Effect of Peanut *(Arachis hypogaea)* on Kidney in Rats

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Abstract

Background: *Kidney is the main excretory organ which can be damaged by various disease conditions, foods, exposure to some chemicals, toxins, or infectious agents. Peanuts (Arachis hypogaea) may have antioxidant activity thereby can be used for the improvement of kidney functions though its exact role is yet to be explored.* ***Objective:*** *To observe the effect of peanut kernel powder on kidney by observing the histology and some biochemical parameters (serum creatinine and blood urea) in Wistar albino rats.* ***Materials and method:*** *This experimental study was conducted between October 2012 to December 2012 in the Institute of Food and Nutrition, University of Dhaka, Bangladesh. A total number of 20 apparently healthy Wistar albino male rats, weighing between 120 to 150 grams, age range 90 to 120 days were used. Prior to conducting the study, the animals were acclimatized for 14 days. Then, they were divided into two groups; control group (Group A) consisted of 10 rats and experimental group (Group B- Peanut treated group) consisted of 10 rats. All groups of animals received basal diet for 21 consecutive days and in addition, experimental group received peanut kernel powder (500mg/kg body weight/day; orally) in the morning along with food for 21 consecutive days. All the animals were sacrificed on 22nd day. The blood and kidney samples were collected. Blood urea, serum creatinine levels were measured and histopathology of kidney was done by using standard laboratory procedure.* ***Results:*** *The mean body weight of peanut treated group was significantly lower than that of control group. The mean blood urea and creatinine levels were higher in peanut treated group in comparison to those of control group but the differences were not statistically significant. On histology, kidney revealed normal findings both in control and peanut treated group.* ***Conclusion:*** *Role of peanut kernel powder in normalizing the biochemical parameters is controversial.*

Keywords: *Peanut; kidney; histology.*

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Introduction

Kidney is an important organ because of its role in getting rid of harmful materials and excretions of drugs and body waste products. Effective normal functioning of kidney is essential for normal health.[1,2]

Kidney disease is a worldwide public health problem due to an increase in both incidence and prevalence in the last decades.[3] Dysfunction of kidney indicates severe disorders, which leads to various physiological and pathological complications.[2] Moreover, current evidence suggests that traditional cardiovascular risk factors, such as advanced age, hypertension, type 2 diabetes, obesity are associated with progression of kidney disease.[4-7]

Of the lifestyle factors, diet appears to have an important role in the prevention and development of kidney diseases. Some nutritional factors or dietary patterns are responsible for the progression of kidney disease.[8] From ancient time, various plants as well as

herbal preparations are used for enhancement of kidney function.[2] However, no specific dietary pattern has been recognized by high-level evidence based studies for prevention or ameliorates kidney diseases.[9]

The peanut or groundnut *(Arachis hypogaea)* is a species in the legume family, *Fabaceae.* It is one of the major oilseed crops of the world. It is world's fourth most important source of edible vegetable oil and the third most important source of vegetable protein feed meal. Peanuts can be consumed as raw, roasted or mixed with other foods or in different processed forms. Recently, peanuts have gained much attention as functional food. In the United States, the consumption of peanuts is greater than all the other nuts combined.[10-13]

Peanut comprises of skin, hull and kernel (seed). Peanut hulls exhibit appreciable antioxidant activity and antimutagenic effect.[14] Peanut kernels were found to be rich in antioxidants as that of blackberries and strawberries.[15] Its major components are protein and fatty acids like palmitic acid, oleic acid and linoleic acid.[10] It is also rich source of magnesium (Mg), folate, fiber, alpha tocopherol, copper, arginine, oxalate, phenolic compound.[16-21]

Recent research on peanuts and nuts in general has found anti-oxidants and other chemicals that may provide health benefits. Also, peanuts are a significant source of resveratol, a chemical studied for potential anti-aging, anti-cancer and anti-inflammatory influences. It has lipid lowering effects and also decreases the body weight. Peanut is safe but it may produce allergic and anaphylactic reactions.[22-25]

Recently some researchers observed that peanuts significantly reduced glycerol induced elevation of serum urea and creatinine levels in rats which indicates protective effect of this crop against renal injury.[26] Moreover, some other researchers found that peanuts have antioxidant properties and inhibit generation of free radicals to provide protection against kidney damage.[27,28] Whereas, some other investigators found kidney stones in hypertensive patients due to consumption of peanuts with beer suggestive of kidney injury.[29]

Kidney disease is potentially serious and causes high morbidity and mortality in our country. In recent years, great effort has been focused on natural food and diet for providing protection against kidney damage. But in Bangladesh, little is known about the effect of peanut on kidney. Therefore, the present study has been designed to observe the peanut effects on histology and selected biochemical parameters of kidney in experimental animals. As there are still debates about the role of peanut, we made an attempt to explore the effect of peanut on kidney as experiment.

Materials and method

This experimental study was conducted between October 2012 to December 2012 in the Institute of Food and Nutrition, University of Dhaka, Bangladesh. A total number of 20 apparently healthy Wistar albino male rats, weighing between 120 to 150 grams, age range 90 to 120 days were used. The animals were purchased from animal house of International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDRB), Dhaka, Bangladesh. Ethical permission was taken from the Institutional Ethics Committee (IEC) of Sir Salimullah Medical College (SSMC), Dhaka, Bangladesh. Prior to conducting the study, the animals were acclimatized for 14 days at 23±20^{o}C room temperature under 12 hour dark light cycle. During this period, they had free access to food and water ad libitum. Then they were divided randomly into two groups; control group (Group A) consisted of 10 rats and experimental group (Group B-Peanut treated group) consisted of 10 rats. Both the groups received basal diet for 21 consecutive days. In addition, experimental group received peanut kernel powder (500mg/kg body weight/day; orally) in the morning for 21 consecutive days. After 14 days of acclimatization, body weights were measured (initial body weight), and final body weights (final body weight) of rats were taken on 22nd day. Then, all the animals were anaesthetized with chloroform and sacrificed on 22nd day. The blood and kidney samples were collected. Kidney was washed in ice cold saline. Then, it was wiped with tissue paper and weighed by electric balance analyzer. Blood was centrifuged at the rate of 4000 rpm for 5 minutes and supernatant serum was collected. Then, estimation of blood urea was done by modified urease-berthelot colorimetric method in auto analyzer and serum creatinine was done by the alkaline picrate method in auto analyzer.[30, 31] Histopathology of kidney was done by using standard laboratory procedure in the department of Pathology, SSMC. Statistical analyses were done by unpaired t-test, using SPSS windows, version 16.

Preparation of peanut *(Arachis hypogaea)* kernel powder

Raw peanut pods were dried at sunlight for 2 days. After drying, pods were manually shelled and the skins were removed from the raw peanut kernels. Then, the raw kernels were crushed in electrical grinder into powder.

Results

Initial body weights of all the groups were almost similar and the differences were not statistically significant. Final body weights were significantly ($p<0.001$) lower in experimental group (group B) in comparison to that of control group (group A) (Figure 1).

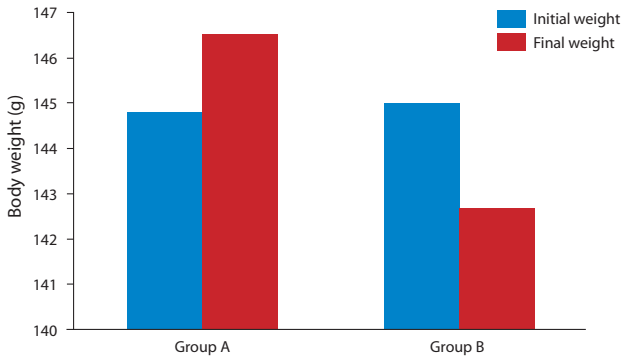

Fig 1: Body weight (in gm) of control and experimental groups in two occasions

Though mean±SD kidney weight of experimental group (Group B) was found higher (0.38±0.04 gm vs. 0.35±0.03 gm) than that of control (Group A), but the difference was not statistically significant ($p>0.05$) (Table I).

Table I: Comparison of kidney weight between groups

Groups	Kidney weight (gm)	p value
A (Control)	0.35 ± 0.03	0.051
n = 10	(0.30 - 0.41)	
B (Experimental)	0.38 ± 0.04	
n = 10	(0.31 - 0.45)	

Parenthesis shows range

Table II shows that mean serum levels of urea and creatinine, both were higher in group B in comparison to those of group A, but the differences were not statistically significant ($p>0.05$).

Table II: Comparison of blood urea (mg/dL) and serum creatinine (mg/dL) between groups

Parameters	Group A (Control) n = 10	Group B (Experimental) n = 10	p value
Blood urea(mg/dL)	26.00 ± 4.85 (18 - 33)	29.89 ± 5.93 (22 - 39)	0.078
Serum creatinine (mg/dL)	0.64 ± 0.13 (0.40 - 0.80)	0.76 ± 0.14 (0.60 - 0.90)	0.055

Parenthesis shows range

In this study, histological examination of kidney revealed normal findings in 100% of rats in group A (photomicrograph 1) and also in group B (photomicrograph 2).

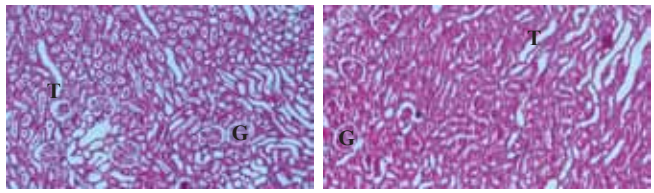

Fig 2: Architecture of kidney of rats of control group & experimental group (X 400), T represents tubules and G represents glomerulus

Discussion

In this study, final body weight of peanut treated group was significantly lower in comparison to that of control group. Some investigators observed similar type of findings.[24] It has been suggested that, peanut intake provides with higher vitamin A, vitamin E, folate, calcium, magnesium, zinc, iron, and dietary fiber, and decrease the level of saturated fat, cholesterol, triglyceride and thus causes reduction of body weight.[23,24]

Again, the kidney weights were almost similar in all the groups and no significant difference of this value was observed between experimental group and control group though high mean value was observed in experimental group. This finding is in consistence with the study done by Attar.[10]

In the present study, serum levels of urea and creatinine were higher in peanut treated group in comparison to those of control group. The differences of these values were not statistically significant. These findings are in line with some other studies.[26,32] Though non

significant increment was observed but higher trend of blood urea and creatinine in experimental group made the role of peanut on kidney function questionable.

Histological findings of kidney in this study were normal in both experimental group and control group. Similar observation was reported by some other investigators.[33] It clearly indicates the fact that peanut has no deleterious effect on renal microstructure.

It has been postulated that, peanuts significantly reduce renal oxidative damage and increase nitric oxide levels. Thus, suppress toxin mediated enhancement of serum urea and creatinine levels.[26] Again, some other researchers suggested that the peanut keeps the serum creatinine level close to normal due to the ability of some antioxidant in peanut to scavenge free radicals generated by irradiation, which would otherwise cause kidney damage.[27]

Histological findings revealed no abnormality and discrepancy and significant reduction in body weight was observed in peanut treated rats; but biochemical parameters namely blood urea and creatinine levels showed non significant higher trend. So antioxidant effects of peanuts on kidney remain controversial. It is also documented that the exact role of peanuts still is debatable as some studies revealed that kidney functions worsened with the consumption of peanuts.[29] As mixed role of peanut was experienced in this study and the exact mechanism involved in the activity of peanuts cannot be found out from this type of study, we recommend more extensive studies involving larger sample size.

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