

*USU Extension Grant 2018-2019*

**Title:** Food safety of low-acid pressure canning in electric programmable pressure cookers

**Discipline:** Family and Consumer Sciences

**Personnel:** Family and Consumer Sciences

Project Leader: Cathy Merrill, A00376061, Utah County

Collaborators:

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**Project Duration:** April 1, 2018, through December 31, 2019

**Total Amount Requested:** \$8,400

**Abstract:**

Electric programmable pressure cookers (“smart cookers”) advertise safe low acid pressure canning capabilities, despite USDA recommendations against them due to potential botulism risk. Using thermal processing datalogging, three units will be tracked internally to see if they can attain correct USDA low acid canning temperatures and pressures for Utah.

## **Introduction:**

Due to the astounding popularity of the multi-function Instant Pot electric programmable pressure cooker (EPPC), the EPPC industry made \$268.4 million from October 2016 to October 2017 (LaVito, 2017). The popular Instant Pot blog has 783,000 followers. To gain a competitive edge on the Instant Pot, rival manufacturers are using additional features to sway potential buyers, such as the claim of push-button pressure canning for low acid foods.

The canning instructions associated with these cookers are as diverse as the manufacturers. While many manuals quote USDA times for processing the food (Carey, or Power Pressure Cooker XL), others merely have the automatic canning button (GoWise USA), and still other units have no instructions or automatic canning buttons, but Amazon reviews of these units show people use them for canning anyway. At this point, there is no researched documentation on whether these units can attain and sustain enough pressure to create the high temperatures required to safely can low acid foods, or whether the times given by the USDA are sufficient to safely can in these units. The National Center for Home Food Preservation (NCHFP) has issued a statement that the EPPCs are not recommended for low acid pressure canning (NCHFP, "Can I can in a multi-canner," 2014). The concern is manufacturers advertising the ease and health benefits of their cookers and the public being largely unaware of the NCHFP stand.

Pressure canning times are determined by the amount of time at or above a specific temperature needed to destroy *Clostridium botulinum* spores in a bottled or canned product. The heat up time, the time at maximum temperature, and the cool down time all figure into the

calculation for safe thermal processing (Etzel, Willmore & Ingham, 2015). A USU Extension EPPC brand comparison study in 2015 (Haws, Hunsaker, Proctor, Serfustini, & Allen, 2015) discovered only one EPPC capable of reaching 15 pounds of pressure, a USDA requirement for safe low acid canning above 3,000 feet.

The intent of this grant is to evaluate USDA recommended processes for low acid canning in three popular EPPCs at three altitudes in Utah. The analysis of this data will give a comparison of expected and actual temperatures reached during recommended processing times. This will help evaluate the appropriateness of using EPPCs to safely can low acid foods in Utah. This preliminary study addresses the USDA priority area of food safety and the Extension mandate to do research that will improve the lives of Utah citizens.

### **Review of Literature:**

The Instant Pot, a multi-function electric programmable pressure cooker (EPPC), was one of Amazon's top five best sellers this year, and the bestselling kitchen appliance in 2017 (Thulin, 2017). The multi-function EPPC market grew 68% from 2016, and the sales from October 2016 through October 2017 were \$264.5 million (LaVito, 2017). The USDA Complete Guide to Home Canning times were established for a specified size of home stove top pressure canners (E. Andress, personal communication, December, 2017). The *C. botulinum* lethality times were determined using the heat-up and cool-down times as well as the time at pressure. Lethality during the long home canner cool-down cycle is between 30 – 40% (Andress, December, 2017, personal communication; Etzel, et al., 2015). If the heat-up and cool-down times for the EPPCs are different than the stove top canners, the canned food has the potential of being over- or under-processed. The concern then is the risk associated with under-processed food and the viability of *C. botulinum* spores.

Long ago Extension published canning times for different sizes of stove top pressure cookers. Eventually the varying sizes of pressure cookers led to Extension recommending that no pressure canning be done in a pressure canner that held fewer than 4 upright quart jar (NCHFP, “Burning issue: Canning in pressure cookers,” 2015, September). Most of the electric pressure cookers are smaller than this definition, which gives an additional risk factor due to size. For this grant we will be using EPPCs that claim to fit 4 quart jars. If the claim is invalid, the canning will be done in pint jars for the sake of consistency.

Venting air in a pressure canner moves the cold air out of the canner, allowing it to completely fill with steam. Without proper venting there will be pockets of air, and uneven heating within the canning vessel, compromising the safety of the bottled product. Only one of the EPPCs surveyed mentions the need to vent the inner pot.

Altitude affects the ability of the canner to get above the temperature of boiling water. In a study in 2015 on EPPCs by USU Extension faculty, it was determined of the four popular cookers examined, only one reached 15 psi at Utah altitudes (Haws, et al., 2015). In a review of electric pressure cookers vs. stove top pressure cookers on the blog *Serious Eats*, the reviewer mentioned the electric pressure cookers “maxed out at 12 to 12.5 psi” (Serious Eats, “Best pressure cookers review,” 2016, August). If this is the case, then canning at 15 psi necessary for the higher altitudes of Utah may not be possible.

As mentioned in the introduction, if an EPPC claims a canning capability, many manufacturers use Ball or USDA canning information as a reference guide (Carey, Power Pressure Cooker XL, Della Magnifica or the Gourmia GPC625), although the NCHFP has specifically stated: “...we do not currently support the use of the USDA canning processes in electric, multi-cooker appliances.” (NCHFP, 2014, November. “Can I Can in a Multi-Cooker?”).

The position is reiterated and expanded upon in the companion article “Burning Issue: Canning in Pressure Cookers” (NCHFP, 2015, September).

The main concerns addressed by the NCHFP are:

1. No USDA thermal process work has been done inside an electric pressure cooker of any kind.
2. Unanswered questions about temperature due to altitude and venting, which are not addressed in appliance instructions.
3. Possible power inconsistencies in an electric appliance causing the temperature to fall below the required minimum during processing, and whether the consumer could monitor if the power drop had occurred.
4. Lethality is calculated including the heat up time, the time at pressure, and the cool down time. It is unknown whether EPPCs have the same process times, and there are too many appliances on the market to make a blanket judgment for all appliances.

### **Objectives:**

The objectives of this research are:

1. To test existing USDA low acid pressure canning recommendations using electric programmable pressure cookers (EPPCs) to determine if safe and expected canning temperature parameters can be met.
2. To test EPPCs at various Utah altitudes during this canning procedure to evaluate the use of EPPCs for low acid canning in Utah.

### **Procedures and methods:**

Using USDA guidelines, we will prepare three common canning foods in quart jars for press canning: green beans, dried pinto beans, and raw pack chicken breasts. This will test

common types of food with different heat penetration patterns. We will use three popular EPPCs that advertise low acid pressure canning as a highlighted feature, or that claim to fit four quart jars. We will test at three different Utah altitudes: St. George, 2,800 feet; Provo or Ogden, 4,500 feet; and Monticello, 7,000 feet.

Wireless data trackers will be used in each appliance and in each jar when foods are processed. A comparison of the actual temperature patterns to the expected patterns of approved thermal processing for low acid foods. Each food type will be bottled in each EPCC brand at each altitude (9 total combinations). Three complete replicates will be done for each combination. The maximum temperature reached and the time at or above 121.1° C will be compared to established values for safe home canning. Variability between the combinations of brands, altitudes, and food types will be evaluated using Analysis of Variance at the  $\alpha=0.05$  significance level.

**Target audiences:**

The target audience is:

1. Utah consumers who buy these units to do home pressure canning.
2. Extension professionals who answer questions about safe home canning methods.
3. Family and Consumer Sciences (FCS) educators who teach food safe preservation methods to students.

**Evaluation plan:**

Evaluation is made upon comparing the actual and expected temperature patterns of the low acid foods canned in the electric programmable pressure cookers (EPPCs) at low, medium and high altitudes in Utah. If the heat patterns are similar, then a more in-depth study will need to

be done to determine microbial lethality of the product in the jars. This study is to provide preliminary data.

**Anticipated outputs and outcomes:**

Extension Fact Sheets and peer-reviewed journal articles will be written about the safety of low-acid pressure canning in the EPPCs. Since the study is specifically focused on the advisability of using EPPCs at Utah altitudes, there will be opportunities to share the data through USU Extension social media and websites. Other Extension and Family and Consumer Sciences (FCS) professionals as well as food safety journals will be interested in the results. In conjunction with the 2012 study of EPPCs and altitudes, other journal articles could be submitted regarding the effect of altitude on electric pressure cooker functions.

If the EPPCs are deemed a significant health risk, media reports will be provided to warn against low-acid canning in these appliances.

**Plans for project beyond the duration of this grant:**

This experiment would not need further funding as it is a one-time study to evaluate the advisability of low acid pressure canning in electric programmable pressure cookers (EPPCs). However, more in-depth studies could be made developing new product timetables for pressure canning in the EPPCs and testing for microbial thermal death kill when pressure canning. These future projects would longer lasting and need funding either through industry or NIFA. For example, the Agriculture and Food Research Initiative Foundational Program grant (USDA-NIFA-AFRI-006351), or the National Institute of Health (NIH), or the USDA all have grants that could fund food safety projects.

**Plans to disseminate results and lessons learned within the USU Extension system:**

Results will be posted on the Extension website and presentations will be made in collaborators' counties. Results will also be disseminated by posters or presentations at professional conferences, as well as through peer reviewed journal articles in *The Journal of Extension*. Social media Extension outlets would also be used as an important source to reach the public.

**Collaborators' roles and responsibilities:**

Collaborators will take part setting up the experiment, doing the experiment, analyzing the data and preparing fact sheets, presentations, and articles from the results. The EPPCs will be tested in St. George (2,800) as the lowest altitude population center, then Provo or Ogden (4,500) as a medium altitude center, and Monticello (7,000) for high altitude processing. The collaborators will be responsible to take part in the test in the areas closest to their county base.

**Budget narrative:**

The cost of the experiment will be chiefly in equipment, time, and travel. The electrical programmable pressure cookers (EPPCs) to be used are currently selling between \$100 and \$200 each. The wireless data trackers, which require recalibration between tests, cost around \$800 each. Printing costs for a large poster, handouts, and Fact Sheets for county distribution, are between \$300 and \$400.

Given the popularity of the EPPCs as a kitchen appliance, after this project, the EPPCs can be safely used to do pressure *cooking* classes within the various counties. The wireless data trackers will also be of use in other projects.

**USU Extension Grants Program  
APPENDIX A - BUDGET TEMPLATE**

11.4.16

\*Fill in blue cells where applicable - budget will be calculated automatically

<b>Salaries</b>	
Graduate student support	\$0.00
Fringe benefits (0.8%)	\$0.00
Graduate student insurance*	\$0.00
Undergraduate student and payroll support	\$0.00
Fringe benefits (8.0%)	\$0.00
Technical or personnel (contract salary) support	\$0.00
Fringe benefits (46%)	\$0.00
<b>Subtotal for Salaries and Benefits</b>	\$0.00
<b>In-state Travel (to conduct research)</b>	\$0.00
<b>Test at three altitudes: 2,800; 4,500; 7,000</b>	\$2,000.00
<b>Materials/Supplies</b>	
<b>Printing for poster, handouts, etc.</b>	\$400.00
<b>Equipment</b>	
<b>Electric programmable pressure cookers</b>	\$600.00
<b>Wireless data loggers (3) \$800 each</b>	\$2,400.00
<b>Recalibration of data loggers 3 times, 3 locations</b>	\$1,000.00
<b>Food to test--3 foods, three times, 3 cookers, 3 locations</b>	\$2,000.00
<b>Other</b>	
<b>Subtotal</b>	\$8,400.00

**References:**

Etzel, M. R., Willmore, P., & Ingham, B. H. (2015). Heat penetration and thermocouple location in home canning. *Food Science & Nutrition*, 3(1), 25–31. <http://doi.org/10.1002/fsn3.185>

Haws, S., Hunsaker, T., Proctor, D., Serfustini, E., & Allen, K. (2015, July). *Brand comparison for electric programmable pressure cookers.*” (USU Extension Fact Sheet

FN/FoodPreparation/2015-01pr). Retrieved from

[https://digitalcommons.usu.edu/extension\\_curall/766/](https://digitalcommons.usu.edu/extension_curall/766/)

LaVito, A. (2017, November 27). “Instant Pot is so popular that it’s out of stock at numerous retailers.” *CNBC*. Retrieved from

<https://www.cnn.com/2017/11/27/instant-pot-is-so-popular-that-its-out-of-stock-at-numerous-retailers.html>

National Center for Home Food Preservation. (2015, September). “Burning issue: Canning in pressure cookers.” (2015, September). Retrieved from

<http://nchfp.uga.edu/publications/nchfp/factsheets/pressurecookers.html>

National Center for Home Food Preservation. (2014, November 25). “Can I can in a multi-cooker?” Retrieved from

<https://preservingfoodathome.com/2014/11/25/can-i-can-in-a-multi-cooker/>

Thulin, L. (2017, November 27). “The Instant Pot is now an entire economy and religion.”

Retrieved from

[http://www.slate.com/articles/technology/technology/2017/11/the\\_instant\\_pot\\_is\\_now\\_an\\_entire\\_economy\\_and\\_religion.html](http://www.slate.com/articles/technology/technology/2017/11/the_instant_pot_is_now_an_entire_economy_and_religion.html)