International Journal of Nutrition Sciences

Journal Home Page: ijns.sums.ac.ir

Review Article

Reducing Dietary Acid Load to Lower Cancer Risk: An Overview of Nutritional Strategies

Hassan Bahrami*

Independent Health/Nutrition Researcher, Tehran, Iran

ARTICLE INFO

Keywords:
Cancer
Diet
Dietary acid load
Blood pH
Alkalization therapy

*Corresponding author:
Hassan Bahrami, PhD;
Independent Health/Nutrition Researcher,
Tehran, Iran.
Tel: +98-9107700749
Email: hbahrami.research@gmail.com

Received: December 12, 2023
Revised: March 7, 2024
Accepted: March 13, 2024

ABSTRACT

Dietary acid load is a known and important risk factor for non-communicable diseases such as cancer. However, despite the link between cancer and acid load in the body, strategies related to this effect have not been properly investigated to reduce the risk of cancer. According to the Warburg Hypothesis, inadequate oxygen delivery to the tissues and an acidic cellular environment are the main causes of cancer. Hence, many cancers may be controlled by maintaining an optimal alkaline pH at the cellular level along with sufficient oxygenation and providing essential nutrients. An acid-forming diet may produce more acid than is excreted by the kidneys and lead to chronic acidosis and a significant increase in the risk of cancer. This unfavorable situation can be effectively managed by presence of sufficient alkaline compounds in the body and by neutralization of excess acids produced around the cells that can lead to the control of the growth and spread of cancer cells too. This review shows the correct and practical use of the Warburg hypothesis for more effective control of preventable cancers. considering Warburg hypothesis as a potential complementary strategy, it may help improve cancer treatment outcomes and increase survival rate.

Please cite this article as: Bahrami H. Reducing Dietary Acid Load to Lower Cancer Risk: An Overview of Nutritional Strategies. Int J Nutr Sci. 2024;9(2):2-8. doi:

Introduction

Cancer is still a worldwide major public health problem that has seriously affected the health, economy and the social development. Nutritional status was demonstrated to have association with certain cancers (1).

It is generally believed that reducing dietary acid load may lower the risk of developing cancers (2, 3). However, the related mechanisms and diet-based treatment strategies are unclear, mainly due to the high focus of cancer studies on diagnosis and medical treatments, with little attention paid to understanding the nutrition-related mechanisms involved in the prevention and control of cancers (4-6). The link between cancer and excess acid load in the body was first revealed by Otto Heinrich Warburg (1883-1970), a German medical scientists and Nobel Prize winner (7, 8). Warburg's most important discovery was that in a cellular environment that chronically lacks oxygen, cells gradually become cancerous and produce high levels of lactic acid that can acidify the cellular environment. The excess blood acidity due to lactic acidosis can further lead to a more extensive and aggressive cancer progression. When the cells are exposed to excess acidity, especially around tumors, they may become inflamed and mutate into new cancer cells (9-11).

According to the Warburg's theory of cancer, all

tumors may behave similarly in terms of lactic acid production. If blood acidity regulation mechanisms in the body fail to balance acidity, due to lack of alkalizing compounds in place, the lactic acidosis contributes to the cancer, and the cancer contributes to the lactic acidosis. However, if there are enough alkalizing compounds in the body, excess acids are neutralized, as a result of which, cancer cells may not spread to other cells and organs, and cancer may be controlled (9, 10). Based on Warburg findings, sufficient oxygen supply to the body tissues and maintaining optimal alkaline pH at the cellular level can significantly reduce the risk of cancer initiation and development. Although Warburg's discoveries did not lead to a cure for cancer, he always believed in the potential of these findings to do so (7, 8, 11).

Knowing the key role of a healthy diet in preventing cancer, Warburg used healthy products in his diet, prepared his own meals from natural foods, even taking his own productions to restaurants, and tried to avoid processed foods as much as possible. Thus, despite having a family history of cancer, he successfully avoided cancer throughout his life (7, 8, 10). This review presents the basic and practical information according to the Warburg Hypothesis to help prevent and control cancer more effectively.

Reducing Dietary Acid Load

Excessive acid load in the body due to frequent high intake of acid-forming foods is associated with a variety of non-communicable diseases such as cancer, osteoporosis, bone fractures and formation of kidney stone, because excess acidity neutralizes bone minerals and releases calcium from the bones (12). However, as it is currently unclear what types of foods can help with maintaining optimal body pH, nutritionists lack the tools to research the acid-base hypothesis and recommend balanced diets (13). Some researchers proposed potential renal acid load (PRAL) and the net endogenous acid production (NEAP) to estimate capacity of acid or base production for various foods as a function of protein, phosphorus, potassium, magnesium, and calcium content of foods (14, 15). PRAL mainly refers to the acid load processed by the kidneys during acid excretion, and NEAP is made up of the foods we eat plus our metabolism, meaning that if we are eating a highly acid-forming diet, it will increase the NEAP and put an extra load on our acid buffering mechanisms (16).

However, recent studies have shown that neither PRAL nor NEAP provided a complete assessment of the effect of foods on actual dietary acid load, because they are based on too simple formulas that do not consider inclusion of dietary amino acids, taurine, purines, fructose, organic acids and polyphenols that have a meaningful impact on dietary acid load (13). Moreover, these systems do not take into account acids that are neutralized by the bones, and determine dietary acid load with great uncertainties (17, 18). Some natural health practitioners proposed alkaline diet to reduce dietary acid load, originated from a blood research work that was performed by Robert Young, a naturopathic practitioner, on the effect of foods as acid-forming or alkaline-forming based on analyzing samples of over 40,000 live blood analysis tests (19). However, the validity or invalidity of the live blood analysis tests was not established to be accepted as a standard laboratory practice (20).

Robert Young's food classification and PRAL's values sometimes disagree. For example, they both classify beef and cow's milk as acidogenic (a positive dietary acid load), meaning that consuming too much of them may lead to an increased risk of bone loss and hip fractures. However, coffee, black tea, and beer are classified as alkalizing based on PRAL values (a negative dietary acid load), but are acidogenic according to Young. Raw almonds are acid-forming according to PRAL values, but have strong alkalizing effect in human body based on Young's classification of foods. Honey is mild alkalizer based on PRAL values (regardless of quality and type), while natural and processed honeys are distinguished as mild alkalizer and mild acidifier, respectively in Robert Young's food classification. Meat products such as fish, chicken, beef and pork have nearly similar positive PRAL values and acidifying effects, but based on Young's classification of foods, chicken and fish are mild acidifiers, lamb meat is medium acidifier, and pork and rabbit are strong acidifiers (the unhealthiest meats) (4, 15, 16, 19, 21, 22).

Supporting Young are studies finding that alcohol intake is associated with a significant increase in osteoporotic and hip fracture risk (23), consumption of green coffee supplements may reduce calcium in bones (24), and a high intake or regularly drinking coffee is associated with a higher hip fracture risk (25, 26). These studies have confirmed that alcohol and coffee have a positive dietary acid load and may be acid-forming, meaning that Young's food classification seems to be more reliable indicator of dietary acid load compared to PRAL values.

Although Robert Young made a tremendous effort to develop the alkaline diet program and his book 'The pH Miracle' was useful to many people, some of his ideas about acid-base balance were inaccurate and not applicable to human body. For example, he gave intravenous fluids mixed with baking soda to cancer patients based on his false belief to the healing properties of baking soda. A 27-year-old

British woman who flew to California in 2012, in hopes that such treatments could save her life, died after spending about three months at Young's ranch. Later, in 2015, a cancer patient sued Young in San Diego Superior Court when her cancer progressed to stage 4 following his alkaline treatment. In 2016, Young was convicted of practicing medicine without a license (27, 28).

This type of incorrect use of Warburg's findings in cancer treatment has been due to a lack of understanding of the body's natural mechanisms in regulating blood pH, as well as failure to consider blood carbon dioxide content and oxygen saturation as key controllers of blood acidity. The normal pH level of human blood is 7.35-7.45, which can be fatal if the blood pH rises above 7.6 or falls below 7.0. A healthy person's arteries generally have a favorable pH due to high oxygen saturation and low carbon dioxide content, but venous blood that has reduced oxygen saturation and increased carbon dioxide content, as well as carries cellular metabolic wastes, has a lower pH level. Since even relatively small changes in blood pH outside the normal range can have harmful effects on the human body, the intravenous injection of sodium bicarbonate (pH around 8.0 to 9.0) to patients may raise the blood pH to levels higher than normal, including for arterial blood, and lead to a significant disturbance in the balance of blood gases, and be fatal in some cases (12).

Likewise, some researchers without a strong background in the life sciences have claimed that drinking "alkaline-water" (pH around 8.5-9.0), oral consumption of baking soda, or regularly taking potassium bicarbonate supplements can alkalize human body and reduce the risk of cancer. But these alkaline substances have no proven alkalizing effect inside human body, because in case of oral consumption, their alkalinity is immediately neutralized in contact with stomach acid, in the sense that, the alkaline pH of ingested alkaline water or baking soda does not reach cancerous tumors. The only thing that happens after consuming alkaline substances is that the stomach acid content becomes weaker and prone to the growth of harmful

Table 1: Dietary acid load for certain foods (4, 12, 16).

Fruits	Canned Fruits, factory juices♦•	Sour cherry♦•	Prunes♦• Plums ♦•	Oranges♦• Peaches♦• Bananas ♦• Cherry♦•	Grapes♦• Apples♦• Melons♦• Pears♦•	Lemons♦• Dates♦• Figs♦• Mangoes ♦•
Vegetables	Fried potatoes♦• Boiled Potatoes♦•s	Fried vegetables♦• Pickled vegetables♦•	Corn chips♦•	Cucumbers♦• Carrots♦• Tomatoes♦• Mushrooms♦•	Pumpkin♦• Lettuce♦• Celery♦• Bell Peppers♦•	Garlic♦• Onion♦• Spinach ♦• Okra♦•
Beans, Legumes	Lentils♦•	Beans♦•	Peas♦•	Green peas♦•	Snow pea♦	Green beans♦•
Grain, Cereals	Pasta♦• Cereals♦• Pastries♦•	Wheat flour♦• Breads♦• Rice flour♦•	Wheat♦• Rice♦• Oats♦•	-		
Nuts and Seeds	Peanuts♦• Cashews ♦•	Pistachios ♦• Seeds (Pumpkin, Sunflower)♦•	Sesame♦• Walnuts♦•	Raw Almonds♦•		
Meats	Pork♦• Beef♦• Rabbit♦•	Tuna♦• Lamb♦• Veal♦•	Chicken ♦• Turkey♦• Fish♦•	-		
Dairy, Eggs	Butter♦• Ice Cream♦•	Cow's Milk♦• Cheese♦•	Yogurt♦• Eggs♦•	-		
Oils	Frying Oils♦•	Sunflower oil♦•	Sesame oil♦•	Olive Oil♦•		
Drinks	Energy drinks♦• Wine♦•	Soft drinks♦• Tea, coffee, Espresso♦•	Beer♦• Bottled water♦	Spring mineral water♦• Coconut water♦•	Fresh fruit juice♦• Lemon-Honey juice♦•	Vegetable juice♦•
Other foods	Milk Chocolate♦• Protein shakes♦•	Mayonnaise and ketchup♦• Vinegar♦•	Processed honey♦• Dark Chocolate♦•	Natural honey♦•	Ginger♦•	

♦Acidogenic according to modified Young's food classification, •Acidogenic according to PRAL values. ♦Alkalizing according to modified Young's food classification, •Alkalizing according to PRAL values.

bacteria, the ability to digest food decreases, and the absorption of some vitamins such as vitamin B12 may be reduced (5, 12, 29-31). Due to the fact that Robert Young's table of alkaline foods had some errors, other researchers applied modifications in Young's table to make a more accurate food chart (4, 19, 30). Table 1 shows the modified Young's food classification, compared to the one based on PRAL values (4, 12, 16, 32). As a general recommendation, in order to alkalize the body according to Table 1, foods and drinks in a meal should be at least 2/3 alkalizing and no more than 1/3 acidifying (16).

Alkalization Therapy for Cancer

Kidneys in human body can excrete approximately 40-60 mEq/per day of acid in normal conditions. However, a typical Western diet may produce more than 100 mEq/day of acid on average, which is more than that can be excreted, leading to chronic acidosis. This condition increases the risk of chronic diseases such as cancer (16), particularly in older people who gradually lose some renal acid-base regulatory function, reducing the effectiveness of the buffering mechanisms in their body (12). A reliable and accurate method to determine the state of acid-base balance is to perform a venous blood gas (VBG) test in an accredited laboratory. VBG analysis results determine pH, oxygen saturation, partial pressure of carbon dioxide, and bicarbonate levels for venous blood. Venous blood pH of more than 7.45 indicates alkalosis, 7.33-7.42 is normal, 7.20-7.30 indicates acidosis, and lower than 7.0 means extreme acidosis (life-threatening). If VBG test shows a blood pH of less than 7.30, then higher intake of alkalizing foods according to Table 1 can help with reaching optimal pH levels (4).

It has been hypothesized that alkalization therapy using dietary modifications can reduce the risk of cancer, help with cancer prevention, and be beneficiary for cancer patients. A research study found that survival rates of cancer patients who had a high intake of alkalizing foods was longer, compared to patients who did not. Hence, they suggested that alkalization therapy may be associated with more favorable treatment outcomes in cancer patients (32, 33). As cancer has an acid-producing nature according to the Warburg Hypothesis (4), some research studies looked into alkalization therapy for cancer using dietary interventions. The researchers studied several case reports and made observation-based evaluations. Many female cancer patients were found to have a high or regular intake of sweet cakes with lots of cheese and cream (acid-forming).

In Wada et al.'s study, in a cancer patient,changing diet to only vegetables and brown rice as a low-calorie and alkalizing plant-based diet could gradually lead to overcoming an advanced cancer (34). In another 84 years old male cancer patient after 4 months of consuming an alkalizing diet, the tumor development in the renal pelvis of the right kidney significantly decreased (34). In another 76 years old female patient with gastric malignant lymphoma, the tumor disappeared after two and a half years of alkalizing diet (34). In another 64 years old male patient with gastric cancer and multiple liver metastases who consumed a diet rich in milk, dairy products and cheese (acid-forming), after changing diet to vegetables and fruits (alkaline-producing) and self-cookings, as well as using some alkalizing agents, in one year and three months, gastric endoscopy showed all cancers to disappear(34). Another female cancer patient who was very fond of sweets, changing to a healthy and alkalizing diet led to treatment of her cancer (34). The authors suggested that approaching an alkalizing diet can be beneficial to prevent and control cancer occurrence and development (34).

A small-scale research study tested the effect of alkalizing foods (Table 1, considering only the modified Young's food classification) on human body by performing venous blood gas (VBG) tests before and after following an alkalizing diet among 10 volunteers (4). The volunteers were one patient with cancer in stage 3 (candidate no. 2), two patients with cyst (candidates 3 and 4), one patient with cancer in stage 2 (candidate no. 6) and others with different conditions. The indicators related to adherence to this type of diet showed a significant improvement in VBG particularly the blood pH, as hypothesized before (4, 35). This study was the first that used and tested this kind of diet (35). The data from the VBG analysis were shown in Figure 1 as a diagnostic diagram for venous blood pH versus oxygen saturation. The blood pH and oxygen saturation showed a significantly improvement after alkalinization treatment, especially for candidate #2, whose venous blood pH was initially very acidic (pH=6.86), but the alkalizing diet within three months helped her reach an optimal blood pH of 7.43, indicating the successful overcoming of acidosis (4).

So dietary patterns that are high in acid-forming foods such as animal proteins, trans or saturated fats, high artificial sugars, refined carbohydrates, processed grains, caffeine, artificially sweetened beverages, and vitamin/mineral supplements resulted in an increased acid load in the body and increased risk of cancer (4, 34, 35). Conversely, a healthy balanced diet rich in alkalizing foods such as on-tree sun-ripened fruits, fresh raw vegetables, and unprocessed nuts, seeds, whole grains, legumes,

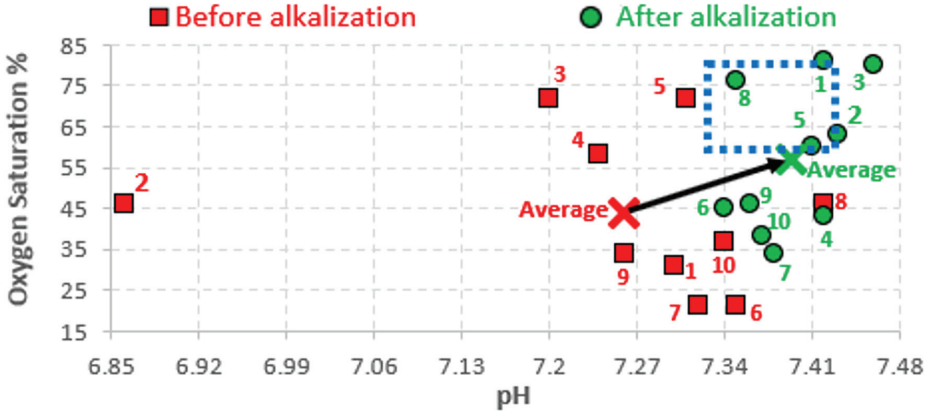

Figure 1: Comparison of venous blood gas parameters before and after the alkalizing diet (3). The red data points present before the alkalization treatment, the green points demonstrate after, and the dotted blue rectangle shows the normal range.

and healthy fats such as olive oil can help maintain a normal level of blood acidity and reduce the risk of cancer (4, 36-40).

Conclusion

A high intake of foods with positive dietary acid load may increase the risk of acidosis as a cancer risk factor. In contrast, adequate consumption of foods with a negative dietary acid load can help eliminate acidosis and maintain acid-base balance, which is beneficiary for cancer patients based on Warburg Hypothesis.

Acknowledgment

The study was performed independently, using the information in the publicly available references. Hence, ethical approval was not applicable for this study. This research did not receive any grant from funding agencies, commercial, or not-for-profit sectors. I would like to thank and show gratitude to Ted Greiner (World Nutrition), Thomas Corriher (Health-Wyze USA), Dr. Ali Karami (National foundation of healthy lifestyle), Majid Tafrihi (University of Mazandaran), Lucas Waters, and Adam Black for their help and/or sharing valuable information that were used in the study.

Conflict of Interest

None declared.

References

1 Ziaian B, Montazeri V, Khazaiee R, et al. Esophageal cancer occurrence in Southeastern Iran. *J Res Med Sci.* 2010;15:290-1. PMID: 21526098.

2 Park YM, Steck SE, Fung TT, et al. Higher diet-dependent acid load is associated with risk of breast cancer: Findings from the sister study. *Int J Cancer.* 2019;144:1834-1843. DOI:10.1002/ijc.31889. PMID: 30247761.

3 Keramati M, Kheirouri S, Musazadeh V, et al. Association of High Dietary Acid Load With the Risk of Cancer: A Systematic Review and Meta-Analysis of Observational Studies. *Front Nutr.* 2022;9:816797. DOI:10.3389/fnut.2022.816797. PMID: 35419387.

4 Bahrami H, Tafrihi M. Greiner T. A small-scale test of whether alkalizing diets can reduce the risk of disease as predicted by the Warburg Hypothesis. *World Nutr.* 2023. DOI:10.26596/wn.20231443-15.

5 Bahrami H, Tafrihi M, & Mohamadzadeh S. Reversing the Warburg effect to control cancer: A review of diet-based solutions. *J Curr Oncology Med Sci.* 2023.

6 Rezaianzadeh A, Peacock J, Reidpath D, et al. Survival analysis of 1148 women diagnosed with breast cancer in Southern Iran. *BMC Cancer.* 2009;9:168. DOI: 10.1186/1471-2407-9-168. PMID: 19497131.

7 Otto A.M. Warburg effect(s)—a biographical sketch of Otto Warburg and his impacts on tumor metabolism. *Cancer Metab.* 2016;4:5. DOI:10.1186/s40170-016-0145-9.

8 Apple S. An old idea, Revived: Starve Cancer to Death. The New York Times. https://www.nytimes.com/2016/05/15/magazine/warburg-effect-an-old-idea-revived-starve-cancer-to-death.html?searchResultPosition=1. Accessed 2016.

9 Liberti MV, Locasale JW. The Warburg Effect: How Does it Benefit Cancer Cells? *Trends Biochem Sci.* 2016;41:211-218. DOI:10.1016/j.tibs.2015.12.001. PMID: 26778478.

10 Bahrami H, Tafrihi M. Understanding the Warburg Effect Yields New Insights into the Metabolic Control of Cancer. *J Cancer Rese Updates.* 2023;12:44-48. DOI:10.30683/1929-2279.2023.12.8.

11 Bunz, F. Principals of Cancer Genetics.

Dordrecht: Springer; 2016. DOI:10.1007/978-94-017-7484-0.
12 Bahrami H, Greiner T. The Alkaline Diet and the Warburg Effect. *World Nutr J.* 2021. DOI:10.26596/wn.202112120-39.
13 McMullen MK. Many foods are more acid-forming than acid-alkaline formulas indicate. *Nutr Health*. 2023:2601060231200677. DOI:10.1177/02601060231200677. PMID: 37700671.
14 Remer TF. Potential renal acid load of foods and its influence on urine pH. *J Am Diet Assoc.* 1995;95:791-7. DOI: 10.1016/S0002-8223(95)00219-7. PMID: 7797810.
15 Ausman LM, Oliver ML, Goldin BR, et al. Estimated net acid excretion inversely correlates with urine pH in vegans, lacto-ovo vegetarians, and omnivores. *J Ren Nutr.* 2008;18:456-65. DOI: 10.1053/j.jrn.2008.04.007. PMID: 18721741.
16 Bio-Practica. The PRAL Table: a clinical guide for assessing dietary acid levels. https://inaturally.com.au/wp-content/uploads/2020/04/The-PRAL-Table.pdf. Accessed 2018.
17 Parmenter BH, Dymock M, et al. Performance of predictive equations and biochemical measures quantifying net endogenous acid production and the potential renal acid load. *Kidney Int Rep.* 2020;5:1738-1745. DOI: 10.1016/j.ekir.2020.07.026. PMID: 33102966.
18 Storz MA, Ronco AL. The 1995 potential renal acid load (PRAL) values may no longer adequately reflect the actual acid-base impact of certain foods: A hypothesis. *Nutr Health*. 2023;29:363-368. DOI:10.1177/02601060231164667. PMID: 36922789.
19 Young R. (2002). The pH Miracle. Warner Books. ISBN 978-0-446-52809-2. 2002.
20 U.S. Department of Health and Human Services. CLIA regulation of unestablished laboratory tests' https://permanent.fdlp.gov/gpo73443/oei-05-00-00250.pdf. Accessed 2001.
21 Hosseini SV, Niknahad H, Fakhar N, et al. The healing effect of honey, putty, vitriol and olive oil in psudomonas areoginosa infected burns in experiental rat model. *Asian J Anim Vet Adv.* 2011;6:572-579. DOI: 10.3923/ajava.2011.572.579.
22 Nejabat M, Astaneh AR, Eghtedari M, et al. Effect of honey in pseudomonas aeruginosa induced stromal keratitis in rabbits. *J Appl Anim Res.* 2009;35:33-36. DOI: 10.1080/09712119.2009.9706996.
23 Kanis JA, Johansson H, Johnell O, et al. Alcohol intake as a risk factor for fracture. *Osteoporos Int*. 2005;16:737-42. DOI: 10.1007/s00198-004-1734-y. PMID: 15455194.
24 Abbass MMS, El-Baz DA. The effect of daily intake of green coffee bean extract as compared to Agiolax® on the alveolar bone of albino rats. *Dent Med Probl*. 2018;55:125-131. DOI: 10.17219/dmp/90983. PMID: 30152614.
25 Dai Z, Jin A, Soh AZ, Ang LW, et al. Coffee and tea drinking in relation to risk of hip fracture in the Singapore Chinese Health Study. *Bone*. 2018;112:51-57. DOI: 10.1016/j.bone.2018.04.010. PMID: 29660426.
26 Kiel, DP, Felson DT, Hannan MT, et al. Caffeine and the risk of hip fracture: the Framingham study. *Am J Epidemiol*. 1990;132:675-84. DOI: 10.1093/oxfordjournals.aje.a115709.
27 The 'doctor' behind the alkaline diet is facing jail time. Fox News. https://www.foxnews.com/health/the-doctor-behind-the-alkaline-diet-is-facing-jail-time. Accessed January 31, 2017.
28 Figueroa T. pH Miracle author Robert Young ordered to pay cancer patient $US105 million. https://www.afr.com/world/north-america/ph-miracle-author-robert-young-ordered-to-pay-cancer-patient-us105-million-20181105-h17i9u. Accessed November 5, 2018.
29 Sunardi D, Chandra DN, Medise, Bernie EM, et al. Health effects of alkaline, oxygenated, and demineralized water compared to mineral water among healthy population: a systematic review. *Rev Environ Health*. 2022 Dec 27. DOI: 10.1515/reveh-2022-0057. PMID: 36571558.
30 Corriher SC. PH food chart. The Health Wyze Report. https://healthwyze.org/reports/191-ph-food-chart. Accessed October 3, 2009.
31 Picco MF. Can heartburn drugs lead to vitamin B-12 deficiency? https://www.mayoclinic.org/diseases-conditions/gerd/expert-answers/heartburn-meds-and-b12/faq-20348628. Accessed June 25, 2022.
32 Osuna-Padilla IA, Leal-Escobar G, Garza-García CA, et al. Dietary Acid Load: mechanisms and evidence of its health repercussions. *Nefrologia (Engl Ed).* 2019;39:343-354. DOI: 10.1016/j.nefro.2018.10.005. PMID: 30737117.
33 Isowa M, Hamaguchi R, Narui R, et al. Effects of alkalization therapy on hepatocellular carcinoma: a retrospective study. *Front Oncol*. 2023;13:1179049. DOI:10.3389/fonc.2023.1179049. PMID: 37313464.
34 Wada H, Hamaguchi R, Narui R, et al. Meaning and Significance of "Alkalization Therapy for Cancer". *Front Oncol*. 2022;12:920843. DOI:10.3389/fonc.2022.920843. PMID: 35965526.
35 Greiner T. Introduction to World Nutrition. *World Nutrition*. 2023;14:4. DOI:10.26596/

wn.20231441-2.
36 Fabiani R, Minelli L, Bertarelli G, et al. A western dietary pattern increases prostate cancer risk: A systematic review and meta-analysis. *Nutrients*. 2016;8626. DOI: 10.3390/nu8100626. PMID: 27754328.
37 Nutrients from food, not supplements, linked to lower risks of death, cancer. https://now.tufts.edu/2019/04/09/nutrients-food-not-supplements-linked-lower-risks-death-cancer. Accessed 2019.
38 Wholegrains, vegetables and fruit and the risk of cancer. https://www.wcrf.org/wp-content/uploads/2020/12/Wholegrains-veg-and-fruit.pdf. Accessed 2018.
39 Wu S, Fisher-Hoch SP, Reininger BM, et al. Fruit and vegetable intake is inversely associated with cancer risk in Mexican-Americans. *Nutr Cancer.* 2019;71:1254-1262. DOI:10.1080/01635581.2019.1603315. PMID: 31017487.
40 Saberi-Firoozi M, Khademolhosseini F, Yousefi M, et al. Risk factors of gastroesophageal reflux disease in Shiraz, southern Iran. *World J Gastroenterol.* 2007;13:5486-91. DOI: 10.3748/wjg.v13.i41.5486. PMID: 17907293.