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Effect of a novel dietary supplement on pH levels of healthy volunteers: a pilot study

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Abstract

OBJECTIVE—To examine the effects of a greens alkalizing dietary supplement on urinary pH levels in individuals with lower than average pH levels.

METHODS—The present study investigated the effects of an alkalizing formula (Reserveage Wholeganic Greens™) on four individuals who had average urinary pH levels below 6.0 for three consecutive days. Following the three-day, baseline period, participants received Reserveage Wholeganic Greens™ for four consecutive days and were instructed to continue to measure their urine pH levels. Paired samples *t*-tests were used to examine pH levels before and after a four day treatment period with Reserveage Wholeganic Greens™.

RESULTS—Compared to baseline, mean urine pH levels in all volunteers were significantly higher following the supplementation with Reserveage Wholeganic Greens™ (5.89 ± 0.20 vs 5.56 ± 0.23 ; $P < 0.01$). Participants' pH levels were also significantly higher than baseline on days 5, 6, and 7 of the treatment period ($P < 0.05$). Noteworthy, on day 7, participants' mean pH levels were significantly higher than at the beginning of the treatment period (6.03 ± 0.15 at day 7 vs 5.65 ± 0.24 at day 4; $P < 0.01$).

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Competing interests

Some authors have conflicts of interest to declare. Ginny Bank serves as a scientific advisor and a consultant for the company RFI Ingredients, LLC, the developer and manufacturer of the Greens product used in this trial. The author has not received personal financial gain from sales of the Greens product. All findings and views expressed in this paper are those of the authors and do not necessarily reflect the views of the RFI, LLC. Drs. Anton and Hausenblas serve as scientific advisors and as consultants for the company ReBody, LLC, which is an affiliate of Reserve Life Nutrition, LLC, the distributor of a Greens product. Neither author has received personal financial gain from sales of this product. All findings and views expressed in this paper are those of the authors and do not necessarily reflect the views of the Reserve Life Nutrition, LLC. There are no other disclaimers to mention.

CONCLUSION—The findings of this study suggest that supplementation with Reserveage Wholeganic Greens™ has an alkalizing effect on the body and can increase the urine pH levels in individuals with lower than average pH levels.

Keywords

Greens; Urinalysis; Alkalizing Enhancement; Metabolic Acidosis

1 Introduction

Metabolic acidosis, which is typically indicated by a urine pH level below 5.3 in adults, is found in a large portion of the population and is the result of an excess accumulation of acid in the body fluids^[1,2]. Common symptoms of metabolic acidosis include fatigue, anorexia, confusion, tachycardia, tachypnea, and dehydration. These symptoms can become increasingly more serious as the condition progresses and the consequences can include pulmonary vasoconstriction, ventricular failure, myocardial depression, hyperkalemia, and hypercalciuria^[3]. There are also health problems associated with the loss of minerals used to neutralize the increased acid levels, which can negatively affect the teeth, bones, hair, fingernails, skin, and gums^[4–8]. Acidification can also lead to overall fatigue, sensitivity to cold, and a weakened immune system^[9]. Over time, high acid levels within the body can increase the risk for hyperurecemia (an abnormally high level of uric acid within the blood), which in turn can increase the risk for a number of serious health conditions including hypertension, renal diseases, and cardiovascular disease^[10].

Metabolic acidosis can be caused by a variety of factors including untreated diabetes, the buildup of lactic acid, and severe diarrhea^[2]. Aging also affects metabolic acidosis due to the physiological decline in kidney function^[11]. Dietary intake can directly contribute to metabolic acidosis, because foods are composed of acidic and/or alkaline elements^[12–17]. Dietary-induced metabolic acidosis is a major health concern for Westernized societies, because Westernized diets typically include acidic or acidifying elements such as meat, cereals, coffee, tea, alcohol, and sugars, and not enough alkaline foods such as fruits and vegetables^[15]. Chronic, low-grade, dietary induced-metabolic acidosis may also contribute to impairments of numerous bodily functions including bone strength and endocrine function^[16].

In normal acid-base physiology, urine pH levels range from 4.6 to 8.0, with 6.0 being average^[18]. Urine pH is currently rarely used to examine metabolic acidosis in the clinic. Yet, recent research has confirmed that metabolic acidosis markers include low serum bicarbonate, high serum anion gap, hypocitraturia, and low urine pH^[11]. Therefore, long-term occurrence of lower than normal urinary pH may be an indicator of diet-induced metabolic acidosis and thus may represent a state of compromised health^[11]. Clinical, long-term pathophysiological effects of dietary-induced acidosis, indicated by low urine pH levels, should be recognized and potentially counterbalanced by dietary means^[17].

Observational studies indicate that a diet higher in fruits and vegetables and lower in protein is associated with a more alkaline pH level^[19,20]. Few clinical trials, however, have tested the effects of specific dietary elements, such as fruits and vegetables or alkalizing dietary

supplements, on pH levels within the body. Dietary interventions with alkaline mineral supplements, plant-based supplements, and different macronutrient compositions have been shown to increase urine pH levels in healthy individuals^[21–23]. For example, a week long study by König and colleagues investigated the effect of a multimineral supplement rich in alkaline minerals (including potassium, calcium, magnesium, and sodium) on the acute and chronic regulation of acid-base balance. Results from this study indicated that both men and women who ingested a daily dose of the multimineral supplement (30 g per day) had a significant increase in both urinary and serum pH levels^[21]. In a study conducted by Berardi and colleagues, healthy adults were given two servings of one tablespoon of a plant-based product per day for two weeks. This study revealed that the consumption of the plant-based dietary product for seven consecutive days significantly increased the participants' urinary pH levels^[22].

Although findings from initial studies suggest that alkalizing foods and supplements can increase pH levels, to our knowledge, no study has tested the effects of an alkalizing dietary supplement in select individuals with documented pH levels below 6.0. Additionally, no study has documented the time course effects of daily supplementation with an alkalizing dietary supplement on changes in urinary pH levels in individuals with documented pH levels below 6.0. For the purposes of this study, we tested the effects of a novel dietary supplement, Reserveage Wholeganic Greens™, on urine pH levels among individuals with lower than average urine pH (i.e., < 6.0). We hypothesized that the use of this alkalizing dietary supplement would significantly increase pH levels in individuals with low pH levels, and therefore help them move into a healthier acid-base balance.

2 Methods

2.1 Participants

Participants were 4 adults (two men and two women) who had pH levels below 6.0. The body mass index of the participants ranged from 23.9 to 29.8 kg/m², and their age ranged from 24 to 54 years. All participants signed an informed consent. Due to the minimal risk associated with the food-based product tested and short-term nature of the study, ethical board approval was not required.

2.2 Procedure

A total of eight adult volunteers were recruited and enrolled in the present study. Participants were asked to record the pH of their urine, immediately after waking and before consumption of food or drink, for 3 d. The participants were instructed to measure their pH levels using handheld pH meters (Hanna Instruments pHep® pH Tester model HI 98107), which have been found to quantify pH levels within ± 0.1 accuracy^[24]. Four of the eight volunteers had pH levels below 6.0 on all three assessment days (days 1 – 3) and therefore were asked to continue participation in this study. These four participants were instructed to continue measuring and recording their pH levels in the mornings for the following four days (days 4 – 7) and to record this data in a log and return it to the study office at the end of the trial. On the night of day 3, these four participants were directed to consume one serving (7 g) of Reserveage Wholeganic Greens™ and to continue to consume one serving of

Reserveage Wholeganic Greens™ at night for the next three days. Each serving was premeasured and was added to water to make a drink. The participants were instructed to consume the Greens formula just prior to going to bed and not to ingest any food or drink following the supplementation. These participants completed pH measurements for seven consecutive days (days 1 – 7) and consumed a total of four servings of Reserveage Wholeganic Greens™ over four days (days 3 – 6).

2.3 Measures

A pH value is an expression of the acidity or alkalinity of a solution on a logarithmic scale from 0 to 14 and is a measure of the hydrogen ion concentration of that solution. The levels of pH levels in the body can be measured in either the serum or the urine. While measuring serum pH is the best way to assess an individual's overall pH balance, urinary pH generally reflects the serum pH, is a good indicator of the acid-base status, and is much easier to monitor^[21]. Urine pH allows for the rapid calculation of the acid-base status in the body. This technique is also less invasive to the participant. Additionally, urine pH is a good indicator of the effects of dietary intake on pH^[19].

2.4 Materials

Reserveage Wholeganic Greens™ is a certified organic food supplement (7 g/serving), which consists of a proprietary blend of alkalizing organic whole food vegetables, fiber, algae, and fermented cereal grasses. Some of these ingredients include: kale powder, broccoli powder, spinach powder, carrot powder, parsley powder, dulse, fiberorganic chia seed powder, inulin powder, sea algaeorganic spirulina, barley grass, wheat grass, oat grass, and alfalfa grass. The product also contains digestive enzymes and probiotics, such as protease, amylase, bromelain, cellulase, lactase, lipase, *Lactobacillus acidophilus*, *Bifidobacterium longum*, *Lactobacillus casei*, and *Lactobacillus rhamnosus*.

2.5 Statistical analyses

Descriptive statistics, mean \pm standard deviation, were used to summarize the urine pH levels for the four volunteers who completed the entire study. Paired *t*-tests were used to determine if there was a significant improvement in the mean urine pH levels between the baseline period (days 1 – 3) and the supplementation period (days 4 – 7). Statistical significance was set at a *P* value of 0.05. Similar tests were also performed to investigate the change in mean urine pH levels over times (baseline, day 4, 5, 6 and 7). SAS version 9.2 was used for all analyses.

3 Results

The pH levels of the participants were significantly higher following supplementation with Reserveage Wholeganic Greens™ (days 4 – 7) compared to the baseline time period (days 1 – 3) (5.89 ± 0.20 vs 5.56 ± 0.23 ; $P < 0.01$). As compared to baseline levels, participants' pH levels were significantly higher at day 5 (5.80 ± 0.35 ; $P < 0.05$), day 6 (6.10 ± 0.12 ; $P < 0.01$), and day 7 (6.03 ± 0.15 ; $P < 0.01$). However, there were no differences in pH levels at day 4 compared to baseline (5.65 ± 0.24 at day 4 vs 5.56 ± 0.23 at baseline; $P > 0.05$). The mean pH level of participants at day 7 (the end of treatment) was significantly higher than at

day 4 (6.03 ± 0.15 at day 7 vs 5.65 ± 0.24 at day 4; $P < 0.01$). Figure 1 depicts the results of the pH measurements during and after supplementation with Reserveage Wholeganic Greens™ for all participants.

4 Discussion

The present study investigated the effects of a dietary greens supplement, Reserveage Wholeganic Greens™, on urinary pH levels in individuals with less than average pH levels. There were a few key findings. First, the mean pH levels of participants progressively increased during a four day supplementation period as compared to baseline levels. Noteworthy, by day 7, the mean pH levels of participants was above 6.0 and within the normal range of urinary pH. Additionally, participants' pH levels were significantly higher at day 7 than at the beginning of the treatment period (day 4). Therefore, the present study's findings indicate that dietary supplementation with a natural greens product can be an effective method to increase pH levels within a short period of time.

Dietary intake has a direct effect on the internal pH because foods are composed of, and therefore broken down into, elements with different pH levels. These elements then enter the bodily fluids and can alter the overall pH balance. As previously mentioned, foods with high fat or high protein composition tend to be acidifying agents, while foods such as fruits and vegetables tend to increase alkaline levels within the body^[19,20]. Previous studies have shown that dietary interventions with different macronutrient compositions, plant-based supplements, and alkaline mineral supplements can influence the urine pH levels of healthy individuals^[21–23]. For example, Reddy and colleagues evaluated the effect of a low-carbohydrate, high-protein diet on urine pH on 10 healthy subjects in an intervention that lasted six weeks^[23]. It was found that the low-carbohydrate, high-protein diet significantly decreased urine pH (and thus, made it more acidic). In contrast, Berardi and colleagues found a statistically significant increase in the mean urine pH levels in 34 healthy participants after a 14-day intervention with a plant-based nutritional supplement^[22]. Similarly, König and colleagues reported a statistically significant increase in urine pH in 25 participants who received a multi-mineral supplement rich in alkaline minerals for seven days^[21].

A strength of this study relative to previous studies was its novel study design, which allowed for the detection of time course effects on changes in urine pH in participants with less than average urine pH levels (who are thus at a higher risk for metabolic acidosis) over the period of one week. Thus, the immediate effects of supplementation with Reserveage Wholeganic Greens™ supplement could be observed. Additionally, all participants reported strong adherence to the protocol, and the observed effects of consuming the dietary supplement were consistent across all participants. A few limitations of this study include the small population size, the self-recorded measurement of urine pH, and the short length of the study. This small, pilot study comprised a sample of convenience. Future research conducted in large-scale clinical trials with more diverse participant populations is recommended. Measurement of both dietary intake and water consumption would have been helpful in evaluating the independent effects of the dietary supplement on urinary pH levels, and thus it is recommended that future studies control for the potential influences of these

factors. The intervention period for this study was limited to four days since the goal of this study was to observe the immediate, short-term effects of this dietary supplement on urine pH levels. Further investigation of the effect of the Reserveage Wholeganic Greens™ supplement on urine pH over longer periods of time is recommended. This would allow for a time-dependent relationship between the supplement and pH levels to be established, the magnitude of the pH increase to be determined, and the safety of the dietary supplement to be further evaluated.

5 Conclusions

In summary, the findings of this study suggest that the novel dietary supplement, Reserveage Wholeganic Greens™, may help individuals with lower than average pH levels (< 6.0) move into a healthier acid-base balance. The urinary pH levels of all participants' increased after supplementation and remained higher than baseline levels throughout the treatment period. Thus, the findings of this study suggest this unique dietary supplement, Reserveage Wholeganic Greens™, can quickly increase pH levels of individuals with documented low pH levels and therefore may be helpful to individuals with conditions related to low pH levels, such as metabolic acidosis.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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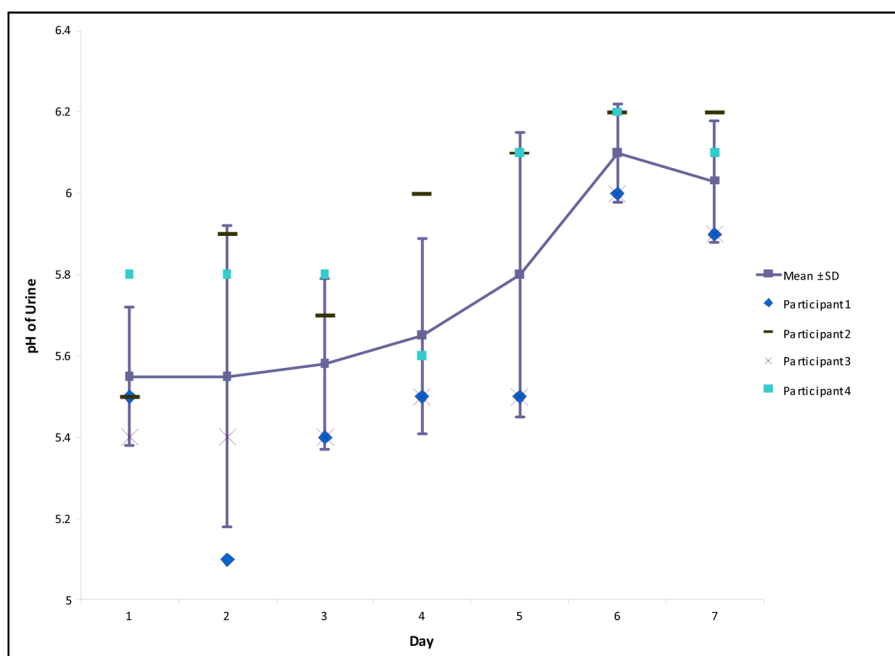


Figure 1.
pH measurements during and after supplementation with Reserveage Wholeganic Greens™