



Lack of Awareness among Renal Transplant Recipients Regarding Consumption of Phosphate-containing Processed Food and Drinks

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Authors' contributions

This work was carried out in collaboration between all authors. Authors YS and HY designed the study, wrote the protocol, and wrote the first draft of the manuscript. Authors RM, TF, IN and NN performed the survey. Authors YS, MK and HY analyzed the data. Author MS reviewed and corrected the manuscript. All authors read and approved the final manuscript.

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ABSTRACT

In the chronic kidney disease (CKD), adequate phosphate control is critical to reduce mortality rate and cardiovascular risks, besides, it may improve renal prognosis. We surveyed the awareness of the high phosphate content in the commercially processed food and drinks among renal transplant recipients, since they usually have reduced kidney function. Thirty seven subjects were provided with a questionnaire to evaluate their awareness of food and drinks containing phosphate. Most of the subjects (91.9%) were aware of the presence of sugar in soda drinks, but only 13.5% were aware of the presence of phosphate. Only 29.7% understood that phosphate is present in processed food, such as hamburgers and pizza, and 64.9% were unaware of the harmful effects of unrestricted consumption of phosphate-containing food and drinks. In this survey, 24.3%

consumed “fast food” once a week and 16.2% took 1 to 5 cans of soda drinks each week. After completing the questionnaire, 32.4% of the subjects considered reducing their phosphate intake and 54.1% showed interest in obtaining more information on phosphate in food and drinks. This survey emphasizes the need of further education in renal transplant recipients to minimize the possible health risks posed by excessive consumption of phosphate additives.

Keywords: Phosphate; fast food; soda drinks; renal transplant; CKD.

1. INTRODUCTION

Phosphate is an essential component of human body [1], however, recent studies have shown the risk of excess phosphate intake in early ageing, arteriosclerosis and renal diseases [1,2,3,4]. In the patients with CKD, hyperphosphatemia is associated with the higher risk of mortality and cardiovascular disease (CVD) which is the most common cause of death in CKD [5,6,7,8,9]. In addition, it is suggested as a risk for end stage renal disease (ESRD) as well. Therefore, CKD patients are often advised to take low phosphate diet, along with the phosphate lowering drugs if necessary [10,11].

Phosphate is one of the basic components of our daily food such as meat, fish, eggs, dairy products and vegetables [1]. The amount of phosphate in the food is generally associated with the amount of protein. However, phosphate compounds are widely used as food additives and the consumption of phosphate additives are markedly increased in the recent years, and American diet may contain phosphate additives as much as 1000 mg per day [12]. Restriction of processed food can measurably reduce the level of phosphate in the dialysis patients.

Therefore, this study is designed to assess the level of awareness among renal transplant recipients on artificially-added phosphate containing foods and drinks in Japan.

2. MATERIALS AND METHODS

We randomly selected 37 patients who underwent renal transplantation from 2006 to 2013 and are outpatients for follow up at Hiroasaki University Hospital. The average age of the recipients was 47.3±14 years old, 26 were male, and 11 were female. All subjects participated voluntarily on the assurance of anonymity and none refused to answer the survey questions, although some patients did not answer particular questions when they were not certain of their response. The questionnaire for assessing the level of awareness of phosphate-containing food

and drinks included seven questions and was administered in May 2013. In designing the questionnaire, we chose not to examine each patient’s knowledge regarding food items with natural phosphate ingredients; instead, we focused on food items and drinks that have artificially added phosphate as a preservative, such as hamburgers, pizza and soda (Table 1). The definition of "fast food" as hamburgers, pizza and similar foods was explained to the subjects beforehand. The study design was approved by the Hiroasaki University ethical committee and all subjects provided informed consent and participated in the survey voluntarily. The results of the survey were analyzed using Microsoft Excel 2007 and chi-square test using StatView 4.0. A p value <0.05 was considered statistical significant.

Table 1. Questionnaire

Please answer the following questions	
Age:	
Sex: Male/Female	
1) Do you know Soda drinks contain high levels of sugar?	Yes / No
2) Do you know Soda drinks contain high levels of phosphate?	Yes / No
3) Do you know processed foods (burger, pizza, etc) contain high levels of phosphate?	Yes / No
4) Do you know taking too much phosphate may be harmful for the body?	Yes / No
5) How many cans of Soda do you take a week?	1-None, 2-1-5, 2-6-10, 3->10
6) How often do you take fast food?	1-never, 2-once a week, 3-once a month, 4-almost every day
7) After you answered above questions, what do you think about phosphate?	1- I want to get more information about phosphate. 2- I want to reduce consumption of phosphate-containing food/drink. 3- I think I have no further interest on phosphate.

3. RESULTS

3.1 Awareness of Sugar and Phosphate in Processed Food and Soda

Most of the subjects (91.9%, 34 of 37 subjects) knew that soda contains a large amount of sugar, but only 13.5% (5 of 37 subjects) were

aware that phosphate is included in soda (chi-square test and Fisher's direct method, $p < 0.0001$) (Fig. 1). Only 29.7% knew that phosphate is included in processed foods (hamburger, pizza, etc.) (Fig. 2) and 64.9% did not know that excessive intake of phosphate is harmful to the human body (Fig. 3).



Fig. 1. The survey participants were asked whether they were aware of the sugar and phosphate content in commercially available soda drink

The majority (91.9%) of the recipients were aware of the presence of sugar, while only 13.5% were aware of the presence of phosphate (phosphoric acid) (chi-square test and Fisher's direct method, $p < 0.0001$), showing a huge awareness gap to phosphate among the recipients

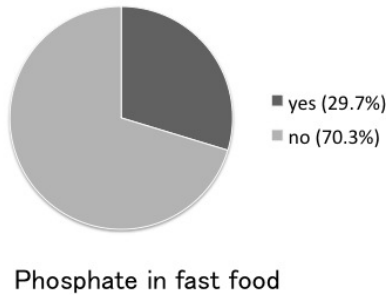


Fig. 2. The survey participants were asked whether they were aware of high phosphate content in commercially available fast food. Only 29.7% of the recipients were aware of the presence of high content of phosphate in fast food

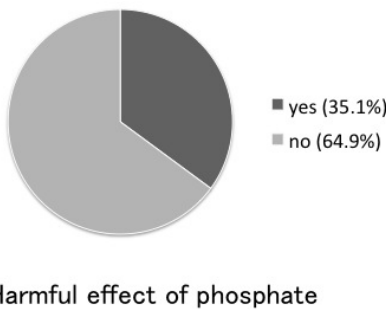


Fig. 3. The survey participants were asked whether they were aware of the possible harmful effects of unrestricted consumption of a high phosphate diet for a prolonged period. The majority (64.9%) of the recipients were unaware of such detrimental effects

3.2 Frequency of Intake of Fast Food and Soda

Most of the subjects (75.7%) rarely drank soda, but 16.2% drank 1 to 5 cans, 5.4% drink 6 to 10 cans, and 2.7% drank more than 10 cans of soda each week. Similarly, most subjects (62.2%) rarely ate fast food, but 13.5% consumed this type of food once a month and 24.3% consumed fast food once a week (Fig. 4).

3.3 Willingness to Modify Diet of Phosphate-containing Food

After completing the survey, 54.1% of the subjects wanted more information on phosphates in food and 32.4% wanted to reduce their phosphate intake by minimizing consumption of processed foods and soda (Fig. 5).

4. DISCUSSION

In the recent years, the graft survival in the renal transplantation has been improving. Consequently, significance of the management of chronic allograft injury has been increasing.

Many of the post transplant recipients are classified as CKD greater than stage 3 [13,14], and according to the recommendations of KDIGO, all kidney transplant recipients should be considered as CKD [15].

At present, phosphate control is one of the routine medical treatments in the patients with CKD in the advanced stages. Nevertheless, the post renal transplantation recipients had insufficient awareness of phosphate, despite the fact that all of them previously had ESRD.

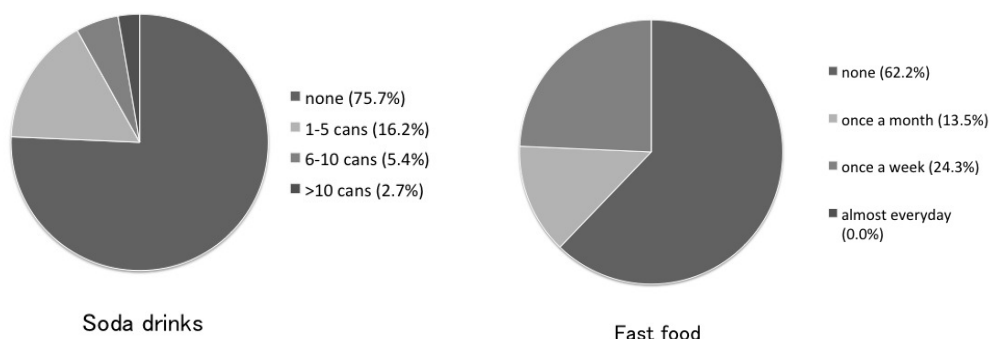


Fig. 4. The survey participants were asked to describe their soda drink and fast food consumption habits. The majority (75.7%) of the recipients do not consume soda drink and 62.2% do not eat fast food

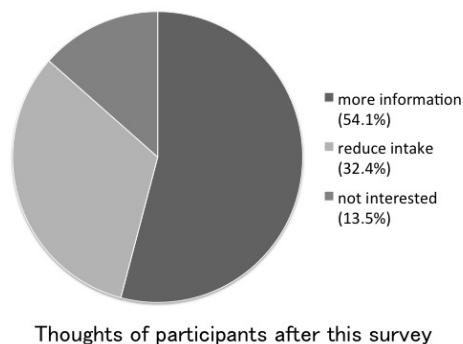


Fig. 5. The survey participants were asked whether they were willing to modify their artificially added phosphate-containing diet. 54.1% of the recipients wanted to have more phosphate-related information and 32.4% were willing to reduce their artificial phosphate intake by minimizing consumption of processed food and soda drinks, while the remaining (13.5%) showed no further interest related to phosphate

It is very important for the recipients to understand that their kidney functions are still in CKD stage, not fully recovered and they need the self-care and education.

We have previously documented the levels of awareness of phosphate intake among future medical professionals, such as medical and nursing students, and the patients undergoing hemodialysis using a similar questionnaire used in the current survey, with the finding that the majority of the students were not aware that fast food and soda drinks contain phosphate additives [16]. A similar lack of awareness was apparent in the renal transplant recipients in this study, but these patients are consuming less fast food and soda drinks compared to the students. The difference might be related to the higher average age of the post-transplant recipients compared with the students, since the younger people are more familiar with the western diet and the processed food and drinks from the younger age. The hemodialysis patients were also unaware of the phosphate additives in fast food and drinks, although most of them were aware that high phosphate diet is harmful [17]. Interestingly, the dialysis patients consume much amount of soda drinks. Probably, dialysis patients are trying to alleviate their thirst and tiredness after dialysis session by taking soda drinks.

There are possible reasons that post-transplant patients are not well educated about the phosphate restriction. First, hypophosphatemia is common in the first months after renal transplantation usually due to hyperparathyroidism [18]. Persistent increase in the fibroblast growth factor 23 level is suggested as a cause of early post-renal transplantation hypophosphatemia [19]. Recovery from the hypophosphatemia is observed in one year after renal transplantation. And Connolly et al. found that higher serum phosphate is a predictor of mortality in the patients after a renal transplant [20] and Benavente et al. [21] showed that serum phosphate at 6 and 12 months post-transplant is an independent predictor of graft loss, with the suggestion that the high phosphate content in a Western diet may damage renal tubules. Thus, avoiding excess phosphate intake seems like reasonable in the post-transplant recipient as well. Whereas, the proper amount of phosphate intake in each post-operative period need to be further elucidated.

Secondly, there is a concern that phosphate restriction may lead to malnutrition [22]. We can minimize these concerns by focusing on the reduction of the added phosphate additives, instead of reducing regular meal. The ingested phosphate additives are most efficiently (90~100%) absorbed [23]. Whereas, phosphate originated from animal protein are absorbed 40%~60%, phosphate from vegetables are absorbed only 20~50%.

Lastly, post-transplant patients are already following so many instructions. They are strictly required to take immunosuppressants as directed, and they need to pay attention to infections and many other complications. Therefore, we need to create concise and feasible educational programs so that these instructions are not being another burden for the patients.

In this study, most of the renal transplant recipients chose the answers "I want to get more information about phosphate" and "I want to reduce consumption of phosphate-containing food and drinks" after they had completed the questionnaire. Their interest and willingness to change their dietary habit suggest that they can reduce the amount of phosphate if the proper education programs are provided. These attempts may reduce the total phosphate intake without any pill burden or compromise in the nutritional status.

5. CONCLUSION

These results suggest that the awareness of phosphate-containing food and drinks is insufficient among renal transplant recipients, although they have sufficient willingness to change their dietary habits. Therefore, providing further education may lead to the better phosphate control, and consequently, better prognosis of life and grafted kidney.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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