RENAL NUTRITION FORUM
A Peer Reviewed Publication of the Renal Dietitians Dietetic Practice Group
www.renalnutrition.org
VOLUME 26 NUMBER 3 ■ SUMMER 2007

Renal Dietitians®

A Dietetic Practice Group of American Dietetic Association

Feature Article:

Leaching Potassium from Tuberous Root Vegetables

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Introduction

Chronic kidney disease (CKD) affects more than 20 million people in the United States (one in nine adults), and millions more are at risk for developing CKD (1). The exact number of people with Stage 1 to 4 CKD is unknown. However, in 2004, almost half a million people in the U.S. were treated for Stage 5 CKD (formerly referred to as end stage renal disease [ESRD]). Moreover, it is projected that by the year 2010 the number of newly diagnosed people with Stage 5 CKD will double (2).

Depending on the stage of kidney disease (3 to 5), patients are usually prescribed a potassium-restricted diet to prevent complications associated with hyperkalemia. Potassium is found in many foods including meats, fruits and vegetables. The potassium content of many tuberous root vegetables such as potatoes, sweet batata and white yam (Ñame) may vary considerably depending on the mineral content of the soil where it is grown. Tuberous root vegetables are the main staple in the diet of many people from such places as the Caribbean, the Dominican Republic and South America. In 2004, 32% of the Stage 5 CKD population in the United States was black (the exact percentage of those from the Caribbean is unknown) and another 14% was Hispanic (2). These numbers are expected to rise as people continue to migrate to the United States from these areas of the world. Therefore, an understanding of the cultural habits and ethnic food preferences of people from countries other than the United States is critical if adherence to medical and nutrition therapies is expected. When people migrate to other countries, culturally based food habits are usually the last traditions to change because they preserve ethnic identity (3). Dietitians must understand the cultural beliefs and eating habits of their patients and try to incorporate these foods into the prescribed nutrition plan and renal exchange system.

The white potato is an example of a tuberous root vegetable which has been studied and shown to lose a significant amount of potassium through leaching (4-6). The potassium content of many tuberous root vegetables has been unknown until recently. Burrowes and Ramer (7) analyzed the potassium content of 13 tuberous root vegetables and determined the amount of potassium that can be extracted through various soaking and cooking procedures. The purpose of this article is four-fold: to summarize the methods used in the study by Burrowes and Ramer (7) for leaching potassium from several raw tuberous root vegetables, to report the potassium content of the raw tubers studied, to show the amount of potassium that can be removed from the vegetables after cooking, and to present a "how to" patient education handout on removing potassium from tuberous root vegetables.

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In This Issue:

Jacobson-Advertising Editor and I will be transitioning to the Managing Editor position. I look forward to working with our new Editorial Board members and continuing to achieve new goals and reach new heights together!

I would like to extend my sincere appreciation to all then 2006-2007 Renal Nutrition Forum authors. The Renal Nutrition Forum would not be what it is without your willingness to contribute, offer your expertise and research findings. Everyone has worked diligently to meet publishing deadlines and incorporate suggested reviewer changes with an open mind and positive attitude. The Feature and Advanced Practice article authors have provided high quality clinical articles that have allowed me the opportunity to apply and receive approval for 6 CPE articles and be able to offer 7.5 hrs of CPE credit this year! I feel fortunate to have had the opportunity to work with these dedicated and terrific authors. I have enjoyed working with all of you and appreciate your hard work and commitment to provide cutting edge information! Please see page 7 for a complete list of RNF authors for this year.

In addition, I am grateful and deeply appreciative for the hard work and dedication of the Forum Clinical Peer Review Panel Members, Sarah Carter, Maria Karalis, Lynn Munson, Susan Salmi and Mary Sundell. Thank you for helping to ensure that all the manuscripts submitted are up to date, clinically relevant and informative. It continues to be a pleasure to work with a great group of committed, highly skilled and professional individuals. I want to thank you for your commitment, hard work and lending your time & expertise to help us strive for excellence with our peer-reviewed publication. Please refer to page 7 for the complete list of RNF Clinical Peer-Review Panel Members for this year.

"We must not be afraid of dreaming the seemingly impossible if we want the seemingly impossible to become a reality" Anonymous

As mentioned, in the previous issue the CPE inserts will now be available exclusively online via the RPG Web site: www.renalnutrition.org. For only the second time there are two CPE articles included in this issue and approved for 1.0 (pending-approval) hrs each for a total of 2 CPE credits. Please take advantage of this member benefit. Did you know that there have been 6 CPE articles offered for a total of 7.5 hrs of CPE credits this membership year?

The Feature article by Jerrilynn D. Burrowes provides very valuable and useful insight about methods that clinicians can use to improve adherence to prescribed nutrition plans for specific ethic groups. It is imperative that as clinicians we are able to provide appropriate education and intervention for different ethic groups based on their traditional meal patterns. This is the first CPE article approved for 1.0 hrs.

The Advances in Practice article by Mary Sundell provides a closer look at the possible limitations of using various tools for assessment of protein and calorie intakes. It is beneficial to understand the potential limitation of tools used to assess the actual vs. prescribed intake using dietary recall methods. This is the second CPE article approved for 1.0 hrs.

In a continuing effort to demystify the area of research and empower more dietitians to become involved in research, a great reprint about Institutional Review Board is included. The Researcher-IRB Partnership article will provide valuable insight about the IRB process from Richard Mattes, the Chair of a University IRB Board.

Maria Karalis provides a terrific Career Development article about presentations that will benefit everyone in any stage of their respective career. She provides specific and detailed information to enhance presentations that improve your public speaking as well as boost your career opportunities.

Jane Byrnes has graciously allowed us to reprint her excellent article, Rules of the Write: Make Words Short and Simple for All Clients. This article provides valuable tips about increasing the health literacy of our patients and clients.

Thank you to the outgoing Membership Chair, Connie B. Cranford who has worked tirelessly to coordinate the Member Spotlight section with the Area Coordinators. I appreciate the efforts of Patti Barba, Karen Basinger, Connie Cranford, MaryJo Dahms, and Pat Williams who were instrumental in finding members in their respective regions to highlight and assist them in writing a brief article about their professional and patient contributions. Please take a few minutes to read the featured Member Spotlight in this issue and access the others via the website.

The next time you are faced with a challenge or change, take a risk and be an original. Dream big, stay focused and follow your dreams and whatever you do you will make a difference! It doesn't matter if it is great or small, all that matters is that you made a difference and helped someone else. ◆

Methods

For a more complete description of the methods used for this study, including details of the cooking procedure and the chemical analysis of the samples, refer to the article by Burrowes and Ramer (7). Fresh tubers were obtained from a local area ethnic market in Queens, New York and in Elmont (Nassau County, Long Island), New York. The common and scientific names and a brief description of the vegetables are presented in Table 1. The names of the tubers are used interchangeably, depending on where they are grown and the ethnic group that consumes them. Pictures of the intact and cross-sections of the vegetables analyzed are presented in the article by Burrowes and Ramer (7).

Raw samples of each tuber were prepared for processing. The samples were thinly sliced (approximately 3mm). Raw samples underwent five experimental conditions: (1) 0-hour soak, followed by normal cooking; (2) 2-hour soak, followed by normal cooking; (3) 4-hour soak, followed by normal cooking; (4) 8-hour soak, followed by normal cooking; and (5) 0-hour soak, followed by double cooking. (Normal cooked samples were placed in deionized water in a 2:1 ratio. Cooking time varied from 5 to 10 minutes, depending on the density of the tuber. Cooking ceased when the samples were soft, yet retained integrity. Double cooked samples were placed in deionized water at room temperature in a 2:1 ratio. The water was brought to a boil and then drained off, and fresh room temperature deionized water was added. The water was brought to a boil again and the sample was cooked until it was soft (yet retained integrity).

Triplicate samples of each tuber were analyzed. Data are presented as means (± standard deviation [SD]). Student's *t* test was used to compare differences between groups. Differences were considered statistically significant at $P < 0.05$.

Results

The mean potassium content (± SD) of the raw tubers is listed in Table 2. The potassium content of raw cocomalanga was the highest (739 mg/100g), followed by sweet batata (613 mg/100g) and red yautia (610 mg/100g). Raw dasheen and yellow yam (□ame) had the lowest amount of potassium (170 mg/100g and 282 mg/100g, respectively). All of the raw tubers, with the exception of dasheen, are considered high potassium vegetables (greater than 200 mg potassium per 100 g sample).

Compared to the raw samples, the 0-hour soak normal cooking reduced the potassium content of the tubers significantly (*P* value < 0.05), with the exception of eddo. The 2-, 4- and 8-hour soak times, followed by normal cooking, did not leach significantly more potassium from most of the tubers. The double cooking procedure was more effective in leaching significantly more potassium than the normal cooking procedure, except for dasheen and yellow yam (see Table 2). Dasheen, black yam, white yam, yellow yam and yampi were the only tubers that had a potassium content less than 200 mg/100 g portion after the double cooking procedure.

Discussion

Burrowes and Ramer (7) were the first to analyze and report the potassium content of the 13 tuberous root vegetables listed in this paper after leaching. The potassium content of the raw tubers was determined after they underwent the five experimental conditions previously stated. Although most of these vegetables are high in potassium (more than 200 mg potassium per 100 g portion [equivalent to approximately 3.5 oz or less than ½ cup]), they are the staple in the diet of many people from the Caribbean and South America, and those of Hispanic descent. Burrowes and Ramer (7) showed that the potassium content of these vegetables can be reduced significantly by the double cooking method, and that soaking the vegetables prior to cooking is not beneficial in leaching additional potassium. Today, patients are usually advised to soak the vegetables overnight before cooking, a practice that this study found inefficient for leaching significant amounts of potassium (compared to the double cook method).

Tubers with a potassium content greater than 200 mg per ½ cup are considered high potassium, between 151 mg and 200 mg per ½ cup is moderate potassium, and

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Table 1: Description of tuberous root vegetables studied

Common and Scientific Name of the Tuberous Root Vegetables Studied	Description
Batata (fresh) *Dioscorea batata*	A type of sweet potato with smooth red or deep purple skin.
Batata (sweet) *Ipomoea batata L.*	A type of sweet potato with pink skin and white flesh.
Cocomalanga *Colocosia esculenta*	A tuberous vegetable with dark brown skin and starchy grayish flesh.
Dasheen *Colocasia esculenta (L)*	Starchy underground vegetables with brown hairy skin and white to grayish flesh.
Eddo *Colocasia e. antiquorum*	A small vegetable with fuzzy brown skin and distinct rings. Flesh is off-white and sometimes contains purple flecks.
Yam (Ñame) (black or Negro) *Dioscorea rotundata*	A large vegetable with smooth, light brown skin and white flesh, when cooked.
Yam (Ñame) (white) *Dioscorea alata*	A large vegetable with rough brown skin and starchy white flesh.
Yam (Ñame) (yellow) *Dioscorea cayenensis*	A large vegetable with smooth, dark brown skin. Flesh is firm and pale yellow when cooked.
Yampi (Yampee) *Dioscorea trifida L.*	A small spherical-shaped tuber with thin, smooth skin with elongated cracks.
Malanga *Xanthosoma spp.*	A large tuber with rough, fuzzy brown skin and patches of yellowish or pinkish flesh beneath.
Yautia (red) *Xanthosoma violaceum*	A tuberous vegetable with cream-colored, yellow or pinkish flesh, dark brown skin.
Yautia (white) *Xanthosoma sagittifolia*	A white fleshed tuber with dark brown/tan bands on skin.
Yuca (Cassava) *Manihot esculenta*	A shrubby tuber with rough dark brown skin and mild white flesh.

Adapted from: Burrowes JD and Ramer NJ. Removal of potassium from tuberous root vegetables by leaching. *J RenalNutr.* 2006; 16:304-311.

Table 2: Potassium content of raw and unsoaked, double cooked tuberous root vegetables

Tuberous Root Vegetables	Mean Potassium Content (± SD)/100 g	
	Raw	Unsoaked, Double Cooked
Batata (fresh)	459.4 ± 21.5	203.7 ± 34.4
Batata (sweet)	613.2 ± 24.5	243.0 ± 48.4
Cocomalanga	739.1 ± 32.7	419.5 ± 17.0
Dasheen	169.5 ± 15.5	54.6 ± 22.6
Eddo	565.0 ± 69.8	339.8 ± 21.5
Yam (Ñame) (black)	339.9 ± 25.0	190.3 ± 10.3
Yam (Ñame) (white)	482.4 ± 10.9	176.1 ± 12.7
Yam (Ñame) (yellow)	282.3 ± 4.7	172.1 ± 8.8
Yampi	343.6 ± 27.5	150.5 ±9.1
Malanga	502.3 ± 37.5	316.9 ± 54.3
Yautia (red)	609.8 ± 29.6	328.9 ± 4.2
Yautia (white)	497.9 ± 8.0	248.1 ± 8.6
Yuca (Cassava)	525.0 ± 5.4	235.4 ± 7.5

P value for difference between means (raw vs. double cooked) was significant at $P < 0.05$ for all vegetables.
Adapted from: Burrowes JD and Ramer NJ. Removal of potassium from tuberous root vegetables by leaching. *J RenalNutr*. 2006;16:304-311.

less than 151 mg per ½ cup is low potassium (8). Most of the tubers in this study had a high potassium content. Even after double cooking (8 out of 13); only one tuber, Dasheen, was low in potassium.

Summary

Although double cooking was effective in leaching significant amounts of potassium from the tuberous root vegetables examined, many vegetables retained a high potassium content. Therefore, patients on potassium-restricted diets need to be educated about limiting the amount of these vegetables in their diet. Table 3 is a "how to" patient education handout that can be used by renal dietitians who counsel and educate patients who consume these foods as a staple in their diet. This handout is included as a separate insert in this issue and also available online.

References

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Website Extras
www.renalnutrition.org

- Obtain this issue's CPE answer sheets/self mailers online. All CPE inserts will now be exclusively online.
- Have you ever attended an ADA House of Delegates Meeting? If not access the RPG website for a terrific article written by Lesley Wujastyk. She details her exciting experience as a first time attendee and offers tips for other opportunities to become more involved in our profession! Don't miss it!
- Remember to access additional Member Spotlights that provide highlights of members from around the country that are making a positive impact in their clinical practice or making a difference for patients!
- Tune in for the RPG events that will take place at the upcoming FNCE meeting in Sept. 2007.
- We value your opinion. Please let us know what you think! cmgmerickel@comcast.net

Congratulations!

Congratulations to Wai Yin Ho, RD, LD, the 2006-2007 RPG Post –baccalaureate Academic Scholarship Recipient. Wai Yin authored the feature article in the last issue of the Renal Nutrition Forum and is currently a Graduate student in the Clinical Nutrition Program at the University of Medicine and Dentistry in New Jersey. She is presently employed as a Renal Dietitian with Davita in Georgia.

Thank You!

I would like to extend a special thank you and debt of gratitude to all of the authors who have contributed original manuscripts and articles for the 2006-2007 membership year. Thank you to Roxanne G. Poole (Abdullah Hamad, Lynn Thomas, Peggy Strawhorn) Alison L. Steiber, Tiffany Sellers (Melinda Bell, Elizabeth M. Speer), Philippa Norton Feiertag, Lesley Wujastyk, Susan Dupraw, Wai Yin Ho, Stephanie McIntyre, Lois Hill, Jerrilynn D. Burrowes, Mary Sundell, Maria Karalis.

Another group of hard working renal dietitians that strives to ensure that all submitted manuscripts and articles provide up to date and clinically relevant information are the Clinical Peer-Review Panel Members.
Thank you to Sarah Carter, Maria Karalis, Lynn Munson, Susan Salmi and Mary Sundell.