

**Clinical Study to Assess the Effect of
Apple Cider Vinegar on the Systemic pH
of Humans**

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ABSTRACT

Objective: To assess the effect of apple cider vinegar on the systemic pH of a human patient determined to be alkaline through urine pH testing, subjective and objective symptomatology, and salivary pH testing.

Design: Clinical study of 30 patients determined to be symptomatic using 15 subjects as a control group and 15 subjects as a test group. In each group the subjects were given a container filled with a substance which was unknown to the subjects. Subjects were randomly assigned to either the test group or the control group and either given apple cider vinegar or water respectively. Both groups were given identical instructions on how to take their unknown for the next five weeks.

Outcome Measures: Urinary and salivary pH, blood pressure, weight, respiration rate, and a subjective survey of symptomatology were monitored over a period of five weeks.

Results: Subjects in the test group demonstrated a lowering of their salivary and urinary pH that peaked out at the three week point. The test group also showed a decrease in severity and number of symptoms on the subjective survey of symptomatology. The subjects in the control group showed a variety of changes due mostly to confounding variables. However, as a whole the group showed no consistent change in any of the methods used to determine outcome.

Conclusion: The use of apple cider vinegar to decrease or alleviate such symptoms that are on the subjective survey of symptomatology is safe and valid for

the average consumer. Apple cider vinegar can be used as an alternative to typical over-the-counter medications that most people use everyday such as antacids, aspirin and other pain relieving medications, anti-histamines and many others. However, it was found that the odor and taste of apple cider vinegar is offensive to some and as such many object to using it as an alternative to typical medicines.

INTRODUCTION

It is indispensable to establish the normal acid-base interrelation in the human body's fluids. The body's various systems must maintain strict pH values with only small amounts of fluctuation or these systems will cease to function properly. In the stomach the normal pH is approximately 1 to 2. While in the cardiovascular system, blood has a pH between 7.35 and 7.45, anything out of this range can cause serious problems.

The concentration of hydrogen ions in the bloodstream determines the acid-base balance (pH) of the blood. Proteins help to regulate the amount of free hydrogen ions by accepting or donating hydrogen ions. This regulation helps to keep the blood pH fairly constant, within the range of 7.35-7.45. Compounds that act to keep pH within this narrow pH range are called buffers. (Wardlaw--Perspectives in Nutrition).

Clinical explanation of acid-base status is based on changes in the concentration of the extracellular electrolytes: H^+ , HCO_3^- , Na^+ , Cl^- , and K^+ . These electrolytes disperse rapidly between plasma and interstitial fluids through the capillary membrane. Extracellular fluids yield the immediate surrounding of the other cells and communicate with the external environment by way of the lungs, kidneys and the gastrointestinal tract. It is imperative to continue a balance between input and output while also regulating electrolyte concentrations.

An examination of the extracellular fluids reveals that bicarbonate is present there in significant amounts. It can be shown that 97-98% of the buffering that is done in the extracellular fluids results from reactions with bicarbonate to maintain the pH balance in these fluids. (James L. Gamble--Acid/Base Physiology).

In the biology of humans we are interested in the behavior of weak acids and weak bases, which are not absolutely ionized when dissolved in H_2O (water). An example of a weak acid is acetic acid, which gives vinegar its acidic taste. (Lehinger--Principles of Biochemistry). Interactions of these weak acids and weak bases are constantly changing to maintain the proper pH balance in our bodies.

Alkalosis occurs when the body is too alkaline or in other words, too basic. It can be the result of excessive intake of alkaline drugs such as sodium bicarbonate

which is used in the treatment of gastritis and peptic ulcers. It can also result from extreme amounts of vomiting, high cholesterol, endocrine imbalances, poor diet, excessive diarrhea and osteoarthritis. The symptoms of alkalosis include sore muscles, crepitis in the joints, bursitis, bone spurs, drowsiness, protruding eyes, hypertension, hypothermia, seizures, edema, allergies, night cramps, asthma, chronic indigestion, night coughs, vomiting, menstrual problems, constipation and skin thickening with burning and itching sensations.

Diet has a mild affect on the acid-base balance in the body. Foods high in protein frequently contain much sulfur and phosphorus. These ions remain after the rest of the protein is metabolized and it eventually forms acids in the body, mostly sulfuric and phosphoric acid. These acids will cause a slight decrease in the blood's pH.

Most fruits and vegetables create a more alkaline effect. These foods contain sodium and potassium ions that are often attached to acids. When food is metabolized, these two ions remain and eventually form sodium hydroxide and potassium hydroxide, two bases.

Although fruits contain acids, their metabolism results in the formation of bases. Because sulfur, phosphorus, sodium and potassium ions are the residue of a metabolic "burning" process, they are known as acid ash and alkaline ash products. In either case, physiological mechanisms compensate for their effect on the body's pH balance. (Wardlow--Perspectives in Nutrition).

Methods

Sample Size

The sample size that was chosen for this study was 30 subjects. This size was chosen because there was enough statistical power from the sample size to detect any statistically significant results.

Subjects

Subject selection began with an initial survey form that had 36 symptoms that were associated with systemic alkalinity (see figure 1). The subjects that were given this survey consisted of students at Logan College of Chiropractic trimesters 1-10.

From the results of these surveys 30 subject were randomly selected to have their urine pH and salivary pH tested.

<i>Acid / Alkalinity Survey</i>	
Please place an " X " in the box in front of any symptom(s) or problem(s) you currently have.	
<input type="checkbox"/> Migratory aches & Pains	<input type="checkbox"/> Psoriasis
<input type="checkbox"/> Neurological or Muscular pain	<input type="checkbox"/> Pale complexion
<input type="checkbox"/> General achy feeling	<input type="checkbox"/> Anemia
<input type="checkbox"/> Cold hands or feet	<input type="checkbox"/> Low blood pressure
<input type="checkbox"/> Poor circulation	<input type="checkbox"/> Tire easily
<input type="checkbox"/> Numbness in the extremities	<input type="checkbox"/> Often feel exhausted
<input type="checkbox"/> Fingers, Legs or Feet may go to "Sleep" easily	<input type="checkbox"/> Low blood sugar
<input type="checkbox"/> Frequent urination day & night but more often at night	<input type="checkbox"/> Tend to be nervous or High strung
<input type="checkbox"/> Loss of sexual desire	<input type="checkbox"/> Under weight
<input type="checkbox"/> Headaches (including Migraines)	<input type="checkbox"/> Overweight
<input type="checkbox"/> Easily Nauseated	<input type="checkbox"/> Varicose veins
<input type="checkbox"/> Slow digestion	<input type="checkbox"/> Cold sweats
<input type="checkbox"/> Sour stomach & Gas	<input type="checkbox"/> Allergies
<input type="checkbox"/> Frequent Heartburn or Belching	<input type="checkbox"/> Brittle hair &/or Nails
<input type="checkbox"/> Runny Nose	<input type="checkbox"/> Dry, itchy skin
<input type="checkbox"/> Puffy ankles or edema	<input type="checkbox"/> Constipation with attacks of loose bowels
<input type="checkbox"/> Asthma	<input type="checkbox"/> Frequent infections/colds
<input type="checkbox"/> Eczema	<input type="checkbox"/> Do not sweat easily

Figure 1

Inclusion criteria for this study consisted of a score of 10 out of the 36 possible responses, having a urine pH of greater than 6.8, and having an acid saliva using a litmus paper test.

The selected group of 30 individual was now randomly divided into 2 groups of 15. One of these groups would become the control group and the other the experimental group. All the members of this group were informed of this study and volunteered to participate. The subjects agreed to a 4 week treatment and an informed consent was obtained from each subject by one of the researchers.

The control group consisted of 9 females and 6 males, while the experimental group consisted of 11 females and 4 males. All these subject were from the St. Louis, MO metropolitan area.

Treatment Protocol

While the control group received only water and no vinegar, the experimental group received 1 tablespoon of apple cider vinegar in 4 ounces of water 3 times a day with meals. Every week for the duration of the experiment each subject had the following measured to note any changes: Blood pressure, respiration rate, weight, and a subjective survey form about the conditions that they had on the screening survey and any other changes that they may have noticed while on the treatment protocol (see figure 2). On the survey form, each patient was asked to make a mark regarding their symptom on a visual analog scale 10 cm in length.

Review of Symptoms

Subject Number _____ Salivary Litmus paper color _____ Urinary pH _____
Blood Pressure _____ Respiration rate _____ Weight (Lbs) _____

Please place an "X" in the box of a symptom you currently have or had when you filled out the original questionnaire. Now place a mark on the line next to the symptom indicating the severity of the symptom currently. The side with the ♣ indicates that the symptom is better and the side with the ♠ indicates the symptom is worse. If the symptom does not apply to you please mark the box N/A.

- Migratory Aches & pains ♠ _____ ♣
N/A
- Neurological or Muscular pain ♠ _____ ♣
N/A
- General Achy feeling ♠ _____ ♣
N/A
- Cold Hands or Feet ♠ _____ ♣
N/A
- Poor Circulation ♠ _____ ♣
N/A
- Numbness in the extremities ♠ _____ ♣
N/A
- Fingers, Legs or feet go to
"sleep" easily ♠ _____ ♣
N/A
- Frequent urination day and
night but more often at night ♠ _____ ♣
N/A
- Loss of sexual desire ♠ _____ ♣
N/A
- Headaches ♠ _____ ♣
N/A
- Easily nauseated ♠ _____ ♣
N/A

Figure 2

RESULTS

The most common complaints from the subjects on the initial survey form were Migratory aches and pains, general achy feeling, cold hands or feet, fingers, legs or feet may go to "sleep" easily, loss of sexual desire, slow digestion, sour stomach and gas, frequent heartburn or belching, allergies, frequent infections or colds, tire easily, and often feel exhausted. Of these, the following had the most improvement with the apple-cider vinegar treatment protocol, migratory aches and pains, general achy feeling, cold hands or feet, slow digestion, sour stomach and gas, frequent heartburn or belching, and frequent infections or colds.

The most common amount of subjective improvement noted by the patients on the visual analog scale was 5 to 7 points or centimeters. Twelve of the 15 experimental subjects had this amount of improvement with at least 1 or more of their symptoms.

In 8 of the 15 experimental subjects there was a noticeable elevation of the systolic blood pressure of 10 to 15 millimeters of mercury and 6-8 millimeters of mercury for the diastolic pressure. There was no reportable affect on any of the patients' respiration rate or weight just normal daily fluctuations.

It should be noted that the patient compliance was poor after the second or third week of the study. This caused the results for the third and fourth week to be somewhat ambiguous. The results for the compliant patients continued to improve while those that failed to follow the treatment regimen had a return or an increase in their symptomatology. This fact did have one positive result. It further demonstrated a relationship between the ingestion of the apple-cider vinegar and an associated decrease in their symptomatology, because when the patient stopped taking the daily vinegar dose their symptoms returned or had an associated increase.

Finally, it should be noted that 4 of the 15 patients that were given the experimental protocol were forced to stop participating in the experiment due to problems with the vinegar. The first of these problems was the patients' inability to correctly follow the treatment protocol instructions they were given for the proper administration of the vinegar. They attempted to swallow an entire undiluted tablespoon of the vinegar which resulted in the becoming ill and not wanting to participate in the study further. The other problem was a reaction to the vinegar itself which resulted in the patient having flu-like symptoms and becoming ill.

CONCLUSION

The overall results tend to support the conclusion that the ingestion of small amounts of apple-cider vinegar with meals will lead to a decrease in the severity or the elimination of the symptomatology that is associated with an abnormal systemic alkalinity.

The subjective survey sheet proved to be a useful screening test to find subjects with hypotension or low blood pressure. Our results showed that out of the 30 subjects recruited 27 had sphygmometer readings between 102/68 and 106/74.

This study also showed that for patients with certain symptomatology such as migratory aches and pains, a general achy feeling, cold hands or feet, slow digestion, sour stomach and gas, frequent heartburn or belching, dry, itchy skin, and frequent infections or colds, apple-cider vinegar is very effective in reducing or eliminating these symptoms. It had some affect on other symptoms in the initial survey but the preceding symptoms were the most prominently affected.

One problem that was encountered during the course of this study was that a small group of subjects became ill with flu-like symptoms after they had begun taking the prescribed amount of apple-cider vinegar and experienced a temporary increase in the symptoms that they had when entering the study. Upon further research a "Stomach Acid Self Test" was found and in this article it explained the test by saying to 'take a tablespoon of apple-cider vinegar with your next meal. If this causes your heartburn to go away, then you need more stomach acid. If it makes the symptoms worse, then you have too much stomach acid and you shouldn't take enzymes containing HCL or other acids. (Balch & Balch-- Prescription for Nutritional Healing).

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