

Lab # 1 Affects of Preparation Treatments on Fruits and Vegetables

Kayla Slater
Heather Brown
Clarinda Lain
Stephanie May

I. Purpose of Experiment

The purpose of this experiment was to test the effects on broccoli's color, texture, and integrity changes based on the application of different heating times (boiling for 4-15 minutes) and each cooking solution's pH (Vinegar-4, baking soda-8, and distilled water-7.).

II. Methodology

A. Variables, Measurements, and Products

Independent variables:

Acid (Vinegar): Added in the beginning

Base (Baking Soda): Added at the beginning

Distilled Water: Used in all methods

Dependent variables:

Texture

Color (liquid and product)

Shape/Integrity

Sample product: Broccoli Florets

B. Procedures of the Experiment

Effects of Cooking Treatments on Vegetables: Prepare five solutions for the broccoli treatment and test their pH values. The first and second treatments were distilled water with separate cooking times (4 and 15 minutes). The third treatment consisted of distilled

water and baking soda that boiled the broccoli for four minutes. The fourth solution was a mixture of vinegar and distilled water, again boiling the broccoli for four minutes until fork tender. The fifth treatment steamed the broccoli in a steamer pan with distilled water for four minutes. The final treatment cooked the broccoli in the microwave for 40 seconds in distilled water. The products of these solutions were compared to the original uncooked product based on their color, texture, and integrity differences.

III. Results

A. Description of Data

The first treatment with distilled water resulted in a product that was a vibrant green color, had a crisp texture and maintained its original integrity. When the second sample of broccoli was again cooked in distilled water for 15 more minutes the product lost color, integrity and gained a mushy texture. The third sample of broccoli was cooked in baking soda for four minutes which resulted in broccoli that again lost color and completely lost its integrity resulting in a very mushy texture. Product four was olive green, tough, and maintained its original shape after being boiled for four minutes in the vinegar solution. The fifth sample of broccoli was steamed using distilled water and resulted in a product that was bright green, had a crisp texture, and its original integrity was unchanged. The broccoli that was cooked in the microwave with distilled water lost some of its initial color while remaining crisp and in its original shape.

B. Tables/Charts

Treatment/Cooking Time	pH of cooking solution	Color of cooking liquid	Color of product	Texture	Shape/ Integrity
A1	7	Very light yellow tint	Vibrant green	crisp	Original, not changed
A2	7	Very light yellow/green tint	Green	mushy	wilted
B	8	Light green/yellow	Green	Very mushy	Not changed
C	4	Almost clear	Olive green	tough	Not changed
D	7	Very yellow pale	Bright green	crisp	Not changed
E	7	none	green	Firm, crisp	Not changed

IV. Discussion

A. The effect of heat on the structure (texture) of vegetables

When heat is applied to vegetables structural changes occur as the plant cell begins to break down. The softening of cellulose causes a reduction in turgor pressure as a result of water loss. Turgor pressure is determined by the capacity of the plant to maintain air between its cells. An increase in turgor pressure increases the crispness of a plant (Brown, 2011, 287). This is why when heat is applied to vegetables they soften.

In this experiment broccoli A1 and A2 were used to show the impact of heat on plant cell integrity. Sample A1 was cooked in distilled water for four minutes with sample A2. After four minutes sample A1 was removed, while A2 remained in the simmering water for 15 more minutes. As a result of the increased cook time

for sample A2, broccoli was mushier than sample A1. Sample A2 was mushier due to the fact that it lost more turgor pressure as a result of the excess heat applied.

B. The effect of pH value on the color and texture of vegetables

As the pH deviates from a neutral state in a cooking solution the product changes from its original color and texture. Adding an acid to a cooking solution creates a tougher product and darker color because of the pectin within the plant cells, increasing the heating time (Brown, 2011, 287). Pectin is a thickening agent, often used in jams and jellies, which create a tough exterior in plants when cooked in acidic solutions (Brown, 2011, 271).

Basic cooking solutions results in a brighter color, but a mushy texture because it makes the products more water soluble. As a result of excess water intake the vegetable loses its original texture and become mushy (Brown, 2011, 287).

The effect of the pH values on vegetables can be seen in products B and C in this experiment. Product B was cooked in a basic solution which resulted in a mushy and vibrant green broccoli floret. After being cooked in an acidic solution product C became tough and varied from its original green color to olive green.

C. Effect of different cooking methods on flavor, color, and nutrient retention of vegetables.

Various cooking methods such as simmering, steaming, and microwaving have different impacts on the flavor, color, and nutrient retention of vegetables.

Simmering uses a relative amount of water which may reduce the overall flavor of the finished product. Some of the flavor, color, and nutrients may be lost from

leaching. To prevent from this during simmering, a minimal amount of water should be used to reduce leaching (Brown, 2011, 290). Steaming takes longer than simmering, but is a better choice to cook vegetables because it provides a better retention of flavor, texture, and color. It retains flavor and color better because it requires less water than steaming and lower heat (Brown, 2011, 290). Microwaving is the best choice to cook vegetables because it retains flavor, texture, color, and nutrient content since it requires little water and is fast enough to minimize loss of quality (Brown, 2011, 290).

In our experiment, product A1, A2, B, and C were simmered, D was steamed, and E was microwaved. We can assume D and E lost less flavor, color, and nutrients since less water was used, they retained their color, and were not as mushy.

V. Conclusions and Implications/Applications

Heat effects the structure (texture) of vegetables because heat reduces turgor, softening cellulose resulting in softening the vegetables. The pH affects the texture and color of the product. Adding an acid will toughen the product because of pectin and darken the color. Adding a basic solution will result in a mushy, but a brighter color because of the changes of the chlorophyll pigments. Steaming, simmering, and microwaving each have different effects on cooking vegetables due to the amount of water, heat, cooking time.

From these findings, we can conclude that the best way to cook vegetables is with as little water as possible, the shortest cooking time possible, and lower heat to better retain color, texture, flavor, and nutrients.

VI. References

Brown, A. (2011, 2008). *Understanding Food Principles and Preparation* (4th ed.)

Belmont, CA: Wadsworth.