l)	4.27+1.91	4.03+0.84	0.442	0.664
Plasma uric Acid (mmol/l)	232.42+57.56	232.79+52.09	0.018	0.986
Fasting blood glucose (mmol/l)	4.23+0.48	4.32+0.46	0.528	0.602

*Statistically significant at P<0.05

Table 5 the levels of Association between Parameters Studied before cucumber consumption.

Parameters	Subjects(n)	Correlation Coefficient Pearson r	p-value
Ht Vs Wt	29	0.642	0.000*
Wt Vs BMI	29	0.802	0.000*
Ua Vs Cr	29	0.651	0.000*

* Statistically significant at P<0.05.

Table 6 The levels of Association between Parameters Studied Post cucumber consumption

Parameters	Subjects(n)	Correlation Coefficient Pearson r	p-value
Ht Vs Wt	29	0.642	0.000*
Wt Vs BMI	29	0.802	0.000*
Ua Vs Urea	29	0.396	0.033*
Ua Vs Cr	29	0.492	0.007*

* Statistically significant at P<0.05. Ht=height; Wt=weight

DISCUSSION

Cucumis sativus (Cucumber) has been found as a suitable functional food for medicinal purposes such as diabetes, hyperlipidemia, hypertension (as diuretic), gall bladder stones, constipation and dyspepsia in Asian Traditional Medicine (Trease *et al*., 2002).

In this study cucumber consumption significantly reduced plasma glucose concentration in apparently healthy subjects. This result confirms the report of Mohsen *et al*., (2011) who investigated the effect of hydroalcoholic and Buthanolic extract of *C. sativus* seed on blood glucose level of normal and streptozotocin- induced diabetic rats and found that both hydroalcoholic (22-33.8%) and Buthanolic (45.0%) extract of *C. sativus* were effective in reducing blood glucose level and controlling the loss of body weight in diabetic rats after nine days of continued daily therapy. Other similar studies in rats also did show the reducing effect of C sativus on blood glucose levels (Dixit and Kar, 2010; Agarwal *et al*., 2007; Sharmin *et al*., 2013; Banshidhar and Deepmala, 2013; Stano *et al*., 2002). The decreased level of fasting blood glucose in post cucumber consumption in the apparently healthy subjects maybe as a result of its stimulation of insulin release from the pancreatic-beta –cells or its release from the bound form (Davis *et al*., 2002; Mahome and Ojewole, 2003; Nolte *et al*., 2004; Banshidhar and Deepmala, 2013). Furthermore, there may have been stimulation of peripheral glucose utilization or enhancing glycolytic and glycogenic processes with concomitant decrease in glycogenolysis and gluconeogenesis (Andrade-cetto and Wiedenfeld, 2004). In addition, the antihyperglycemic activity of cucumber may also be due to the presence of hypoglycemic Saponins, Tannins, Triterpines, Alkaloids, Flavonoids e.t.c (Sparg *et al*., 2004; Sahu *et al*., 2008).

Interestingly, cucumber consumption had no significant effects of renal parameters/functions in the total population. Out of all the parmeters studied, the mean plasma creatinine level was significantly higher in the males compared to female subjects prior to the consumption of cucumber. This significant increase in the mean plasma creatinine level in the male than female subjects may be due to higher muscle mass in the male subjects. Creatinine production is proportional to sekelatal muscle mass. Men tend to have higher levels of creatinine than women because they generally have a greater mass of skeletal muscle (Taylor and Howard, 1989). Eating a lot of meat can increase daily creatinine (Taylor and Howard, 1989). However, following cucumber consumption the difference was no longer significant. In contrasts, in previous studies it was observed that there was a significant increase in the plasma creatinine level following the investigation of the potential of the alcoholic extract of *Cucumis sativus* as an antiurolithialic agent in male and female rats which were calculi-induced (Krishnaveni *et al*., 2013 and Tushar *et al*., 2014).

The present study shows a significant increase in the mean plasma uric acid level in the male than female subjects in the post cucumber consumption period. This confirms the work of Krishnaveni *et al*., (2013) who showed that there was a significant increase in the mean plasma uric acid level in rats after investigating the potential of the alcoholic extract of cucumis sativus as an antilithialic agent in male and female rats that were calculi- induced. This increase in the mean plasma uric acid level may be as a result of the gender variation (Taylor and Howard, 1989).

This research indicates that there is a positive correlation between height and weight of the subjects before and after cucumber consumption. Report has it that there is a significant decrease in weight after cucumber consumption *(*Szalay*,* 2015*)*. The weight versus body mass index (BMI) indicates a positive correlation before and three weeks post cucumber consumption. This means that as the weight of the body increases, the body mass index increases too.

There was a positive correlation between the plasma uric acid versus creatinine as well as in urea versus creatinine both before and after cucumber consumption. This perhaps explains the fact that they are both indicators of kidney function and are continually maintained within a reference limit in healthy subjects (Jacki *et al*., 2007; Harrita, 2009; Amed, 2011; Allen, 2012). Accumulation of these metabolites in the blood indicates renal disorder (Sarnak *et al*., 2003; Perazella and Klan, 2006; Appel *et al*., 2008).

CONCLUSION

From the current study, we conclude that cucumber has significant antihyperglycemic effects and is able to keep the body hydrated. Therefore, cucumber can be useful, at least as an adjunct, in the therapy of diabetes, a condition in which hyperglycemia and hyperlipidemia coexist quite often. However, further study is necessary for the screening of chemical compounds and the structure elucidation of the respective antidiabetic property as well as their extraction mechanism.

RECOMMENDATIONS

Based on our findings, we recommend that adequate nutritional and health education strategies should be adopted to enlighten the general public on the beneficial effects of cucumber. Cucumber can be used in the management of Diabetes Mellitus. Further studies should be carried out to fully understand the full benefit of cucumber consumption.

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AUTHORS' CONTRIBUTIONS

All authors (Ogbodo EC, Ezeugwunne IP, Analike RA, Ezeodili VK**,** Egbe JU,Obiorah MO, Aguta UE, Madukwe DUP, Nwanko JC, Onah C, Ugwu MC, Meludu SC.) contributed to the completion of this research work and were actively involved in the presentation of this manuscript.