

Is Preparing Certain Foods in an Air-Fryer a More Effective Method of Preparation for Time-Efficiency, Cleanliness and Healthy Eating in Comparison to Using a Standard Oven

Abstract:

An air-fryer, in its essence, is very similar to that of a standard oven. Both an air-fryer and electric oven use heat in a closed-spaced compartment where radiating heat surrounding the food, cooks it. There are differences however. The air-fryer is designed to circulate air flow originating from the top of the fryer to the bottom. This aerodynamic design helps give the food within the basket of the air fryer the texture and feel of deep-fried food, without the use of oil. The purpose of the experiment is to determine if this innovative derivation of a standard oven, convenient for those with a busy lifestyle or looking for a healthier method of eating "fried" foods. The experiment uses breaded chicken (chicken tenders) and potatoes (french fries) as the foods to be tested. Foods were put in both air-fryer and oven. They were compared in cooking timing and texture of food. It was found from the experiment, that indeed the air-fryer was able to achieve the texture of fried foods. The results imply that the use of an air-fryer can be quite attractive to many would-be consumers. Those tight on time and those who would like to indulge in "greasy and fried" without the actual grease and oil. The air-fryer has been recently getting much attention from those conscious of timing, healthy eating and even greenhouse emissions.

Introduction:

Technological innovation has always had the goal of being more convenient for use, than its predecessor. As technology becomes more sophisticated through innovation it gains the ability to suit individual needs. The air-fryer is an example of this. Electric ovens are a standard kitchen appliance used by many and is a result of innovation from the brick oven. The air-fryer is now the innovative result from the electric oven suiting certain needs. The air-fryer, in its essence is like the oven, it produces heat and cooks the food. It is engineered and designed to use its small chamber to reduce cooking time, cleaning, and give a nice crispy texture to the food. The air-fryer is suited for those looking for not only convenience but also looking to add a crispy texture to their food without the use of oil. The goal of the experiment is to determine how effective the air-fryer really is to suit the needs of those who look for time-efficiency, easy clean-up and eating healthier. For the experiment, the foods used are what one would typically see in fast-food menus. The experiment uses chicken (to make chicken tenders), potatoes (to make french fries). The timing to make the foods are compared along with a description of texture of the foods. Studies done show that, due to the elimination of oil, air-fryers provides healthy eating. Healthy eating results in greatly reducing cholesterol, blood sugar and risk of heart attack [2]. Healthier recipe alternatives to most fatty foods are widely available as well. Also, air-fryers have been seen to be more energy efficient in comparisons to ovens that on average run on 2,400 watts. Air-fryers also is seen to reduce greenhouse gas emissions [3]. Indeed, the air-fryer has its many advantages and can fit the needs of many.

Materials:

It should be noted that for the foods being tested and cooked, the same environment, instruments and thickness of foods have been considered and applied. The foods used were 400 grams of Idaho white potatoes, 200 grams of boneless chicken breasts and 20 grams of 4C Bread Crumbs. The air fryer was a Phillips Airfryer XXL model HD96030. Within the air fryer itself, it consisted of a basket with a mesh bottom. The basket has an approximate weight capacity of 0.8 kg and a volume of 2,888 cm³. On the outside of the air fryer there was a temperature knob and time dial. Other materials used were a weight scale and alarm.

Procedure:

Chicken:

Air-Fryer Trial 1- The chicken is first weighed and cut, if needed, to fit the 200 grams requirement. Then without the use of oil, the chicken was tenderized atop of the 20 grams of bread crumbs. The air-fryer's temperature knob has been set 350 degrees Fahrenheit and set at a time recommended by the manufacturer

for chicken, 25 minutes. The timing dial was set to 25 minutes, but for the sake of accuracy the egg timer was set to 25 minutes as well. Also, by recommendation, the air fryer was to be pre-heated at 350 degrees Fahrenheit. The chicken was spaced evenly atop the 19 cm x 19 cm mesh bottom and the cooking began. After the 25 minutes, the basket was taken out the compartment and chicken taken out. The chicken was well-fried throughout. Figure 1 shows comparison between both chicken tenders' groups.

Oven Trial 1- The chicken again was taken from the pre-cut package and weighed to 200 grams. The chicken was then tenderized atop of the bread crumbs and placed in an oven-safe pan. The oven was then set to 350 degrees Fahrenheit and allowed to heat for 10 minutes; after so the chicken was placed in for 25 minutes. When the time was up the chicken was well-cooked but soggy. The topside facing portions of the chicken was soggy and the bottom was less soggy but slightly fried. Figure 1 shows comparison between both chicken tenders' groups.

Potatoes:

Air-Fryer Trial 2- The potatoes were weighed to 404 grams and cut as close to $\frac{1}{2}$ " x $\frac{1}{2}$ " as possible, with no considerable size difference. The now french fries, was then washed and placed in a coriander to wash away the starches present on the potatoes. The oven has already heated to 350 degrees Fahrenheit and so the french fries were placed in the oven for 25 minutes. The fries were taken out and was found to be well-fried. Figure 2 compares both french fries' groups.

Oven Trial 2- The potatoes were weighed to 401 grams and cut as close to $\frac{1}{2}$ " x $\frac{1}{2}$ " as possible, with no considerable size difference. Was washed and air-fryer set to pre-heat at 350 degrees Fahrenheit. The fries were then placed in the oven for 25 minutes. Upon the 25 minutes mark, the potatoes were still rough and raw on the surface and so an additional 20 minutes was set; found in Figure 2a. After the 20-minute mark, an additional 10 minutes was added, due to several fries having a raw feel; found in Figure 2b. Figure 2c compares finished results of both trials.

Results:

Looking at the french fries' cook timing results, it is evident that in the air fryer, it has been able to achieve the crispy texture of french fries and done in a timely manner. The air fryer was 46% more efficient in timing in comparison of the time needed for the oven trial. In Figure 2a and 2b, the results of the trial shows that additional time was needed to cook the fries, while in Figure 2c (to the right) the fries were fried throughout and edible in 25 minutes. For the chicken, at a time of 25 minutes, both trials were able to achieve edibility and juiciness however, in the oven trial the tenders were soggy and moist. Referring to Figure 1 on the left, the tenders on one side was soggy but on the other side slightly fired. Comparing this to the air fryer result, to the right, the tender seems much more fried. However, upon inspection and taste the chicken was placed in for a little too long and was a tad dry. One could extrapolate that the actual cooking time for the chicken in an air fryer is probably a minute or two less.



Figure 1: Picture to the left is Oven Trial 1. Picture to the right is Air-Fryer Trial 1.

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Figure 2: Pictures 2a, 2b and 2c are of Oven Trial 2. 2a. French fries at the 25-minute mark. 2b. French fries with additional time of 20 minutes. 2c. French fries at the final addition in timing of 10 minutes. 2d. French fries from Air-Fryer Trial 2.

The Phillips Airfryer XXL model HD96030 uses 1425 Watts. The standard units used in the United States for power is in Kilowatt-Hour. An electric oven can range from 5000 – 2000 watts. For comparison, the average was taken with equation 1.

Equation 1: $\frac{a1+a2+\dots+an}{n}$

Equation 2: $\frac{kWh * hours\ of\ use\ per\ day}{1000} * 30\ days * 12\ months * \$0.12/kWh$

Only two terms are used and so the average is $\frac{5000\ watts+2000\ watts}{2} = 3,500\ watts$.

Roughly estimating use of the electric oven for making french fries we use equation 2. The watt hour for the average electric stove therefore is 3,500 kWh and the hours used is 1. The product is 3.5 kWh per day. The average number of days in a month is 30 days and so the product of 3.5 kWh and 30 days is 105 kWh per month. The average cost for power in New York City is \$0.18/kWh but throughout the United States it is

\$0.12/kWh [1]. The product of 105kWh and the average power cost in the United States is \$12.60 per month. In a year it is \$151.2.

For the chicken tenders only half the hour was used. Using equation 2, the power use for making chicken tenders is \$75.60. Table 2 compares the prices for uses.

The costs for using an air fryer yearly, using equation 2, for the both the chicken and potatoes is \$61.56.

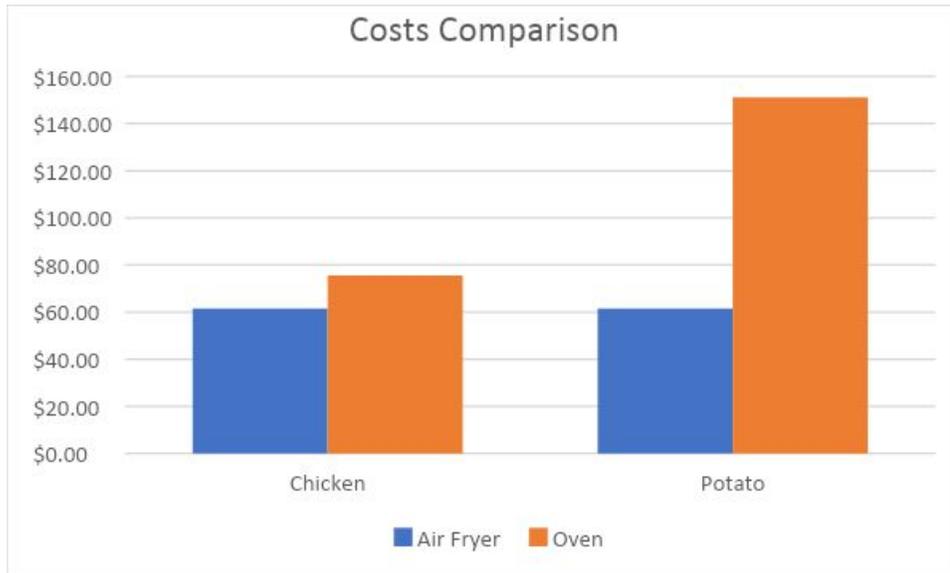


Table 1: Table shows the comparison of costs between the two cooking mediums.

Analysis:

There should be some clarification into some aspects of the experiment and of results that may be hazy. It is obvious that given the volume of the basket within the air fryer, the oven can indeed hold more food and weight. It should be emphasized however, that the experiment was set to determine how well the air fryer stood against the oven to fit specific individual needs; healthy eating and timing (cleaning and cooking) were the goals. Other than the faster cook time, the air-fryer was also successful in achieving the crispy texture that one would expect from oil drenched foods. In Oven Trial 2, additional time was needed in order to “fry” the potatoes and resulted in a sum of 55 minutes. As a result, the air fryer was able to achieve the fries’ crispy texture and edibility at a 46% decrease in time. Also, the Air-Fryer Trial 2 yielded fries that were not only crispy but still had the potato taste and still had actual potato in them. Oven Trial 2 resulted in fries that felt like the insides were just of air. The air fryer results for both trials show that the air fryer was indeed the better medium for “fast food”.

The data from Table 1 indicates that for the chicken, in a yearly basis, the costs are nearly the same. However, when comparing costs to a denser food, like potatoes, the cost is cut by more than half the cost for the oven use. The cost of an air fryer can range from \$100 - \$300. In two years, the air fryer would have already been paid for, when using only a conventional oven.

The results in this experiment show how close air fried food is to that of fast food. When showed side by side the look and texture of the foods are incomparable. Time-efficiency is evident in comparing the Air-Fryer Trial 2 and Oven Trial 2. The potatoes in the air fryer was made crispy in 25 minutes. The potatoes from the oven however took nearly an hour. The air fryer has been able to mimic the texture of fast food in a timely manner and most importantly has done so without the use of oil. This is important because in the United States more than about one-third of adults are classified as obese [2]. This alarming statistic comes from the

availability of fast food and its convenience. However, the results of this experiment show that not only is the air fryer convenient, but it also eliminates the use of oil and inspire healthy eating. Healthy eating may be life changing as it may reduce cholesterol levels, blood sugar levels and decreases the risk of heart attacks [3]. The air fryer is a good alternative as a cooking medium that also has benefits in helping the environment. In a 2017 study, researchers have concluded that the use of air frying vs conventional means of making potato chips had a significant decrease in Carbon-Dioxide emissions due to energy use [4]. The study, like this experiment, uses potatoes to emphasis how clean and effective the air fryer can be.

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