

Dietary Behavior Modification by Lifestyle Medicine to Improve Kidney Function in CKD Patients

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Abstract

This quasi-experimental research aimed to develop the capacity of health personnel to carry out dietary behavior modification according to nutritional therapy principles (NTP) and to organize a project for patients with chronic kidney disease (CKD) to modify their dietary behavior following NTP to restore kidney function. The project was assisted by health personnel according to lifestyle medicine practices. The research method was adapted from the study of the main author who conducted a quasi-experimental study in patients with CKD which resulted in kidney function improvement over a period of four weeks in the year 2019. The present study was conducted in two phases between February 2024 and May 2024. The first phase involved two training sessions to develop the capacity of health personnel according to lifestyle medicine guidelines, including thirteen volunteers, nursing staff and nutritionists. In the second phase, the trained health personnel implemented dietary behavior modification in accordance with lifestyle medicine guidelines for volunteer groups of CKD patients. A total of fifty-one participants attended 4 visits. The results of Phase 1 among personnel showed that the overall knowledge score improved significantly (25.69 ± 2.18 vs 27.08 ± 2.10 , $p < 0.05$). Additionally, the knowledge score of CKD increased (12.08 ± 0.86 vs 12.62 ± 0.87 , $p < 0.05$), and the NTP for CKD knowledge score also showed significant improvement (11.15 ± 1.14 vs 12.39 ± 1.33 , $p < 0.05$), and all personnel gained the capability to do motivational interviewing skills. The results of Phase 2 showed that dietary behavior of the CKD patients significantly improved (71.58 ± 10.17 vs 74.28 ± 9.93 , $p < 0.05$). Improved kidney function was observed in 49.02% of patients at the second visit, 41.18% at the third visit, and 41.18% at the fourth visit included serum creatinine levels decreased. Noticeably, fasting blood glucose levels were controlled in every visit.

Keywords: dietary behavior; lifestyle medicine; chronic kidney disease; nutritional therapy principles

Introduction

In 2018, more than 10% or 850 million people worldwide suffered from chronic kidney disease (CKD).⁽¹⁾ In Thailand, in 2021, 17.6% of the population, or 8 million people suffered from CKD⁽²⁾, and 170,000 were in end-stage renal disease (ESRD). There were annually new reported 19,000–22,000 CKD cases. Recent health measures could help slow the progression of the disease, which eventually turned into ESRD.⁽³⁾

The quasi-experimental study of Chaipanont S, et al.⁽⁴⁾, conducted among 92 CKD cases at Bang-Gruay district hospital, showed kidney function improvement within a period of 4 weeks. Therefore, the present study utilized the previous research to help the CKD patients by having health personnel coach them to change their dietary lifestyle. According to lifestyle medicine (LM)⁽⁵⁾, it is recommended to help the patient by individually coaching, empowering, building motivation, and encouraging confidence and engagement. The key successful factors depend on the patients' self-awareness and insights. Health personnel can help the patients find their own answers or how to manage their own self-care plan and goals. The collaboration of the patient is an initial requirement.

Therefore, the program of this research was designed to build the lifestyle coaching capacity of health personnel to help CKD patients change their dietary behavior. Lifestyle dietary coaching has focused on dietary behavior change according to the Nutritional Therapy Principle for CKD (NTP),⁽⁶⁾ Motivation Interviewing (MI),⁽⁷⁾ encouraging the patients to set and follow their own self-care plan, including the goal of improving kidney function, and raising awareness

of the mono-sodium glutamate (MSG) negative effects on the kidney.⁽⁸⁾ Under the coaching of skilled personnel, it could empower the patients to change their dietary behavior, eventually prevent disease progression to the end stage.

The purposes of this quasi-experimental study were to build capacity of health personnel on CKD knowledge and lifestyle coaching skill, and to modifying dietary behavior of CKD patients for kidney function improvement by the trained personnel.

Material and Methods

This study was a quasi-experimental research. The samples were:

Health personnel group; Sample size was purposively selected from primary health center (PHC) where the chief officers permitted the study to be performed in their sites. The inclusion criteria were: (1) health personnel who were working at the study site, such as physician, nursing practitioner, nutritionist, and public health officer, and (2) health personnel who were interested in the research. Thus, a total of 13 participants were voluntarily recruited for the study.

CKD patient group: Sample size was calculated from G*Power 3.1.9.7 software. The authors determined: (1) effect size = 0.2 (medium effect), (2) α err probability = 0.05, (3) Power (1- β err probability) = 0.90, Number of groups = 1, Number of measurements = 4; Total sample size = 46; then plus 10% loss, $N = 51(46 + 10\% \times 46)$

The inclusion criteria were: (1) CKD patients with proficiency in the Thai language who attended the NCD clinic at one of the three study sites between February and May 2024; and (2) Subjects whose

underlying non-communicable diseases such as diabetes, hypertension, dyslipidemia; and (3) Participants voluntarily completed the study. Those unwilling to participate were excluded.

Fifty-one subjects voluntarily participated in the study from three Health promotion hospitals (HPH): (1) 8 CKD subjects attended Bangkok metropolitan health promotion center (BMHPC), (2) 21 subjects attended Bang-Rak Noi Moo 3 sub-district HPH, and (3) 22 subjects attended Nonthaburi municipal elderly hospital (NMEH).

The study was conducted in two phases during February–May 2024 as follows:

Phase 1: The health personnel group underwent training for two sessions, providing knowledge on: (1) CKD, (2) NTP and MSG effect on kidney, and (3) Motivational interviewing (MI).

Phase 2: The CKD subject group was intervened for four visits, each consisting of a 3-hour course to: (1) provide training on CKD knowledge, NTP and create awareness of the MSG effect on kidney, and (2) carry out MI to encourage dietary behavior modification in CKD subjects.

The data collecting methods:

Phase 1:

1) Test of Knowledge on CKD and NTP for CKD, developed by expert, consisting of 35 items. The test had an Item Objective Congruence (IOC) Index of 0.878.

2) Questionnaires for MI by Dejkhong T⁽⁹⁾, who was an MI trainer in Phase 1.

Phase 2:

1) The questionnaires from a previous study by the main author for assessing CKD subject's dietary behaviors. Cronbach's alpha coefficient of the

questionnaires was 0.797.

2) Blood samples were collected from the patients during every visit, for analysis of blood urea nitrogen (BUN), serum creatinine, estimated glomerular function (eGFR), and fasting blood sugar (FBS).

The tool:

The recipes for CKD handbook from previous study of the main author were provided to all CKD subjects. The handbook consisted of NTP and eighteen menus regarding NTP.

Statistics

Stata (14.1, Stata Corp LLC, College Station, TX) was used to analyze the data using the following: descriptive, analytic, paired t-test, and linear mixed model.

Ethical review

The approval code for the research ethical committee of the Department of Health was 718/January 2567.

Results

Phase 1: Training health care personnel; 13 participants including 1 physician, 6 practical nurses, 3 nutritionists, 2 public health officers, 1 social worker; with an average age of 38.2 ± 10.7 years; 84.6% had no previous CKD consultation experience.

The health personnel showed a significant improvement (pre-post) in whole knowledge scores (25.69 ± 2.18 vs 27.08 ± 2.10 , $p=0.002$), knowledge on CKD as (12.08 ± 0.86 vs 12.62 ± 0.87 , $p=0.028$), knowledge on NTP for CKD as (11.15 ± 1.14 vs 12.39 ± 1.33 , $p < 0.001$). All of them can do MI as shown in Table 1.

Phase 2: Dietary behavior modification of CKD subjects; there were 51 CKD subjects with an average

of 66.6±8.5 years old, comprising 19 (37.25%) men and 32 (62.75%) women. 21 (41.18%) subjects were retired with no occupation, residing in Bangkok metropolitan and Nonthaburi province. CKD status was at stage 1: 7.84%, stage 2: 39.22%, stage 3: 52.94%, and no subjects were found to be at stage 4.

The CKD subjects showed a significant improvement in their dietary behavior scores (71.58±10.17 vs 74.28±9.93, p=0.021), and a significant decrease in low dietary behavior scores (40% vs 20%, p<0.001) as shown in Table 1.

Blood chemistry results of CKD subjects found that the whole group significantly controlled fasting blood sugar (FBS) at the 3rd visit (128.61±35.42 vs 125.18±32.42, p=0.038), and the 4th visit (128.61±35.42 vs 120.31±29.40, p <0.001). On the contrary, the whole group significantly declined

eGFR at the 3rd visit (60.89±18.03 vs 57.93±17.87, p=0.003); significantly uncontrolled creatinine (1.13±0.28 vs 1.19±0.33, p=0.001) at the 3rd visit, and (1.13±0.28 vs 1.17±0.33, p=0.029) at the 4th visit as shown in Table 2.

After analysis of the whole results, the study showed a tendency of improvement in eGFR and serum creatinine at the 4th visit, and in FBS at all visits, as shown in Figure 1.

The whole group of CKD subjects found several subjects whose eGFR improvement was 25 (49.02%) at the 2nd visit, 21 (41.18%) at the 3rd visit, and 21(41.18%) at the 4th visit. Noticeably, a number of subjects showed 100% eGFR improvement at BMH-PC during the 2nd visit, and a relatively high in number of eGFR improvement than other study sites, as shown in Table 3.

Table 1 Results of capacity building in comparison between pre and post program of the health care personnel group (N=13) and the CKD subject group (N=51).

Capacity results	Mean±SD		p-value
	Pre-test	Post-test	
Group 1: Health care personnel (N=13)			
1. Knowledge (35 items)	25.69±2.18	27.08±2.10	0.002a*
- Chronic kidney disease (15 items)	12.08±0.86	12.62±0.87	0.028a*
- Nutrition principle of CKD (17 items)	11.15±1.14	12.39±1.33	<0.001a*
- Kidney effect of MSG (3 items)	2.46±0.88	2.07±0.64	0.209 a*
2. Motivation interviewing skill	N/A	All capable	
Group 2: CKD subjects (N=51)			
1. Dietary habits (25 items)			
- Whole Group score	71.58±10.17	74.28±9.93	0.021a*
- Level of dietary behavior score:			
low (score 25 - 69)	20 (40%)	40 (26%)	< 0.001b*
moderate (score 70 - 84)	26 (52%)	32 (64%)	
high (score 85 - 100)	4 (8%)	5 (10%)	

a Paired t test, b Fisher's exact test

Table 2 Blood chemistry results of the CKD subjects (N = 51)

Variable	Baseline	The 2nd Visit		The 3rd Visit		The 4th Visit	
	Mean±SD	Mean±SD	p-value€ Mean change (from baseline)μ	Mean±SD	p-value€ Mean change (from baseline)μ	Mean±SD	p-value€ Mean change (from baseline)μ
eGFR	60.89±18.03	59.87±19.28	0.311 -1.00	57.93±17.87	0.003* -2.93	59.26±19.08	0.103 -1.61
95%CI			-2.95, 0.94		-4.87, -0.99		-3.55, 0.33
Creatinine	1.13±0.28	1.16±0.31	0.117 0.03	1.19±0.33	0.001* 0.07	1.17±0.33	0.029* 0.05
95%CI			-0.01, 0.07		-0.03, -0.11		-0.01, 0.09
FBS	128.61±35.42	125.96±32.85	0.109 -2.65	125.18±32.42	0.038* -3.43	120.31±29.40	<0.001* -8.29
95%CI			-5.89, 0.59		-6.67, -0.19		-11.53, -5.06

€ p-value from linear mixed model (fixed effect + random intercept model);

μ Mean change from coefficient in linear mixed model

Figure 1 The changes of eGFR, Creatinine and FBS during the 1st, 2nd, 3rd and 4th visits

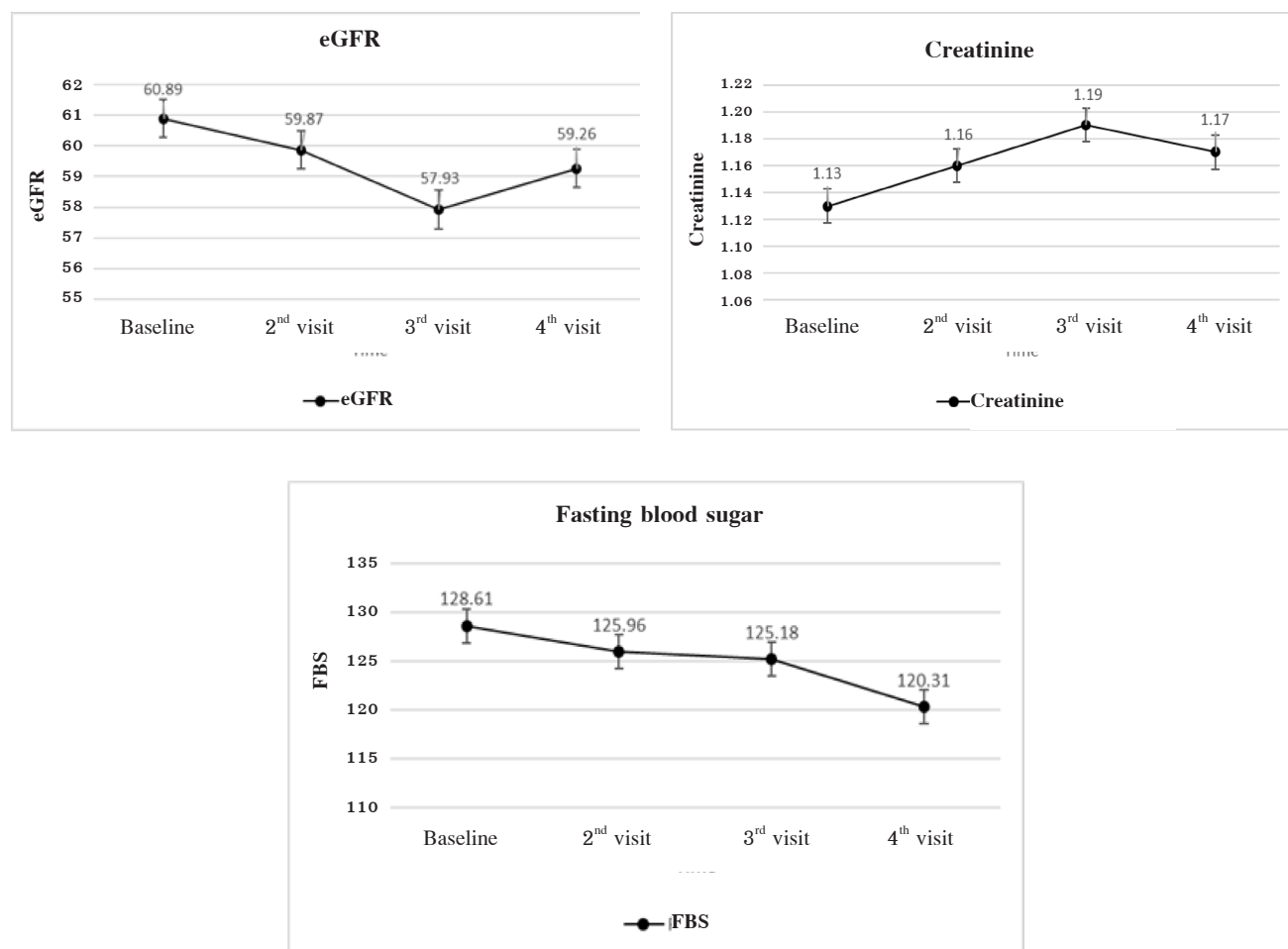


Table 3 Blood chemistry improvement results analyzed based on three study sites.

Variables	The 2 nd visit	The 3 rd visit	The 4 th visit
The whole CKD group (n=51)			
eGFR	25 (49.02%)	21 (41.18%)	21 (41.18%)
Creatinine	30 (58.82%)	24 (47.06%)	25 (49.02%)
FBS	41 (80.39%)	43 (84.31%)	42 (82.35%)
Site 1: Bangrak–Noi Moo 3 HPH (n=21)			
eGFR	12 (57.14%)	8 (38.10%)	12 (57.14%)
Creatinine	17 (80.95%)	11 (52.38%)	16 (76.19%)
FBS	15 (71.43%)	16 (76.19%)	15 (71.43%)
Site 2: NMEH (n=22)			
eGFR	5 (22.73%)	7 (31.82%)	3 (13.64%)
Creatinine	5 (22.73%)	7 (31.82%)	4 (18.18%)
FBS	20 (90.91%)	20 (90.91%)	20 (90.91%)
Site 3: BMHPC (n=8)			
eGFR	8 (100%)	5 (62.50%)	6 (75.00%)
Creatinine	8 (100%)	6 (75.00%)	5 (62.50%)
FBS	6 (75.00%)	7 (87.50%)	7 (87.50%)

Summative information from motivation interviewing of CKD subjects.

According to the 2nd, the 3rd, and the 4th visits, the authors and trained health personnel conducted MI to assess the kidney function status in accordance with the subjects' dietary behaviors, such as:

1) Having home or self-cooked meals following NTP or CKD recipes.

2) Avoiding any diets containing MSG as condiment, for example, noodle cuisine with its soup.

The results of the study at the 2nd, 3rd, and 4th visits, showed that there were two groups: the improver group, whose kidney function showed improvement, and the non-improver group, whose kidney function did not improve. In all visits, the improver group reflected adherence to home or self-cooked

meals following NTP and CKD recipes from the author's previous study, including avoidance of any cuisine that containing MSG. Some cases who relapsed from the improver to the non-improver reflected that their dietary behaviors, according to NTP, reverted to previous dietary behaviors not in accordance with NTP, or they consumed meals containing MSG as food condiments, such as noodle cuisine.

Discussion

The study of dietary behavior change regarding the NTP of CKD patients was conducted via LM practice, as mentioned by Frates B.⁽⁵⁾ The study started with motivation interviewing to help the patient determine goals, set the plans, and modify dietary behavior into their real-life actions under the coaching of trained

health personnel. Nutrition played a significant role in 7 of 10 the top causes of death.⁽¹⁰⁾ It has been reported that NCD accounted for 74% causes of deaths, globally in 2023.⁽¹¹⁾ This study focused on nutrition as main issue for CKD patients to have their meals according to NTP. It advocated for CKD subjects with eGFR improvement results of dietary change from a previous study.⁽⁴⁾ According to LM practice⁽⁵⁾, MI was conducted at every visit to help patients change their eating behaviors regarding NTP and MSG avoidance. Inclusively, setting the SMART goals as: (1) S=Specific, meaning main diet regarding NTP and MSG avoidance by self- or home-cooked cuisine for those working outside their home; (2) M=Measurable, meaning number of meals following NTP diets and MSG avoidance; (3) A=Achievable, meaning having their meals follow NTP and resulting in eGFR improvement; (4) R=Realistic, meaning NTP diets which CKD patients had under self- or home-cooked in some cases but found difficulty with those working outside their home; (5) T=Timely, indicating a 2-week period, when CKD subjects achieved early eGFR improvement as shown in previous study. Basile DP, et al.⁽¹²⁾ showed the evidence of acute renal failure found kidney function restoration after halting the causes for 14 days. Lally P, et al.⁽¹³⁾ found that eating habits could begin changing within 18–254 days of health intervention. The author's previous study also showed early improvement results.⁽⁴⁾

In the present era of digital technology, accessibility is high, and some patients had set up Line application group as social network to support health benefits. The authors motivated CKD patients at every visit by utilizing those with eGFR improvement as intrinsic motivation and others as extrinsic motivation

or their own challenge. According to Dejkhong T, NCD patients achieved health benefits after the fourth session of MI.⁽⁹⁾ Similarly, the study showed a tendency of improvement in eGFR and serum creatinine at the 4th visit, and in FBS at all visits. The study found that some improvers rebounded to be non-improvers at the 2nd or 3rd visit, indicating a return to previous unhealthy dietary behavior, or fewer self-cooked meals. Noticeably, peer group and family-based support was found to be beneficial in some improvers.

Weis L, et al., in their 2 years study, found that 62 patients (15.3%) out of a total of 406 CKD patients achieved eGFR improvement at any stage, with decreased metabolic complications.⁽¹⁴⁾ While this study found CKD subjects with eGFR improvement: 25 out of 51 (49.02%) at the 2nd visit, 21 out of 51 (41.18%) at the 3rd visit, and 21 out of 51 (41.18%) at the 4th visit.

Recommendations

The capacity of health personnel had been built up so that they could help improve kidney function of CKD patients whose dietary behavior had been changed under lifestyle coaching by trained personnel. The study showed that dietary behavior modification had caused fluctuating results after early achieved improvement, especially number of 100% improver at the second visit was found in subgroup of Bangkok Metropolitan HPC. The challenging issue was the maintenance of dietary behavior that had been changed for at least six months to sustain the eGFR improvement result so that the patient must not turn into the previous inappropriate dietary behavior.⁽⁵⁾ LM and trans-theoretical theory of change recommended that sustaining coaching process should be done for a

period of at least one year to stabilize the changed behaviors. Ultimately, the termination stage is the goal for all changes when the patients have not any temptation to return to previous unhealthy behavior.^(5,15) Furthermore, there might be some more related behaviors such as physical activity, stress, sleep, relationships, and substances to be modified later. While this study had just done on modifying dietary behavior.

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บทคัดย่อ: การวิจัยกึ่งทดลองครั้งนี้มีวัตถุประสงค์เพื่อพัฒนาศักยภาพให้บุคลากรสุขภาพมีศักยภาพดำเนินการปรับเปลี่ยนพฤติกรรมบริโภคอาหารตามหลักโภชนาบำบัด และจัดโครงการให้ผู้ป่วยโรคไตเรื้อรังทำการปรับเปลี่ยนพฤติกรรมบริโภคอาหารตามหลักโภชนาบำบัดเพื่อฟื้นฟูการทำงานของไตให้ดีขึ้น ภายใต้การดูแลของบุคลากรสุขภาพที่ให้ความช่วยเหลือตามหลักเวชศาสตร์วิถีชีวิต ทั้งนี้วัตถุประสงค์การวิจัยนี้ได้ปรับมาจากแนวทางการวิจัยเมื่อปี พ.ศ. 2562 ของผู้วิจัยที่ได้ทำการศึกษาทดลองในผู้ป่วยโรคไตเรื้อรัง โดยพบว่ามีผลลัพธ์ช่วยให้การทำงานของไตดีขึ้นในระยะเวลา 4 สัปดาห์ การศึกษาครั้งนี้ได้จัดดำเนินการเป็น 2 ระยะ ระหว่างเดือนกุมภาพันธ์ พ.ศ. 2567 ถึงพฤษภาคม พ.ศ. 2567 โดยระยะแรก ได้ทำการอบรมพัฒนาศักยภาพบุคลากรสุขภาพตามแนวทางเวชศาสตร์วิถีชีวิต 2 ครั้ง อาสาสมัครเป็น เจ้าหน้าที่พยาบาล และนักโภชนาการ จำนวน 13 คน ระยะที่สอง บุคลากรสุขภาพที่ผ่านการพัฒนาศักยภาพได้ดำเนินการปรับเปลี่ยนพฤติกรรมบริโภคอาหารตามแนวทางเวชศาสตร์วิถีชีวิตให้แก่กลุ่มอาสาสมัครผู้ป่วยโรคไตเรื้อรัง จำนวน 51 คน ที่ได้เข้าร่วมกิจกรรมกลุ่ม 4 ครั้ง ผลจากการศึกษาในระยะที่ 1 ในกลุ่มบุคลากร พบว่ามีคะแนนความรู้โดยรวม (25.69 ± 2.18 vs 27.08 ± 2.10 , $p < 0.05$) คะแนนความรู้ โรคไตเรื้อรัง (12.08 ± 0.86 vs 12.62 ± 0.87 , $p < 0.05$) คะแนนความรู้หลักโภชนาบำบัดสำหรับโรคไตเรื้อรัง (11.15 ± 1.14 vs 12.39 ± 1.33 , $p < 0.05$) และมีทักษะการสนทนาสร้างแรงจูงใจ ส่วนผลการศึกษาระยะที่ 2 ในกลุ่มผู้ป่วย พบว่า มีพฤติกรรมบริโภคอาหารผลลัพธ์ดีขึ้นอย่างมีนัยสำคัญ (71.58 ± 10.17 vs 74.28 ± 9.93 , $p < 0.05$) จำนวนผู้ป่วยที่พบว่าไตทำงานดีขึ้น ร้อยละ 49.02 ในการเข้าร่วมโปรแกรมครั้งที่ 2 ไตทำงานดีขึ้นร้อยละ 41.18 ในการเข้าร่วมครั้งที่ 3 และไตทำงานดีขึ้นร้อยละ 41.18 ในการเข้าร่วมครั้งที่ 4 โดยพบว่ามีสถานที่ทำการศึกษานิ่งหนึ่งที่พบว่า การทำงานของไตดีขึ้นในผู้ป่วยทุกราย ที่มาร่วมโครงการวิจัยในครั้งที่ 2 และการศึกษาครั้งนี้พบว่า มีแนวโน้มการทำงานของไตดีขึ้น ค่า creatinine ลดลง ในครั้งที่ 4 และระดับน้ำตาลหลังอดอาหารได้รับการควบคุมลดลงในทุกครั้ง

คำสำคัญ: พฤติกรรมบริโภคอาหาร; หลักโภชนาบำบัด; เวชศาสตร์วิถีชีวิต; โรคไตเรื้อรัง