Definitive Study of Bagel Baking During COVID-19 Isolation

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Purpose of the Study
The author recently posted on Facebook a photograph of a batch of bagels he had baked. That posting came into criticism for not having data about the batch considering my roll in helping teach journalists methods of computer-assisted reporting through conferences sponsored by the National Institute for Advanced Reporting held at Indiana University-Purdue University Indianapolis.

This study is a response to that criticism.[1]



[1] One noted complainer was Chris Feola.

Methodology
Bagel making incorporates both science and art. The scientific baker tries to control variables that are controllable so that results are consistent from batch to batch. Serious bakers weigh ingredients rather than using measuring cups. Art comes into the process in trying to make the finished bagels more visually appealing. Are they uniformly round? Is the hole a consistent diameter? Is the hole in the true center? Is the height consistent? Would they meet the test of a New York City bagel connoisseur?

Since humans are social, we would like for our friends to have a similar esthetic and taste experience when they follow our recipe of ingredients and instructions. In other words, is the bagel baking experience repeatable? This study is a beginning effort is standardizing bagel making methods and thus, make marked improvement in the experience of looking at bagels (aesthetics), baking bagels (science) and in moving social media to have more articles on bagel making than conspiracy theories. This paper won't solve all of the world's problems but it makes a dramatic and significant effort.

In previous batches, the author's bagels weighed random amounts at approximately 130 grams or less. For this study, as many bagels in the batch as possible were made at 125.0 grams. This batch of dough made 11 bagels at 125 grams; the 12th bagel weighed only 106 grams. Keep that in mind as you study the data.

Finished bagel measurements were made with digital calipers.[2] Bagels were placed close to the edge of the counter so that the counter edge could be a visual approximation when placing the calipers at 90 degrees and at 45 degrees to the counter edge. Four diameter measurements were made. Measurements were made by visually directing the mass of the bagel, using the bar of the digital calipers to find the approximate angle. The height of the bagels were measured with the digital calipers at the highest point in the circumference, determined visually. Measurements of holes in the bagels were not measured since the silicone cones standardized the size of the holes.

Boiling times, two bagels at a time was 30 seconds, plus or minus 1.3247 seconds. The time was set by the vocal utterance of Hey Siri, set timer 30 seconds.[3] All 12 bagels were boiled in a total elapsed time of 4 minutes, 30 seconds.

Analysis was conducted using the Apple Numbers app. In calculating the standard deviation, the STDEVP statistic was used for the standard deviation since the total population of bagels was available.[4]

All 12 bagels were included in the analysis, including the undersized one.

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[2] Wixey Digital Calipers with Fractions. https://www.amazon.com/Wixey-WR100-Digital-Calipers-Fractions/dp/B001PTGBR6/ref=sr_1_5?dchild=1&keywords=digital+caliper+wixey&qid=1612560562&sr=8-5

[3] For non-Apple readers, Siri is a miniaturized person living inside your iPhone who answers just about any question you may have. She can take directions too, such as setting a timer.

[4] From the Numbers app—"The STDEVP function returns the standard deviation—a measure of dispersion—of a set of numeric values based on their population (true) variance."

Table 1 Data Measurements for Bagel Baking

Bagel	Diameter 1 mm	Diameter 2 mm	Diameter 3 mm	Diameter 4 mm	Mean mm	Standard Deviation of the Diameter Measurements (mm)	Height in mm	Weight of dough in grams
1	113.5	104.35	100.6	113.05	107.875	5.56	47.1	125
2	122.55	103.1	97.3	121.2	111.0375	11.04	42.2	125
3	111.4	108.1	103.6	108.5	107.9	2.79	43.05	125
4	117.65	104.1	99.8	102.95	106.125	6.84	45.5	125
5	114.15	110.4	103.7	107.95	109.05	3.80	44.45	125
6	101.75	109.1	117.2	111	109.7625	5.51	44.6	125
7	102.75	110.35	117.9	107.6	109.65	5.49	43.15	125
8	107.9	109.3	106.8	106.2	107.55	1.18	45.7	125
9	120	114.10	84.45	114.7	108.3125	13.97	42.65	125
10	110.25	103.1	104.15	103.1	105.15	2.98	44.5	125
11	107.9	112	109.65	108.15	109.425	1.63	42.9	125
12	104.75	96.7	95.8	104.55	100.45	4.21	47.6	106
							Avg. Height Across Bagels	
							44.45	
							Std. Dev. of Population	
							1.68	

Discussion

The standard deviation of the four measurements of diameter varied considerably (see Table 1). This was probably due to the relative inexperience of the author in bagel making. Indeed, some of the holes, although standardized in size due to the silicone baking cones[5], were off center. This was due to some imprecision in pressing the dough over the top of the cone. Some of the bagels had several notches in their perimeter, clearly not a good look aesthetically.

[5] https://www.amazon.com/gp/product/B01LO0KFJK/ref=ppx_yo_dt_b_asin_title_o03_s00?ie=UTF8&psc=1

Remarkably, the height of the bagels, including the undersized bagel #12 was very consistent with a standard deviation of only 1.68 mm. Bagel #12, the 106 gram one, was the highest at 47.6 mm. It also had the smallest mean diameter at 100.45 mm.

Repeating the Experiment
If this bagel experiment is to replicated successfully, the same recipe of ingredients and instructions must be followed. This recipe was passed to the author by Steve Sweitzer, an experienced bagel maker and eater who worked for years trying to make the perfect bagel. He augmented the instructions from his source so I will refer to the process used in this experiment as the Sweitzer Method.[6]

Ingredients were measured according to the instructions in the recipe. The white flour used was Harvest Hotel and Restaurant all-purpose flour (Costco) and the whole wheat flour used was Bob's Red Mill 100% Stone Ground. Those researchers who want to replicate this study should use these particular flours.

The flours used were relatively clean and did not have even close to the federal government allowable limits of rodent droppings or insect parts.

Those bagel researchers wishing to replicate the study should follow the Sweitzer Method, which is outlined in the Appendix.

Suggestions for Further Study
More research is needed on different types of stoves. Would the results obtained persist over convection, gas and electric stoves? Could a Scout reproduce the results with a Dutch oven on a camping trip? Would there be a difference using charcoal briquettes vs. hard wood coals as a heat source for the Dutch oven? A pellet-fired grill might improve the taste by imparting a hint of smoke to the bagels. Then again, the smoking might ruin the taste. So much is as yet unknown.

Finished bagels could be scanned and printed with a 3-d printer for further analysis of dimensions. Future measurement instruments may have better accuracy than the digital calipers used. However, 3d printed bagels should not be subjected to taste tests. One problem with the present method of analysis is that the bagels were soon consumed, preventing future study. Archaeologists have an advantage over bagelologists in this regard. Bones and other artifacts are relatively permanent.

With assistants and multiple pots of boiling water, al 12 bagels could be boiled simultaneously thus eliminating any variance caused by the total elapsed time for boiling in this study of 4 minutes, 30 seconds. Some bagels got more rest after boiling than others. The effect of the additional resting is unknown and is possible fertile ground for future study.

Is bagel #12 an outlier or not? A hypothesis for future study is: no matter the weight of the dough, the height of the baked bagel will not be significantly different from the others in the batch. This question alone, may be worth of a doctoral dissertation.

Acknowledgement
The author is grateful to not have suggestions from fellow data devotees, Steve Ross, Tom Johnson and Chris Feola, prior to publication. They would have torn the manuscript apart.

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[6] Steve Sweitzer found the original recipe in Bread Bible, p. 152

Further they might have stolen my idea and rushed to publish their results first. They would have ripped the Pulitzer from my hands.

Bibliography
The bibliography is noticeably sparse since this is the first known bagel measurement study.

1. Beranbaum, R. L. (2003). The Bread Bible. New York, W. W. Norton & Company.

2. Sweitzer, S. (2021). How I Make Bagels. J. W. Brown. Indianapolis.

Appendix (Equipment and Recipe)

Equipment
- Kitchen Aid mixer with dough hook
- Digital kitchen scale capable of measuring grams
- Digital Calipers for measuring dimensions
- Silicon bagel cones
- Oil
- Refrigerator
- Stove
- Pot
- Ladle

Recipe
INGREDIENTS
Sponge
156 g Whole Wheat flour
312 g King Arthur Bread flour
1 t Yeast
531 g water

Flour mixture
52 g Whole Wheat flour
335 g King Arthur Bread flour
1 t Yeast
1 T Malt powder
1 T Sugar
1 T Salt
1 t Ground Pepper

Dough
3 T Butter
1/3 C add if needed, King Arthur Bread flour[7]
½ C Sunflower Seeds

Boiling
2 T Molasses
1 T Baking Soda

1 egg beaten with T water
Sesame Seeds or desired topping

DIRECTIONS
Sponge
Mix with Kitchen Aid for 2 minutes. Scrape down from the side.

Flour mixture

[7] In the last three batches of bagels made by the author, including the batch for this study, no additional flour was needed.

Add on top of the sponge. Cover, let sit for an hour and then refrigerate overnight.

Dough
Add Butter and up to 1/2 cup Bread Flour. Mix with a dough hook in the Kitchen Aid. Once the dough is combined, mix on #2 for a total of 4 minutes.

Add Sunflower seeds after 2 minutes.

It should be slightly sticky and pull away from the sides of the bowl.

Oil bowl, cover and refrigerate for 24 hours.

Shape
Remove dough from fridge and let come to room temperature - at least an hour.

Shape dough into a log - at least a foot long.

Cut into 12 pieces - cut in 1/2, then 1/2 again and finally into three pieces - about 130 - 140 grams each.

Shape into 12 round balls and then flatten. The flattened ball should be about 3" in diameter.

Oil the King Arthur cones and then press the cone through the dough balls.

Allow to rise for :30 to :60.

Cook
Heat to a boil a large pan of water - deep enough to cover bagels.

Add molasses and baking soda.

Drop the bagels into the boiling water and boil for 30 - 60 seconds, the longer the boil the thicker the crust.[8]

Whisk together the egg and 1 T water.
Brush bagel with egg and dust with sesame seeds.
Bake
Preheat the oven to 450°
Bake at 450° for 5 minutes.
Bake a 400° for 5 minutes
Bake a 350° for 10 minutes
Turn heat off for 5 minutes
Crack the oven door for 5 minutes.

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[8] The Sweitzer method uses silicone bagel cones, which tend to float in the boiling water. Use a ladle to flow boiling water over the bagels.