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Home Canning: Pressure Gauge Testing

Abstract
Nebraska Cooperative Extension provides dial gauge testing for pressure canners as part of educational programs on safe home food preservation. Results of dial gauge testing, conducted in a multi-county area over 25 years, demonstrate the need for annual dial gauge testing for accuracy to produce safe home processed food. Gauge testing provides Extension educators a "hook" to position themselves as the local food safety experts.

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Introduction

Many families continue to preserve food at home. This may be due to the prevalence of home gardens, cost savings, and the fact that families enjoy preserving specialty items to use as gifts. Families may prefer home grown produce over store bought items and want to know what they are eating.

The Complete Guide to Home Canning (USDA, 1989) and commercial resources (Alltrista Corporation, 1999) recommend that dial pressure gauges be checked for accuracy each year to ensure that the food is processed safely. Spores of *C. botulinum* may survive in the preserved food if an inadequate food processing method is used.

As part of the educational program to help home food processors preserve food safely, Nebraska Cooperative Extension offices provide pressure gauge testing of dial gauges on pressure canners. This educational activity allows Extension educators the opportunity to position themselves as local food safety experts.

Background

The Cooperative Extension System and USDA have been recognized as reliable sources for science-based recommendations for home food preservation. A recent survey (Andress, D'sa, Harrison, Kerr, Harrison, & Nummer, 2002) conducted by the newly established National Center for Home Food Preservation (Andress, 2000) reported that a high percentage of home food processors were using practices that put them at risk for food-borne illness. In their survey, approximately 25% of those who used a pressure canner had the dial gauge tested during that year.

The *Complete Guide to Home Canning* recommends that dial gauges be replaced if they read high or low by more than 1 pound at 5, 10, or 15 pounds of pressure (USDA, 1989). High readings indicate that the product is under processed and presents a food safety risk. Low readings cause over processing and may indicate that the accuracy of the gauge is unpredictable.

Methodology

Nebraska Cooperative Extension offices provide dial gauge testing for pressure canners as part of educational programs on home food preservation during the home preservation season. As part of the Brown-KeyaPaha-Rock Counties Extension food safety program, dial gauges for pressure canners have been tested for safety and data recorded from 1977 to 2002. Pressure gauge testing was done in the Extension offices, at county fairs, and as part of educational programs on food preservation. Consumers were informed of the availability of pressure gauge testing through local media.

A Presto Gauge Tester (National Presto Industries, Inc., Eau Claire, Wisconsin 54703) was used to measure the dial gauges of consumer pressure canners. The manufacturer's directions for the use of the gauge tester were followed. As the gauge tester increased in pressure to 20 pounds pressure, the consumer's gauge was evaluated at 5, 10, and 15 pounds pressure. As the pressure was reduced from 20 pounds to 0 pounds, the gauge was again evaluated for accuracy at 5, 10, and 15 pounds pressure. Data recorded were the differences at 5, 10, and 15 pounds and whether that difference was high or low. (For example, +2 was recorded if a gauge registered 12 pounds when the tester gauge registered 10 pounds.)

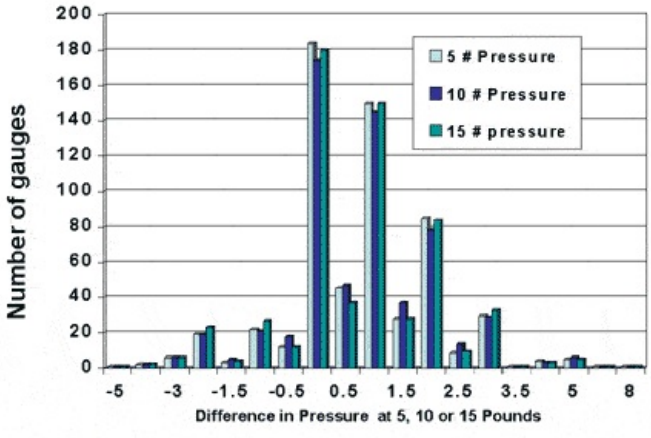
As part of the dial gauge testing, an educational sheet was provided for the consumer with the data and instructions on how to make adjustments if the gauge can be safely adjusted. Recommendations were made to replace a dial gauge if the gauge was off by more than 1 pound. The informational sheet also contained guidelines for proper use and care of a pressure canner. Additional educational materials, such as the Complete Guide to Home Canning (USDA, 1989), were made available for consumers to aid in proper processing of home canned food. Altitude adjustments were also emphasized.

Data was entered into a statistical program (SAS, 1989) and analyzed using ANOVA and LS means. Pressure differences were categorized as accurate (-1 to +1), tested high (>1), and tested low (<1). Some gauges did not register and data were not recorded other than the statement 'replace gauge.'

Results

Over the 25-year period, 634 pressure gauges were tested at 5, 10, and 15 pounds pressure. Pressure differences ranged from -5 to + 8 pounds (Figure 1). Pressure gauges were more accurate (or less likely to deviate) at 5 pounds pressure than at 10 and 15 pounds (not statistically significant). Processing is done more often at 10 and 15 pounds pressure, and accuracy at these pressures is very important for obtaining a safely processed product.

Figure 1.
Differences in Pressure at 5, 10, and 15 Pounds for Dial Gauges



After categorizing the pressure differences, 35.7% (average of gauges testing high, low and no data at 5, 10, and 15 pounds pressure) of the pressure gauges over the 25-year period were deemed inaccurate and in need of replacement (Table 1). The majority of the inaccurate gauges tested high (example: 26.8% at 10 pounds pressure). When a pressure gauge is testing high, the food product is not receiving the proper processing treatment. This, in turn, could result in a food product that is under processed and possibly a safety risk. For example, +2 pounds recording at the 10-pound pressure setting, would result in food being processed at 8 pounds of pressure. If an altitude adjustment needed to be made and was not done, the safety risk would be increased. At the location where these gauges were tested, an altitude adjustment of 2 pounds is necessary.

Table 1.
Accuracy of Pressure Gauges at 5, 10, 15 Pounds Pressure (n=634)

	5 Pounds		10 Pounds		15 Pounds	
	No.	**%**	**No.**	**%**	**No.**	**%**
Accurate	413	65.1	405	63.9	406	64.0
Tested High	164	25.9	170	26.8	166	26.2
Tested Low	31	4.9	33	5.2	36	5.7
No Data/Replace[1]	26	4.1	26	4.1	26	4.1
[1]Gauges were deemed unusable and needed to be replaced.						

Annual testing of pressure gauges is recommended in The Complete Guide to Home Canning (USDA, 1989). The data presented in this paper represents home food canners who have voluntarily had their pressure gauges tested. Many home canners do not have their pressure gauge tested and this data demonstrates that they may be under processing home canned food and reinforces the need to have their pressure gauge tested annually.

Table 2 provides the accuracy rate of pressure gauges by individual year. Accuracy rates of pressure gauges increased in recent years (P = 0.02). This finding is unique. The *Complete Guide to Home Canning* (USDA, 1989) was released in 1989 and may have increased home food canners' awareness of proper canning procedures and the need for pressure gauge testing for safe home food processing. Home food canners may have unreliable gauges tested, replaced them with a new gauge, and returned on an annual basis to maintain the accuracy of the new gauge. Also more new home food canners may have purchased new pressure canners and had the gauge tested annually. The increase in accuracy may be that the message of the Extension educator has reached the intended audience and they have understood the need for pressure gauge testing.

Table 2.
Accuracy of Pressure Gauges by Year (n=634 gauges [634 x 3 pressure levels])

Year	Accurate		Tested High		Tested Low		No Data[1]	
	No.	**%**	**No.**	**%**	**No.**	**%**	**No.**	**%**
1977	36	70.6	9	17.6	0	0.0	6	11.8
1978	21	53.8	6	15.4	9	23.1	3	7.7
1979	18	46.1	15	38.5	0	0.0	6	15.4
1980	39	54.2	27	37.5	6	8.3	0	0.0
1982	27	50.0	24	44.4	0	0.0	3	5.6
1983	49	32.7	83	55.3	6	4.0	12	8.0
1984	47	40.1	67	57.3	0	0.0	3	2.6
1985	99	70.2	23	16.3	13	9.2	6	4.3

1986	54	94.7	3	5.3	0	0.0	0	0.0
1987	57	59.4	31	32.3	8	8.3	0	0.0
1988	47	71.2	16	24.2	3	4.6	0	0.0
1989	27	64.3	9	21.5	3	7.2	3	7.2
1990	91	72.2	29	23.0	3	2.4	3	2.4
1991	102	61.8	42	25.5	12	7.3	9	5.4
1992	75	75.8	21	21.2	0	0.0	3	3.0
1993	63	65.6	18	18.8	9	9.4	6	6.2
1994	85	76.6	23	20.7	3	2.7	0	0.0
1995	12	100.0	0	0.0	0	0.0	0	0.0
1996	36	70.6	12	23.5	0	0.0	3	5.9
1997	57	70.4	14	17.3	7	8.6	3	3.7
1999	36	80.0	3	6.7	0	0.0	6	13.3
2000	41	85.4	4	8.3	3	6.3	0	0.0
2001	12	80.0	3	20.0	0	0.0	0	0.0
2002	93	72.1	18	14.0	15	11.6	3	2.3

[1]Gauges were deemed unusable and needed to be replaced.

Implications

Dial pressure gauges need to be tested for accuracy to produce safely processed food products. The results of the data presented in this study enforce the need to test dial pressure gauges before the home processing season begins. A large number (75%) of home canners do not have their dial gauges tested annually as reported by Andress, D'sa, Harrison, Kerr, Harrison, & Nummer, 2002. More than one third of these home food processors may be improperly processing food and increasing the risk of food borne illness for their family.

Testing of pressure gauges at local extension offices is an opportunity for Extension Educators to provide research-based educational materials on safe food processing to home food processors. The one-on-one teaching method used with home food processors during pressure gauge testing provides a teachable moment especially for people are new to home canning and contributes to establishing the county Extension Educator as a valuable local food safety expert.

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