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Low Phosphorus and Protein-Based Snack Bar Processed Products of Brown Rice for Sufferers Chronic Kidney Disease

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ABSTRACT

Chronic kidney disease (CKD) causes metabolic disorders such as hyperphosphatemia. Limiting phosphorus and protein intake is one option, but egg whites and brown rice snack bars are another. This study aimed to compare CKD patients' mean blood urea levels before and after intervention at Prabumulih City Hospital in South Sumatra. This study employs a two-stage quasy design. The first stage of making snack bars was organoleptic tests with Friedman test analysis. In Phase II, patients are given snack bars, and their blood urea levels are measured using t-dependent tests. Purposive sampling was used to select CKD patients from a group of up to 13. The best formula for the brown rice snack bar was formula 3 with 225 kcal energy, 3.46 g protein, 12.68 g fat, 24.26g carbohydrate, 38.92 g phosphorus, and a Phosphorus-Protein ratio of 11.24 mg/g. The mean blood urea levels of CKD patients differed statistically (p-value 0.000). With its low protein and low phosphorus-to-protein ratio, the snack bar's formula can lower blood urea levels in CKD patients. So this snack bar can be used as CKD diet food.

Keywords*: blood urea level; brown rice; Chronic Kidney Disease; phosphorus; snack bar*

ABSTRAK

Penyakit gagal ginjal kronik (GGK) merupakan masalah kesehatan yang menyebabkan gangguan metabolisme dalam tubuh, salah satunya hiperfosfatemia. Salah satu cara menurunkan kadar fosfor dalam darah adalah pembatasan asupan fosfor dan protein, alternatifnya adalah putih telur dan beras merah yang diolah dalam bentuk makanan ringan *snack bar*. Tujuan penelitian ini yaitu mengetahui kandungan zat gizi, rasio fosfor-protein, tingkat kesukaan *snack bar* beras merah, serta perbedaan rerata kadar ureum darah pada pasien GGK sebelum dan sesudah mendapat intervensi di RSUD Kota Prabumulih, Sumatra Selatan. Penelitian ini menggunakan desain *quazy experiment* dengan dua tahap. Tahap I pembuatan *snack bar* dengan rancangan acak lengkap non faktorial 4 kombinasi formula, dilakukan uji organoleptik dengan analisis uji Friedman. Tahap II memberikan intervensi pemberian *snack bar* kepada pasien dan mengukur kadar ureum darah dengan analisis data uji *t-dependent.* Sampel penelitian adalah pasien GGK yang dirawat sebanyak 13 orang diambil secara *purposive sampling*. Hasil penelitian didapatkan formula terbaik s*nack bar* beras merah adalah formula 3 dengan kandungan zat gizi persaji : Energi 225 kkal, protein

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3,46 g, lemak 12,68 g, karbohidrat 24,26g, fosfor 38,92 g, dan rasio Fosfor-Protein 11,24 mg/g. Uji statistik menunjukkan perbedaan rerata kadar ureum darah pasien GGK (*p-value*= 0,000). Formula *snack bar* beras merah yang dibuat telah memenuhi standar diet rendah protein dengan rasio fosfor-protein rendah serta dapat menurunkan kadar ureum darah pasien GGK, sehingga ini dapat digunakan dalam makanan diet untuk pasien gagal ginjal kronik.
Kata Kunci: kadar ureum darah; beras merah; Gagal Ginjal Kronik; fosfor; *snack bar*

INTRODUCTION

Chronic Kidney Disease (CKD) is a health problem many people experience, both in developed and developing countries. The number of patients being treated for chronic kidney failure globally is estimated at 3,010,000 in 2012, and in America, in 2012, the number of CKD patients was 114.814 people. Indonesia is a country with a relatively high rate of CKD sufferers (Fresenius Medical Care, 2013). According to the Indonesia Renal Registry (IRR), in 2011, in Indonesia, 15,353 patients had recently undergone hemodialysis (HD) and an increase of 4,268 patients in 2012. Overall, 19.621 patients had recently undergone HD. The prevalence of chronic kidney failure based on doctor's diagnosis in Indonesia is 0.2% (Pusat Data dan Informasi, 2017). There was an increase to 0.38% in 2018. Meanwhile, South Sumatra with a prevalence of 0.27% chronic kidney failure patients, which means close to the national prevalence (Badan Penelitian dan Pengembangan Kesehatan, 2019). In Prabumulih City Hospital, according to medical record data, data on patients with chronic kidney failure in 2020 contained 0.87% of the total patients treated.

One strategy to reduce phosphorus levels in the blood is to limit phosphorus and protein intake. A low protein diet plays a role in helping control phosphorus intake because protein sources tend to contain high phosphorus and reduce glomerular hyperfiltration so that damage to the structure of epithelial cells and proteinuria can be reduced (Helal *et al.*, 2012). The recommended intake of phosphorus and protein for patients with stage 4 CKD is 800-1000 mg/day and 0.6 grams/kg body weight/day, respectively, or around 8% of the daily energy needs of adults (Suharyati, 2020).

The parameter that can help patients choose foods that are low in phosphorus and protein sources is the phosphorus-protein ratio. Low ratios are generally found in protein sources but are also followed by high phosphorus and protein content. Research shows that consuming foods with a high phosphorus content and a phosphorus-protein ratio of more than 16

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mg/gram is associated with an increased risk of death in patients with CKD. Therefore, alternative food ingredients are needed other than sources of protein that are low in ratio and contain low levels of phosphorus and protein, one of which is a source of carbohydrates (Jauhariah and Ayustaningwarno, 2013).

The nutritional composition of brown rice is calculated per 100 g, with 100% Edible Weight, namely energy 149 Cal, protein 2.8 grams, fat 0.4 g, carbohydrates 32.5 g, phosphorus 63 mg, potassium 91.4 mg, fibre 0.3 g. The phosphorus content in brown rice is much lower than if we use the direct ingredients of brown rice, namely phosphorus 257 mg and potassium 202 mg (Badan Penelitian dan Pengembangan Kesehatan, 2019). Consumption of foods with high protein biological value plays a role in increasing nitrogen absorption for protein synthesis, thereby reducing the rest of the protein breakdown products in the body and reducing the workload of the kidneys. The biological value of phosphorus in brown rice is low, so the risk of increased phosphorus levels in the blood is lower than animal sources. Brown rice is also a high source of energy. Fulfilment of sufficient energy, either from a source of carbohydrates and fats, may help prevent catabolism of protein as energy to minimize waste products of protein metabolism and improve the efficiency of the use of protein for the formation and repair of body tissues (Swandyani, Santoso and Kristianto, 2016).

In general, processed rice served to patients is rice and porridge. At stage 4, patients tend to experience decreased appetite and feel bored with less varied food offerings. To overcome the problem, it can be modified to serve rice. Some of the processed rice products currently being marketed in the community are rice cereal, crispy rice, and *brondong* rice. The three products have a compact, crunchy, and attractive form of material to be developed as a snack, one of which is a snack bar. Several kinds of snack bars that have been previously researched are derived from tempe flour and dried jackfruit (Amalia, 2011), pumpkin and red bean flour (Dwijayanti, 2016), high soy protein (Lobato *et al.*, 2012), and black glutinous rice (Fauziyah *et al.*, 2020).

Snack bars are snacks in the form of sticks and are generally consumed as a snack, with a weight ranging from 15-25 grams per stick and a protein recommended for patients with CKD 4-6 grams (Jauhariah and Ayustaningwarno, 2013). A binder in egg whites can be an alternative to sucrose to produce better nutritional content for the

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snack bar. Egg whites are generally recommended as a good alternative source of protein for CKD patients. Egg whites have a low phosphorus-to-protein ratio (1.4 mg/gram) and high biological protein value. Although the biological value of phosphorus in egg whites is high, it is also balanced by its low phosphorus content. The risk of increasing levels of phosphorus in the blood is lower than other animal sources. In 100 grams of egg white contains 52 kcal of energy, 10.9 grams of protein, 0.17 grams of fat, 0.7 grams of carbohydrates, 15 mg of phosphorus, 7 mg of calcium, 166 mg of sodium, and 163 mg of potassium/100 grams (Kalantar-Zadeh and Fouque, 2017).

The production of snack bars as a snack for people with chronic diseases is currently being developed by researchers. It can be influenced by the ease of processing and modifying the raw materials used for making snack bars. Interludes are generally in small portions with nutrient content ranging from 10%-15% of daily energy needs. However, the production of snack bars for CKD patients in Indonesia is still rare, so the development of the formulation is still needed. Based on this background, a study was conducted to analyze the nutritional content, phosphorus-protein ratio, and the level of preference for snack bars with processed brown rice products. The purpose of this study was to determine the nutritional content, phosphorus-protein ratio, the level of preference for the brown rice snack bar, and the average blood urea level in CKD patients before and after receiving intervention at the Prabumulih City Hospital.

METHOD

The research has two stages, the first stage of making snack bars is a quasi-experimental study with a non-factorial, Completely Randomized Design with four formula combinations. After that, an organoleptic test was carried out. It was found that the formula that the panelists most favoured was then analyzed for its nutritional content using the Proximate Test. Statistical analysis was carried out on the results of organoleptic tests to determine the panellists' response to the level of preference for snack bars, through a non-parametric approach through the Friedman test, to the level of preference for taste, texture, aroma and color.

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Table 1. Combination Treatment of Snack Bar Making Materials

Ingredients	Formula			
	F1	F2	F3	F4
Brown rice (g)	18	15	12	9
Egg White (g)	9	11	13	14
Corn Oil (g)	5	5	5	5
Carrot (g)	10	10	10	10
Sugar (g)	10	10	10	10

Phase II Giving snack bars to patients with kidney failure, using a quasi-experimental study with a pretest-posttest design. This design also does not have a comparison group (control). Still, at least the first observation (pretest) has been carried out which allows testing the changes after the experiment/treatment.

The population of this study were patients with kidney failure who were treated at the Prabumulih City Hospital. The sample in this study is part of the population selected based on the inclusion criteria set as follows: Ureum level > 50 mg/dl, conscious, willing to be a respondent and consume red rice snack bar, aged over 18 years. According to Lemeshow, the sample size used a sample calculation, and the calculation obtained the number of samples as many as 13 people. The sample is taken by purposive sampling, a technique used in determining the sample with special considerations so that it is feasible to be used as a sample following the number that has been previously determined and meets the inclusion criteria. Blood urea levels obtained from the results of blood examinations and recorded in the patient's medical record were then analyzed to see the difference in the average urea level between the first observations (before giving snack bar processed brown rice) and the second observation (after administration) using a statistically dependent t-test. The research ethics approved by the Health Research Ethics Committee of Health Polytechnic Ministry of Health Palembang number 733KEPK/Adm2/III/2021 date Feb 26th 2021.

RESULTS AND DISCUSSION

The formula percentage for one serving is calculated based on the RDA of 2000 Kcal for snacks 10-15% of the total energy requirement/day. Calorie calculation using the Nutri Survey Application. In one serving, the snack bar consists of 2 sticks of Red Rice Snack Bar with a weight

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ranging from 20-25 grams/stick, along with the composition of food ingredients with a percentage ratio.

Table 2. Composition of Food Ingredients in 4 Formulas

Ingredients	Percentage (%) Presentation Formula			
	F1	**F2**	**F3**	**F4**
Brown rice	34.6	29.3	24	19
Egg White	17	21.5	26	29
Corn Oil	10	10	10	10
Carrot	19.2	19.6	20	21
Sugar	19.2	19.6	20	21

Table 3 below presents the composition of nutrients in each formula. Based on the calculation of calories using the Nutri Survey, it is known that the highest calorie is found in formula 1 (306.4 kcal), and the lowest is formula 4 (242.2 kcal). The protein content in Formula 1, 2, 3 is the same and Formula 4 is lower at 4.4 grams/portion. The same thing is also found in fat content. Meanwhile, the highest carbohydrate content was found in Formula 1 (48.2 g), and the lowest was found in Formula 4 (34.8 g).

Table 3. Composition of Nutrients in 4 Serving Formulas

Formula	**F1**	**F2**	**F3**	**F4**
Calories (Kcal)	306.4	288.2	268.6	248.2
Protein(g)	4.8	4.8	4.8	4.4
Fat (g)	10.8	10.6	10.6	10.4
Carbohydrates (g)	48.2	43.8	39.2	34.8
Phosphorus (mg)	98.2	84	69.8	55.4
F-P Ratio (mg/g)	20.45	17.5	14.6	12.6

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The highest phosphorus content and phosphorus-protein ratio are found in Formula 1 (98.2 mg), and the ratio is 20.45 mg/g. The lowest Phosphorus content and Phosphor-Protein ratio were in Formula 4 (55.8 mg), and the ratio was 12.6 mg/g.

Table 4. Organoleptic Test Results

Organoleptic Test	**F1**	**F2**	**F3**	**F4**
Color	38	50	54	52
Scent	46	50	44	45
Texture	43	39	36	27
Flavor	44	41	52	52
Total	171	180	186	176

The results of the organoleptic test in table 4 show that the highest value is found in Formula 3, namely with a total value of 186. The formula was selected for the proximate test and given to the respondents. The organoleptic test was held on Feb 19th, 2021, at the Nutrition Department of Poltekkes Palembang with 20 panelists of Diploma IV Students from the Department of Nutrition. The results of the analysis through the Friedman test, in table 4 below, it was found that there were differences in the level of panelists' preference for taste (p-value 0.003), aroma (p-value 0.000), color (p-value 0.000), and texture (p-value 0.012), where p-value <0.05.

Table 5. Organoleptic Test Analysis

Formula	**N**	**Flavor**		**Scent**		**Color**		**Texture**	
		Mean±SD	**Description**	***Mean±SD***	**Description**	**Mean±SD**	**Description**	**Mean±SD**	**Description**
F1	20	2.2±0.410	Nice	2.2±0.410	delicious	1.9±0.552	Interesting	2.15±0.745	Crispy
F2	20	2.05±0.604	Nice	2.05±0.604	delicious	2.5±0.512	Very interesting	1.95±0.686	Crispy
F3	20	2.6±0.502	Very Delicious	2.6±0.502	Very delicious	2.7±0.470	Very interesting	1.8±0.767	Crispy
F4	20	2.6±0.502	Very Delicious	2.6±0.502	Very Delicious	2.6±0.502	Very interesting	1.35±0.670	Not crunchy
p		0.003		0.003		0.000		0.012	

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The selected formula 3, with the composition of 12 grams of brown rice, 13 grams of egg white, 5 grams of corn oil, 10 grams of carrots and 10 grams of sugar, then analyzed the nutritional content through the Proximate Test. Table 5 presents the nutritional content per 100 grams of formula and serving. The standard energy content for one serving of snacks for CKD patients is 200-300 kcal. The results showed that the energy content in one serving of the snack bar is 225 kcal/50 grams, which means that it is following these standards. This study is in line with the research results conducted by Jauhariah and Ayustaningwarno (2013) in the manufacture of snack bars for CKD patients, namely 193.20-202.66 kcal/45 grams.

Table 6. Results of the Proximate Test of Brown Rice Snack Bar

Analysis Type	**Per 100 gram**	**Portion**
Water content	18.72	9.36
Ash Level	0.48	0.24
Protein Content (g)	450	225
Kadar Protein (g)	6.92	3.46
Fat Content (g)	25.36	12.68
Carbohydrate Content (g)	48.52	24.26
Phosphorus Levels (mg)	77.83	38.92
Phosphorus-Protein Ratio (mg/g)	11.24	11.24

The standard protein content for one serving of snacks for CKD patients with hyperphosphatemia is recommended to be a maximum of 4-6 grams so that a snack bar serving size is 50 grams/portion. The weight of one snack bar ranges from 20-25 grams so that in one serving, two snack bars can be consumed. Based on the Proximate analysis results, the content of the Red Rice Snack Bar already meets the protein content standard, which is 3.46 grams. Egg white is a high biological value protein source because it contains a fairly complete amino acid content. Consumption of foods with high biological protein value plays a role in increasing the efficiency of nitrogen absorption for protein synthesis, thereby reducing the rest of the protein breakdown products in the body and reducing the workload of the

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kidneys. The standard fat content for one serving of snacks for CKD patients is 6.3-9.8 grams. Based on the study results, the fat content in one serving of a snack bar is 12.68 grams, which means more than the standard. After going through processing (the brown rice is fried before making a snack bar), there is an increase in the fat content, but most of the fat comes from corn oil, which is good for people with CKD.

The standard carbohydrate content for one serving of snacks for CKD patients is 16.1-24.15 grams. Based on the study results, the carbohydrate content in one serving of the snack bar is 24.26 grams, which means it is appropriate as recommended. Carbohydrates play a role in determining the characteristics of foods such as sucrose which causes a sweet taste, and non-enzymatic browning reactions between reducing sugars and amino acids that produce a brown color and caramel aroma in the product (Muchtadi Tien R, 2010).

The standard phosphorus content for one serving of snacks for CKD patients is recommended to be a maximum of 80 mg (Syauqy, Susetyowati and Suhardi, 2012). Based on the study results, the phosphorus content in one serving is 38.92 mg/50 grams, which meets these standards. In the CKD diet with hyperphosphatemia, the phosphorus-protein ratio serves as a parameter that helps patients choose low in phosphorus and protein foods. One study showed CKD patients who consumed a low-ratio diet (≤16 mg/gram) had a lower risk of death than those with a higher-ratio diet (Noori *et al.*, 2010); Kalantar-Zadeh and Fouque, 2017). The highest phosphorus-protein ratio was found in Formula 1 (20.45 mg/gram), and the lowest of 12.6 mg/gram was found in Formula 4. The results showed that the phosphorus-protein ratio of the selected snack bar was 11.24 mg/gram, which means it is following the standard to reduce the risk of increased levels of phosphorus in the blood. Jauhariah and Ayustaningwarno (2013) research in the manufacture of snack bars for CKD resulted in a higher phosphorus-protein ratio of 23.74-27.27 mg/g. Although the ratio of the snack bar is higher, it is also offset by low levels of phosphorus (<80 mg).

Respondents in this study were patients with Chronic Kidney Failure based on the doctor's diagnosis who had increased blood urea levels and were treated at the Prabumulih City Hospital. The general description of the frequency distribution of respondents can be seen in the following table:

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Table 7. Frequency Distribution of Respondents Characteristics

Characteristics	Respondent	
	n	%
Gender		
Male	6	46.2
Female	7	53.8
Age (Year)		
18-29	1	7.7
30-49	4	30.8
50-64	5	38.5
65-80	3	23.1
Education		
Primary School	8	61.5
Junior High School	2	15.4
Senior High School	2	15.4
College	1	7.7
Nutritional status		
Underweight	5	38.5
Normal	7	53.8
Overweight	1	7.7

Table 7 shows that more than half of the respondents are female (53.8%), then the majority of respondents are in the age group of 50-64 years (38.5%). For education status, it is known that most of the respondents have an elementary school education, as many as 61.5% (8 people). The average respondent has a normal nutritional status, which is 53.8% (7 respondents).

Table 8. Frequency Distribution of Nutrient Intake

Macro Nutrient Intake	Category	n	%
Energy	Not enough	5	38.5
	Well	8	61.5
Protein	Not good	3	23.1
	Well	10	76.9
Fat	Not enough	1	7.7
	Well	12	92.3
Carbohydrate	Not enough	5	38.5
	Well	8	61.5
Phosphorus	In accordance	8	61.5
	It is not in accordance with	5	38.5

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Table 8 presents the intake of macronutrients (energy, fat, and carbohydrates) consisting of two categories, namely good (>80 RDA) and less (<80% RDA) based on the Nutritional Needs for a Low Protein Diet (Suharyati, 2020). While protein consists of two categories, namely not good (>0.8 g/kg BW) and good (≤0.8 g/kg BW), and Phosphorus intake of respondents consists of two categories, namely appropriate (≤17 mg/kg BW) and inappropriate (>17 mg/kg BW).

Table 9. Average Nutrient Intake

Intake of Nutrient Substance		n	Mean	Difference	Min	Max
Energy	(kcal)	13	1583.77	498	1315	1813
Protein	(g)	13	37.23	18	30	48
Fat	(g)	13	54.12	12	47	59
Carbohydrate	(g)	13	138.15	21	128	149
Phosphor	(mg)	13	708	436	479	915
Phosphorus-Protein Ratio	(mg/g)	13	18.93	10	15	25

Table 9 presents the average results of recall of food consumption during the seven days of the intervention. The recall of food consumption was carried out to see the respondent's food intake in addition to being given a red rice snack bar as a morning and afternoon snack. Energy requirements in CKD patients are calculated by 35 kcal/kg BW for those aged <60 years and 30 kcal/kg for those aged 60 years and over. Table 8 shows that 61.5% (8 respondents) had a good energy intake (≥80% of needs). During the seven days of intervention, the average energy intake was 1583.77 kcal, and as much as 450 kcal (28.4%) was obtained from snack bars as a snack given two times a day.

Protein needs for patients with CKD are calculated based on protein requirements of 0.6-0.8 g/kg BW, which is based on a Low Protein Diet divided into RP30/Rp35/RP40 (Suharyati, 2020). Table 8 shows that the protein intake of the respondents as much as 76.9% (10 respondents) is included in the good category. This is because the patient is under treatment and received a low protein diet during the intervention. The average protein intake during the seven

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intervention days was 37.23 grams, and 6.92 grams (18.58%) was obtained from consuming snack bars as a snack gave two times a day. Poor protein intake (>0.8 g/kg BW) impacts high blood urea levels. Amino acid catabolism involves releasing amine groups that will produce urea which is the end product of nitrogen metabolism (Rahmawati, 2017; Swandyani, Santoso and Kristianto, 2016). A low protein diet improves the symptoms of uremia because it reduces levels of uremic toxins, which are mostly produced from protein metabolism (Eknoyan *et al.*, 2013).

Fat needs for patients with CKD are given 25-30% of the total energy of about 63 grams. Table 8 shows that the fat intake of the respondents as much as 92.3% (12 respondents) is included in the good category. The average fat intake during the seven days of the intervention was 54.12 grams, and as much as 25.36 grams (46.85%) was obtained from consuming snack bars as a snack gave two times a day. The good fat content of the brown rice snack bar formula helps maintain fat intake because it is sourced from corn oil which contains 59% polyunsaturated fatty acids (PUFA), 24% monounsaturated fatty acids and 13% saturated fatty acids (SFA) (Astuti, 2016).

Carbohydrate needs for patients with CKD are given enough. The rest of the calculation of protein and fat is around 161 grams. Table 8 shows that the carbohydrate intake of the respondents as much as 61.5% (8 respondents) is included in the good category. The average carbohydrate intake during the seven days of intervention was 138.15 grams, and as much as 48.52 grams (35.12%) was obtained from consuming snack bars as a snack gave two times a day. Based on a study, if patients with chronic kidney failure who consume carbohydrates below the normal value will not be able to maintain a neutral nitrogen balance (Kusumastuti, 2015). Phosphorus intake in patients with CKD is limited to <17 mg/kg body weight a day. Table 8 shows that the phosphorus intake of 61.5% of respondents (8 respondents) is included in the appropriate category. The average phosphorus intake during the seven days of intervention was 708 mg (Table 9), and as much as 77.83 mg (10.99%) was obtained from consuming snack bars as a snack gave two times a day. Phosphorus is a mineral that the body needs for bones (Isakova *et al.*, 2017). Suppose the excess phosphorus in the body can not be removed if the kidneys are not functioning properly. Calcium levels in the bones can decrease due to high phosphorus, which is

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eventually released into the blood so that calcium levels are high. It causes brittle bones, itching, bone pain and red eyes (Kowalak and P, 2020). The phosphorus-protein ratio was obtained based on the respondent's protein intake by calculating the ratio of the phosphorus content to the protein consumed by the research subjects. From Table 9, it can be seen that the average intake of phosphorus divided by the average daily protein intake obtained a ratio of 18,93 mg/g included in the high category, namely >16 mg /g/day. A low phosphorus-protein ratio in food can improve nutritional status and reduce the risk of malnutrition in chronic renal failure patients (Noori *et al.*, 2010).

Table 10. Frequency Distribution of Ureum Levels before and After Treatment

Ureum Level	n	Lowest Ureum	Highest Ureum	Mean±SD	SE	Mean Difference	p-value
Before	13	70	198	129±42.837	11.881	29.23	0.000
After	13	52	140	99.77±30.441	8.435		

Table 10 presents that respondents' urea levels were measured before treatment and repeated on the 8th day after the intervention. Based on the table above, there was a decrease in blood urea levels by 29.23 mg/dl. The results of statistical tests (t-dependent test) obtained p-value <0.05 (0.000) that there was a difference in blood urea levels before and after the intervention. Increased intake of protein or amino acids has been shown to affect renal hemodynamics and contribute to kidney function and tissue damage. Low protein diet therapy in patients with CKD has been introduced for a long time. It provides benefits for reducing the accumulation of waste materials that the kidneys cannot excrete. Low protein diet therapy can reduce the symptoms of uremia, decrease proteinemia and slow the initiation of dialysis (Jain *et al.*, 2012). Uremic syndrome is due to progressive reduction in renal function, leading to impairment of several biochemical and physiological functions. Impaired kidney function reduces the excretion of many compounds that accumulate in extra and intracellular compartments, which contribute to the development of the uremic syndrome. It is noteworthy that urea (as a marker of uremic toxins) reduction is not the only aim of the low protein diet. Italian nephrologists have a longstanding tradition in implementing low protein diets in the

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treatment of CKD patients, with the principal objective of alleviating uremic symptoms, improving nutritional status, and possibly slowing down the progression of CKD or delaying the start of dialysis. A renewed interest in this field is based on the aim of implementing a wider nutritional therapy other than only reducing the protein intake, paying careful attention to factors such as energy intake, the quality of proteins and phosphate and sodium intakes, making today's low-protein diet program much more ambitious than previous (Bellizzi *et al.*, 2016). Research by Di Micco *et al.* (2019) states that a low protein diet can reduce edema, diuretics, and blood pressure with a low sodium diet, reduce the dose of phosphate levels and phosphate binders and slow down the damage of CKD.

CONCLUSION

Red rice snack bar formula has met the standards of a low protein diet with a low phosphorus-protein ratio. There was a significant difference in the panelists' preference for taste, aroma, color and texture. The most preferred formula was Formula 3, with the composition of 12 grams of brown rice, 13 grams of egg white, 5 grams of corn oil, 10 grams of carrots and 10 grams of sugar. There was a significant difference in respondents' blood urea levels before and after the intervention, and blood urea levels decreased after treatment. So this snack bar can be used in dietary food for CKD patients to prevent chronic kidney failure. The reported experiences demonstrate the different dietary approaches in the various centres resulting from research before, as innovativeness using low-protein diets.

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