

# Dietary Intervention in Phosphatemia Control—Nutritional Traffic Light Labeling



Marcela T. Watanabe, RD, MSc, Pasqual Barretti, PhD, and Jacqueline C. T. Caramori, PhD

THE CONTROL OF phosphatemia has been increasingly recognized as an important strategy for dialysis patients' because hyperphosphatemia is a risk factor for cardiovascular diseases, progression of kidney disease, and mortality in chronic kidney disease (CKD) as a whole.<sup>1</sup> The prevention and correction of hyperphosphatemia are important components of CKD, achieved by dietary phosphate restriction, phosphate binders administration, and adequate dialysis.<sup>1</sup> In this context, we emphasize the importance of knowledge about the phosphate content in food and we developed the “phosphate traffic light”, as a new tool for nutrition education and suggestion to improve nutrition labels.

Dietary phosphate comes in an organic form (phospholipids and phosphoproteins), such as meat and dairy products, and in an inorganic form as food additives that are increasingly added to processed foods and beverages.<sup>2</sup> However, estimates of dietary phosphate intake rarely considers the amount of phosphorus in mineral supplements, water, or food additives.<sup>3</sup> This is extremely important because phosphate supplied in additives is more easily absorbed in the gastrointestinal tract.<sup>4</sup>

Protein from animal origin, such as meat, fish, and dairy products contains phosphate mainly in an organic form which is easily hydrolyzed and absorbed by the human digestive system.<sup>1</sup> High-protein plant based foods, such as legumes, nuts, cereals and seeds, contain phosphate mainly in phytate, or the phytic acid form. This type is not dissolved in the human intestine due to the lack of phytase

enzyme, responsible for phosphate liberation.<sup>1</sup> In general, intestinal absorption is lower in foods of vegetable origin rather than in animal origin.<sup>5</sup>

In food, extra quantities of inorganic phosphorus may be added as food additives, of which polyphosphates are their main components. The content of phosphate in processed foods is much higher than in raw foods.<sup>6</sup> Ordinary sources of inorganic phosphate include soft drinks, processed meat, frozen food, cereals, snacks, processed cheese, and instant products.

However, it is important to emphasize that nutritional labels do not indicate phosphate quantities in foods.<sup>7</sup> There are not laws or regulations in place requiring manufacturers to indicate such amounts in food packages, which makes it very difficult to estimate the amount of phosphate in foods.<sup>5</sup>

We consider the nutritional traffic light label a complete and ideal tool for foods containing phosphate. This would quantitatively indicate phosphate content and the presence of additives. Thus, red would indicate RISK (excessive amount), yellow would indicate WARNING (moderate amount), and green would indicate FREE (small phosphate amount). The intention is to make the information on labels more understandable, directing people to make education choices for health. It is a long way to go to achieve such measures; it involves consumer defense agencies, medical and nutritional advice, government bodies, and support from the food industry. There is a lack of information about the harmful effects of phosphate excess for consumers, despite the scientific research and propagation of knowledge to medical institutions.

Despite all the potential problems described previously, studies have shown that nutritional education focused on processed food restriction is very viable and effective on dialysis patients. The efficacy of this approach is strongly supported by a controlled randomized clinical trial, which assessed the impact of dietetic counseling focused on food additive restriction (intervention group) versus conventional nutritional counseling on phosphatemia in a maintenance hemodialysis population. After 3 months, the phosphatemia average significantly decreased in the intervention group, providing evidence on the effects of additives on hyperphosphatemia.<sup>8</sup> In this context, Reddy et al.<sup>9</sup> suggest that educational initiatives are effective in

Faculdade de Medicina de Botucatu, UNESP Univ Estadual Paulista, Department of Clinical Medicine, Botucatu, São Paulo, Brazil.

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Address correspondence to Jacqueline C. T. Caramori, PhD, Faculdade de Medicina de Botucatu, UNESP, Univ Estadual Paulista, Av. Prof. Mário Rubens Guimarães Montenegro, s/n, Botucatu, Sao Paulo, Brazil, CEP 18618-687. E-mail: [jteixeir@fmb.unesp.br](mailto:jteixeir@fmb.unesp.br)

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improving patients' knowledge about phosphate, and consequently, improve control of hyperphosphatemia. The authors studied 115 patients who had classes about phosphate and noted a significant reduction in phosphatemia in patients' hyperphosphatemic pre-intervention.

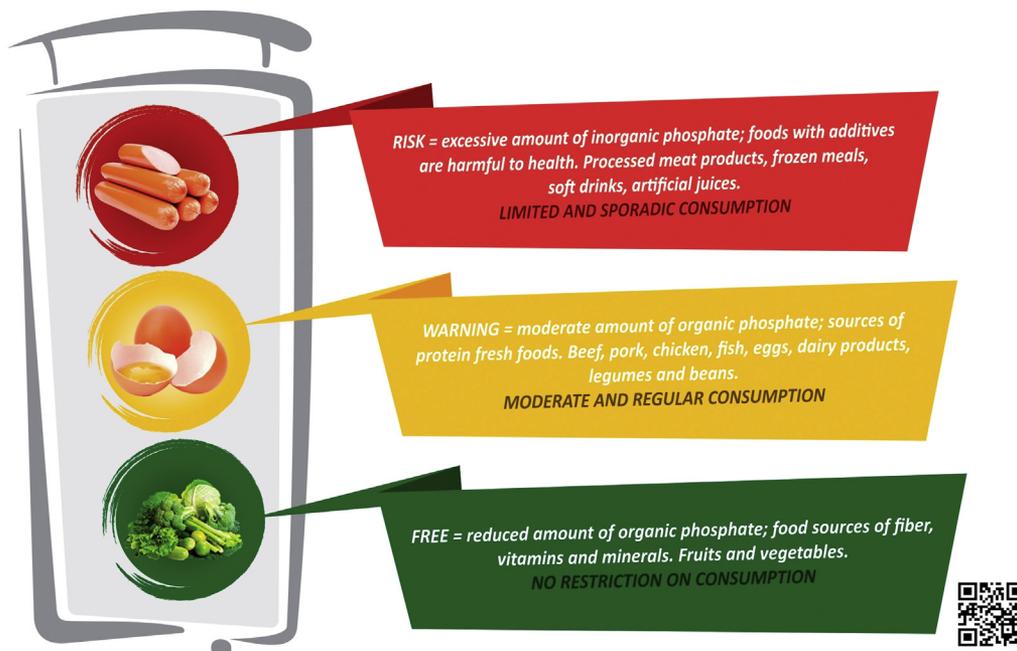
Although the effect of focused dietary counseling is motivating, its efficacy may be harmed by the presence of "hidden" phosphate. Labels of many food products do not contain the entire list of additives,<sup>5</sup> making the challenge even greater for patients. Previous studies, through lab analysis, have shown the scope of this problem. Results found that various food items contain higher phosphate content than their labels or a nutritional database suggest.<sup>6,10</sup>

An important action for CKD patients is to learn about processed foods and to check carefully the nutritional food composition. Well-informed people have better chances of making appropriate food choices, resulting in a decrease in the complications associated with hyperphosphatemia. The data presented further emphasizes the importance of knowledge about phosphate content in foods for nutritional counseling of CKD patients. Nutritional education focused on additives may improve hyperphosphatemia control, whether using tools such as the "Phosphate traffic light" or by including nutritional information on food labeling. Individuals with renal disease and the general population should choose healthier products with less added phosphate for consumption and for health benefits.

## References

1. Waheed AA, Pedraza F, Lenz O, Isakova T. Phosphate control in end-stage renal disease: barriers and opportunities. *Nephrol Dial Transplant.* 2013;28:2961-2968.
2. Chiu Y-W, Teitelbaum I, Misra M, de Leon EM, Adzize T, Mehrotra R. Pill burden, adherence, hyperphosphatemia, and quality of life in maintenance dialysis patients. *Clin J Am Soc Nephrol.* 2009;4:1089-1096.
3. Nolan CR, Qunibi WY. Treatment of hyperphosphatemia in patients with chronic kidney disease on maintenance hemodialysis. *Kidney Int Suppl.* 2005;67(suppl 95):S13-S20.
4. Uribarri J. Phosphorus homeostasis in normal health and in chronic kidney disease patients with special emphasis on dietary phosphorus intake. *Semin Dial.* 2007;20:295-301.
5. Fouque D, Horne R, Cozzolino M, Kalantar-Zadeh K. Balancing nutrition and serum phosphorus in maintenance dialysis. *Am J Kidney Dis.* 2014;64:143-150.
6. Watanabe MT, Araujo RM, Vogt BP, Barretti P, Caramori JCT. Most consumed processed foods by patients on hemodialysis: alert for phosphate-containing additives and the phosphate-to-protein ratio. *Clin Nutr ESPEN.* 2016;14:37-41.
7. Uribarri J. Phosphorus additives in food and their effect in dialysis patients. *Clin J Am Soc Nephrol.* 2009;4:1290-1292.
8. Sullivan C, Sayre SS, Leon JB, et al. Effect of food additives on hyperphosphatemia among patients with end-stage renal disease: a randomized controlled trial. *JAMA.* 2009;301:629-635.
9. Reddy V, Symes F, Sethi N, et al. Dietitian-led education program to improve phosphate control in a single-center hemodialysis population. *J Ren Nutr.* 2009;19:314-320.
10. Sullivan CM, Leon JB, Sehgal AR. Phosphorus-containing food additives and the accuracy of nutrient databases: implications for renal patients. *J Ren Nutr.* 2007;17:350-354.

## ATTENTION TO PHOSPHATE IN FOOD:



Certificate of Registration of the image "Phosphate traffic light" N°2532413 by HoodID Registros Online Ltda., on September 13, 2017.  
Authorship of Watanabe, MT & Caramori, JCT.

The phosphate's traffic light presents foods divided into three levels based upon phosphate content and bioavailability.

- **Red color indicates RISK**, because the foods of this group have high amounts of inorganic phosphate from food additives. They are mostly absorbed by the gastrointestinal tract, harmful to health and consumption should be limited and sporadic. Dietary sources in this level are: processed meat products, frozen meals, soft drinks and artificial juices.
- **Yellow color indicates WARNING**, because these foods are important sources of dietary protein, but have moderate amounts of organic phosphate that is 40-60% absorbed in the gastrointestinal tract. Eat moderate moderate amounts and regular consumption. Dietary sources in this level are: beef, pork, chicken, fish, eggs, dairy products, legumes and beans.
- **Green color indicates FREE**, because foods of this group have low amounts of organic phosphate which is minimally absorbed. Thus, the consumption is free. These foods are sources of fiber, vitamins and minerals, however, in case of CKD patients, the potassium content should be considered. Dietary sources in this level are: fruits and vegetables.

***This educational tool "Phosphate Traffic Light" was designed to help renal dietitians improve nutritional counseling to patients about their phosphate dietary choices, providing simple information, in an illustrative and easy form.***