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EFFECTS OF BARLEY AND WHEAT SEMOLINA ON RENAL PARAMETERS IN CKD PATIENTS

KEYWORDS: Type 2 diabetes, chronic kidney disease, Barley and wheat semolina

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ABSTRACT *Objective: To study the effects of barley and wheat semolina to a renal diet on renal parameters in patients with CKD stage 2*

Material and methods:Randomly selected type 2 diabetes mellitus with CKD stage 2 patients were included in the study. The basic design of the study was 30 days intervention trail. Selected biochemical and anthropometric measurements were observed before and after intervention period. Student t-test was used to detect significant changes within each group.

Results: Significant improvement was observed with barley and wheat semolina intervention in anthropometric and biochemical parameters.Highly significant difference were in weight (P<0.000) and triceps (P<0.000) with barley and wheat semolina. Renal parameters of uric acid (P<0.000) showed significant with barley and wheat whereas serum creatinine ((P<0.060) was not significant. Significant urine albumin excretion (P< 0.000) was observed with barley semolina intervention. FBS (P<0.001) and PPBS (P<0.000) were also observed significant with barley semolina whereas wheat semolina showed improvement in PPBS and no difference with rice semolina.Renal function ofuric acid (P<0.033) and urinary albumin excretion (p<0.007) found significant in barley and wheat semolina and there was no significant difference were observed for serum creatinine with barley, wheat and rice semolina intervention.

Conclusion:Barley and wheat semolina intake in breakfast has been shown to have beneficial effects on anthropometric, renal parameters and glycemic control in CKD stage II patients. Among cereal interventions the wheat semolina showed better improvement in anthropometric measurements and barley semolina intervention found to have better cardiac, glycemic and renal functions.

INTRODUCTION

Chronic kidney disease is caused by a variety of prolonged renal insults such as diabetes mellitus, hypertension and primary renal diseases such as glomerulonephritis[1]. Careful dietary management may make it possible to stabilize the progression of chronic kidney disease(CKD) and avoid or post pone dialysis.Conservative management of CKD has included variety of dietary manipulations; supplementation of dietary fiber to reduce adverse symptoms is a novel approach[2].

Barley is one of the cereal grains and is a staple food in most countries of Middle East [3]. Wheat is the second most important cereal crop in India[4].Barley is the world's fourth most important staple in many countries and importance as a food grain in the ancient world[5]. This grain makes an excellent choice as the starring ingredient in main sources, side dishes, breakfast fare and more. In addition to its versatility, whole grains are important sources of complex carbohydrates, dietary fiber, antioxidants, vitamins and minerals and have been linked in protecting individuals from cardiovascular diseases, cancer and diabetes[6]. Barley has got alkalizes detoxifies and acts as a diuretic and is good for anemia, digestive disorder and increases appetite[7].The chromium content of barley has shown to improve glucose tolerance in glucose intolerance people and could be benefit in dietary management of diabetes mellitus[8]. Limited studies are available on therapeutic uses of barley hence the present study was undertaken with the following objective.

Objective: to compare the effects of barley and wheat semolina to a renal diet on renal parameters in patients with CKD stage 2

MATERIAL AND METHODS

Study was conducted in RL Jalappa hospital attached to Sri Devaraj Urs Medical College, Kolar. Randomly selected type 2 diabetes mellitus with CKD stage 2 (MDRD calculation) (eGFR 60-80 ml/min/1.73m^2) patients attending medicine outpatient department of RL Jalappa hospital, Kolar between March 2013-December 2013 was included and randomly divided by using random number table, into three groups of 50 patients each. Group I was barley semolina, group II was wheat semolina and group III was standard renal diet acting as control group. The basic design of the study was 30 days intervention trail. Patients suffering from other causes of renal impairment were excluded. Informed consent was obtained from all the patients. All the patients were interviewed with pre-designed Proforma.

Barley, wheat and rice semolina were obtained from the local market in a lot and cleaned and conditioned barley was milled into semolina in a commercial mill and each of 100 g of barley, wheat and rice semolina was packed

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in air tight poaches, and stored at room temperature andmustard seeds, black gram dhal and oil (refined sunflower) were also obtained from the local market and was used for the study.

A known quantity of barley and wheat sample with initial moisture content of 8.5% was mixed with four percent additional water and tempered for five minutes. Tempered grains were milled into fine semolina in a commercial mill. The semolina was passed through an opening of 670(32 mesh sieve) and +32 size fraction was termed as semolina and -32 fraction was termed as flour. The bran and flour were separated from semolina by winnowing[9].

100g of each barley, wheat and rice semolina was packed in air tight poaches and 5g Bengal gram dhal and 1g of mustard seeds, 3g salt and 20 g oil were also packed separately in air tight pouches and used for the study. All the above ingredients were weighed by electronic weighing balance and above all were put in one big pouch along with handout of uppuma preparation.

Table1. Ingredients and measures for uppuma preparation

Ingredients	Weight(g)	Measures
Semolina	100	½ K
Onion	20	4-5 small
Chilies	5	2-3
Mustard	1	Few
Black gram dhal	5	1 tsp
Bengal gram dhal	5	1tsp
Oil	10	2 tsp
Water	200ml	1-1/3 K
Salt	3	¼ tsp

Method of preparation: Chop chilies and onions. Splutter mustered in hot oil; add black and Bengal gram dhal. Fry them for a few seconds. Add chopped onions and chilies and fry till the onions become slightly brown. Add semolina. Fry about a minute. Add salt and water. Cooked on slow fire till down and served[10].

All the participants were instructed to follow the diet of Clinical practice guidelines and recommendations for diabetes and chronic kidney disease, 2011[11] and randomly assigned 100 g semolina to one of two treatment groups (50 patients in each group). Patients and their attendants were demonstrated the use of semolina in preparing South Indian traditional food uppuma for the breakfast.

Anthropometric measurements: The equipment's used for measuring anthropometric and clinical parameters- the weighing machine, the electronic blood pressure machine and the tape measures will be calibrated and certified for their accuracy by central work shop and also inter rater reliability will be obtained for each of the parameters. Weight will be measured (to the nearest 0.5 kg) with the participant standing motionless on a bathroom weighing scale without shoes or any heavy outer garments, and weight equally distributed over each leg. Height will be measured(to the nearest 0.1cm) using a standards non-elastic tape measure with the participant standing erect against a wall, without shoes, and the head looking straight. And the body mass index (BMI)[12] was calculated. Waist circumference (WC) [13]will be measured using a standard non-elastic tape measure (to the nearest 0.1cm). The participant will be asked to stand with the arms by the sides and to breathe out normally. Standing to the side of the participant, the inferior margin (lowest point) of the last rib and the crest of the ilium (top of the hip bone) will be located and marked with a fine pen. The midpoint between the two will be marked and measurement for waist circumference will be taken at the level of this midpoint. The hip circumference (HC) [14] will be measured around the maximum circumference of the hips. Sitting blood pressure will be measured using blood pressure apparatus (to the nearest 1mm Hg). Two readings will be taken on left arm at an interval of 10 min. If difference between the two readings will be more than10 mm Hg, a third reading of blood pressure was recorded. The mean of 2 (or 3) readings will be taken as the final measurement[15].Systolic blood pressure (SBP) and Diastolic blood pressure (DBP) were noted.Skinfold thickness was measured by using herpendicular caliper over the triceps, biceps, and subscapular and suprailiac region[16].

Biochemical investigations: Fasting blood glucose (FBS) and post prandial blood glucose (PPBS) were estimated by glucose/oxidase peroxidase-4-aminophenazonephenol; Randox method. Uric acid (UA), serum creatinine and urinary albumin excretion (UAE) were estimated by standard laboratoryprocedures.

Statistical Analysis: Student's paired t-test and Anova were used to detect significant changes within each treatment group from baseline to the end of the 30 –day's intervention period.

Table2. Details of the study subjects enrolled in the study

Sample	Total enrolled	discontinued	Remains
Barley	77	27	50
Wheat	61	11	50
Rice	56	6	50
Total	194	44	150

Table3. Reasons for discontinued in study

Reasons	Number (%)
Not interested to consume daily	14(31.81)
Don't have time to prepare and to eat	11(25.00)
Feeling difficult to consume alone	9(20.45)
Fear of abnormal results of blood tests	6(13.63)
Difficult to prepare the uppuma	2(4.55)
Inability to come with fasting from home	2(4.55)

Table4. Mean and SD of anthropometric and biochemical variables of barley before and after intervention

Variables	Barley			
	Before	After	t-value	p-value
Weight	65.96±11.71	61.90±12.14	13.059	0.000**
BMI	27.44±8.53	23.28±4.12	1.036	0.305
WC	95.38±9.85	94.62±10.86	.793	0.431
HC	95.12±9.98	93.52±9.87	6.424	0.000**
WHR	1±0.00	1±0.00		0.060
Biceps	10.42±1.75	10.04±1.57	2.614	0.012*
Triceps	10.41±2.25	9.89±1.74	3.218	0.000**
Supra iliac	10.24±1.96	10.10±1.86	1.477	0.146
Subscapular	10.14±1.69	10.04±1.53	1.941	0.058*
SBP	130±12.20	124±11.06	5.635	0.000**
DBP	80±9.77	75±11.93	4.046	0.000**
FBS	178.76±117.65	123.28±30.67	3.481	0.001**
PPBS	233.02±83.56	156.82±62.49	5.969	0.000**
Creatinine	1.00±0.00	1.00±0.00		0.060

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UA	4.49±1.11	4.50±1.07	3.755	0.000**
UAE	377.78±240.32	276.52±176.31	4.574	0.000**

Table5. Mean and SD of anthropometric and biochemical variables of wheat before and after intervention

Variables	Wheat			
	before	after	t-value	p-value
Weight	67.00±9.31	65.22±9.44	7.770	0.000**
BMI	25.06±3.86	24.30±3.77	6.174	0.000**
WC	92.76±8.83	91.84±8.94	4.234	0.000**
HC	94.30±7.90	92.60±7.85	8.478	0.000**
WHR	1.00±0.00	1.00±0.00		0.000**
Biceps	10.40±1.84	9.96±1.47	4.043	0.000**
Triceps	10.77±2.05	10.14±1.77	4.123	0.000**
Supra iliac	10.40±1.72	10.00±1.45	3.742	0.000**
Subscapular	10.10±2.13	9.46±1.50	4.413	0.000**
SBP	130±11.07	128±10.96	1.358	0.181
DBP	80±9.06	76±11.38	2.286	0.027*
FBS	149.92±52.19	142.06±71.35	.648	0.520
PPBS	248.40±89.32	186.71±154.93	4.769	0.000**
Creatinine	1.02±0.14	1.04±0.19	-.573	0.569
UA	5.02±1.02	4.88±0.84	2.189	0.033*
U.albumin	441.22±334.29	364.02±202.51	2.832	0.007*

Table6. Mean and SD of anthropometric and biochemical variables of rice before and after intervention

Variables	Rice			
	before	after	t-value	p-value
Weight	65.44±10.46	65.02±10.47	3.133	0.003*
BMI	25.26±3.81	25.18±3.92	1.273	0.209
WC	94.79±8.24	94.36±8.45	1.686	0.098
HC	96.93±9.18	95.73±15.44	0.787	0.435
WHR	1.00±0.00	1.00±0.000		0.060
Biceps	10.42±1.67	10.42±1.52	0.058	1.000
Triceps	10.73±1.48	10.08±1.03	1.415	0.000**
Supra iliac	9.93±1.42	9.77±1.06	1.938	0.059*
Subscapular	9.97±1.36	9.93±1.29	0.531	0.598
SBP	128±12.18	126±11.17	2.341	0.023*
DBP	80.49±9.30	76.90±10.40	2.856	0.006*
FBS	80.49±9.30	76.90±10.40	2.856	0.006*
PPBS	242.10±95.45	182.04±38.80	4.461	0.000**
Creatinine	1.00±0.01	1.00±0.01	1.010	0.317
UA	4.46±0.73	4.20±0.91	1.866	0.068
U.albumin	464.89±300.43	438.36±259.08	0.969	0.338

Figure 1 Biochemical parameters of rice before and after intervention

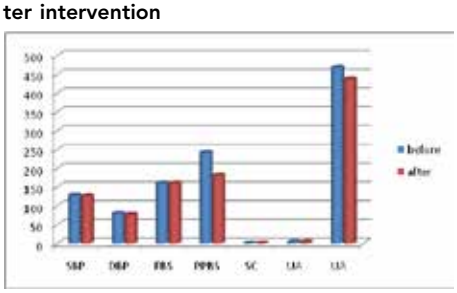

Figure 2 Biochemical parameters of wheat before and after intervention

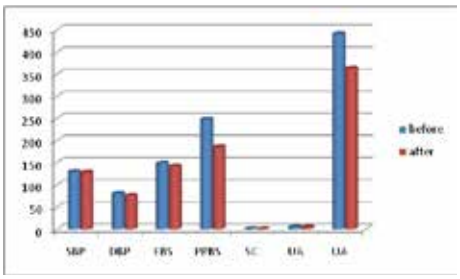

Figure 3 Biochemical parameters of barley before and after intervention

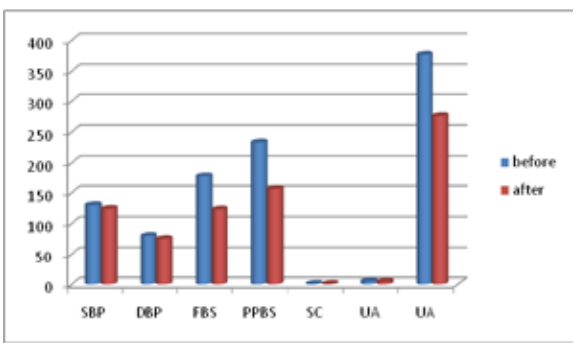

Figure 4 Anthropometric parameters of rice before and after intervention

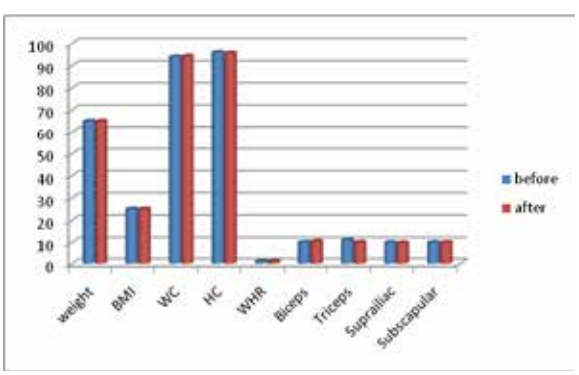

Figure 5 Anthropometric parameters of wheat before and after intervention

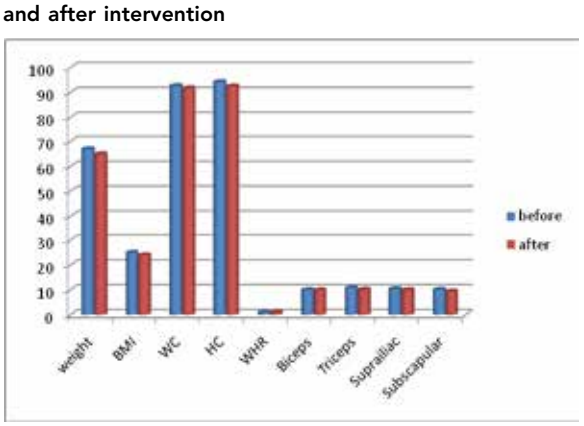

Figure 6 Anthropometric parameters of barley before and after intervention

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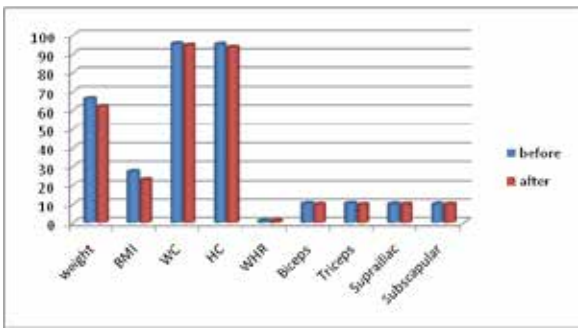

RESULTS

A total of 242 individuals were approached for the study as shown in table 2. Out of this, 194 participated in the study and got interview, anthropometric and clinical measurements done and reported for blood investigations. A total of 48 refused to participate in the study and 44 were discontinued in between the study and the reasons for same are given in table 3.Most of the people discontinued to participate in the study because of monotony of breakfast (31.81%) and difficult to prepare uppuma. The second most common cause was fear of abnormal results (13.63%). Most of the study participants were discontinued from barley (27) sample followed by wheat (11) and rice (6) this was due to the nutty flavor of barley and consumed little long time for cooking and less members from rice was due to the staple diet and 11 members were discontinued from wheat due to difficult in digestion and loose stools (table 2 and 3).

Intervention of wheat and barley semolina in breakfast for 30-days in CKD stage 2 patients were improved significantly for anthropometric and renal parameters. The mean values of anthropometric measurements with barley semolina intervention was observed highly significant for weight(P<0.000), HC(P<0.000) and triceps(P<0.000) and biceps(P<0.012) and subscapular (P<0.050) were found statistically significant. Whereas BMI (P<0.305), WC (P<0.431), Suprailliac (P<0.146) were not statistically significant (table4 and figure 1&2). Significant difference were also observed for SBP (P<0.023) and DBP (P<0.006). The mean renal parameters of uric acid (P<0.000) showed significant whereas serum creatinine ((P<0.060) was not significant. Significant urine albumin excretion (P< 0.000) was observed with barley semolina intervention. Significant improvement in FBS (P<0.001) and PPBS (P<0.000) were also observed with 30-days intervention of barley in breakfast in CKD patients.

The mean values of anthropometric parameters weight (p<0.000), BMI (P<0.000), WC (P<0.000), HC (P<0.000), Skin fold thickness indices biceps (P<0.000), triceps (P<0.000), Suprailliac (P<0.000) and subscapular (P<0.000) were highly significant with wheat semolina intervention (table 5 and figure3&4)). Diastolic blood pressure (P<0.027) showed significant whereas systolic blood pressure (P<0.181) was not significant. Post prandial blood sugars showed significant and there was no significant difference found with fasting blood sugars. The mean renal function tests uric acid (P<0.033) and urinary albumin excretion (p<0.007) found significant and there was no significant difference observed for serum creatinine (P<0.569) with wheat semolina intervention.

Anthropometric measurements weight (P<0.003), triceps (P<0.000) and Suprailliac showed significant and the other observed values were found not significant with rice semolina intervention.The observed SBP(P<0.023) and DBP(P<0.006) were found significant and the glycemic control FBS (P<0.006) and PPBS (P<0.000) were improved significantly and the renal function tests were not significant with rice semolina intervention (table 6 and figure 5&6).

DISCUSSION

Cereals have been an essential part of the diet since the beginning of agriculture. In the present study we found all three cereal semolina interventions showed significant difference for anthropometric measurements. Highly significant weight reduction was observed with barley than wheat and rice semolina (table 4, 5&6)Barley is a food known for its high fiber content ranging from 15.3% to 31.6% compared with 9.6% in whole meal wheat flour[17]. The skin fold variables of triceps showed significant with all three cereal intervention. However from the results found that the better anthropometric measurements were with wheat semolina followed by barley and rice (Figure1, 2 &3).Highly significant improvement in cardiovascular risk factors in CKD stage patients were also observed with barley semolina and in wheat semolina DBP was improved whereas in rice semolina SBP was improved. Better glycemic control was observed cereal interventions and highly significant improvement was observed in PPBS with respect to all three cereal interventions and the FBS were improved only with barley intervention(table4,5&6).The interest in barley benefits to human health was partially reawakened by the author's observation that substituting barley bread for wheat bread has been traditionally used by diabetic people in Iraq as a means of combating their diabetic condition, especially in rural areas where access to modern medicine is limited[18,19]. Accordingly, a series of investigations were conducted by the author and coworkerswho found that the replacement of wheat flour with flour of certain types of barley grown in Mesopotamia-renamed Iraq in modern times could be of benefit in the dietary management of diabetes mellitus[20, 21, 22, and 23]. It was also reported by an experiment, albeit being acute, short term and small, that the glycemic response to barley bread was significantly lower than that to white wheat bread both in healthy volunteers and in type 2 diabetes[24].The author and coworkers found that the beneficial effects of consuming barley on the cardinal signs of diabetes- hyperglycemia, polyphagia and polydipsia were attributable to the chromium and not to any other constituent of the barley[25]. Chromium supplementation was shown to improve glucose tolerance in glucose intolerant people and in type 2 diabetics with further improvement of the glucose tolerance by increasing the dosage of the supplemental chromium[26]. In addition, it has been demonstrated that chromium supplementation could ameliorate microangiopathy and microangiopathy of diabetes mellitus the single most important factor predisposing to morbidity and mortality in diabetes, probably through insulin potentiation by the supplemental chromium[27,28].The improved renal function tests were found in barley semolina intervention followed wheat and rice. Serum creatinine was found not significant with three of the cereal intervention. Whereas for uric acid and UAE were showed highly significant for barley semolina and significant with wheat semolina (table 4, 5 &6 and figure 3, 4, 5). Barley flavonoids mainly saponarins, possess giant and diverse chemical activities enabling them to act as potent toxins detoxifiers and free radical scavengers. [29, 30& 31.] Barley flavonoids are strong antioxidants, contributing to protection against chronic degenerative diseases.

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CONCLUSION

Findings clearly show that the health advantages of barley and wheat semolinaconsumption in breakfast for CKD patients on anthropometric, renal parameters and glycemic control in CKD stage II patients. Among cereal interventions the wheat semolina showed better improvement in anthropometric measurements and barley semolina intervention found to have better for cardiac, glycemic and renal functions.

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