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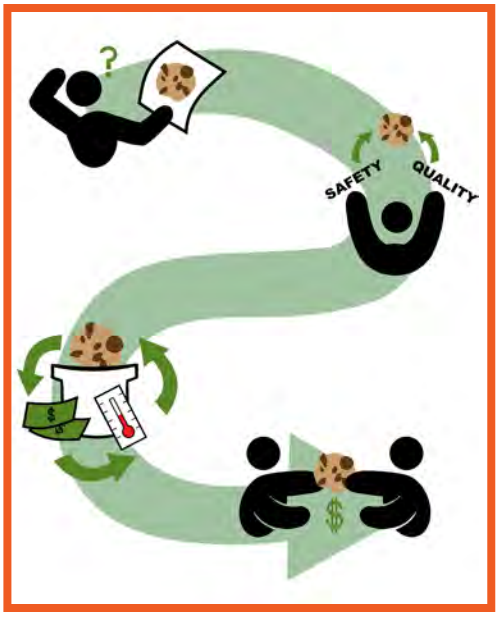

Increasing Food Safety Preparedness of Small and Emerging Food Businesses with Targeted Food Safety Training

ABSTRACT

There is strong consumer demand for local, value-added food products; however, these smaller scale food manufacturing operations tend to face more challenges in understanding and complying with food safety regulations, specifically, the Food Safety Modernization Act (FSMA) Preventive Controls for Human Food (PCHF) rule. An eight-module educational program was developed to introduce food safety throughout the product development life cycle and included concepts related to the FSMA PCHF rule. The program was offered in person (n = 2) and virtually (n = 6) to 143 participants in total, who were mostly early-stage food developers. Most (74%, n = 90) had little to no prior food safety-related training and experience. The majority (93%, n = 90) agreed they will apply the knowledge and skills learned in the course to food applications, such as developing food safety plans, label review, and good manufacturing practices. Self-rated level understanding for each module ranged from 4.4 to 4.6 on a 5-point Likert scale. Overall, participants felt better prepared to conduct various food safety activities after taking the course, supporting the need for nonmandatory training opportunities to enhance FSMA PCHF regulatory compliance. These types of training may be important for small-scale operations to improve the learning outcome and regulatory compliance.

INTRODUCTION

Small processors improve the local economy and increase access to local value-added foods. They grow regional food production markets, create new employment opportunities, and strengthen economic investment in local and regional food system networks *(1)*. Within this market space, there has been a rise in demand for kitchen incubators that has coincided with a rise in small and newly emerging food businesses. Between 2013 and 2016, there was a 50% increase in these types of facilities, with up to 200 reported nationwide *(9)*. In addition, the Specialty Food Association reported that specialty and nonspecialty food sales grew 17% at retail between 2018 and 2020 *(15)*, where specialty refers to "unique and high-value food item made in small quantities from high-quality ingredients" *(22)*. Although

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there is strong consumer demand for local value-added production, processes, and products, there is a concern or risk that these small and emerging food businesses may not be as knowledgeable in the specific food safety regulations or the need for establishing food safety control from concept to commercialization. The Food Safety Modernization Act (FSMA) was signed into law in 2011 to regulate how food is grown, harvested, and processed and to oversee the supply chain. To fully implement this act, the U.S. Food and Drug Administration (FDA) promulgated seven rules targeting the food industry. One of these rules, Preventive Controls for Human Food (PCHF; 21 CFR 117), required processors governed by this regulation to develop a food safety plan compliant with the current good manufacturing practices (GMP), hazard analysis, and risk-based preventive controls. Although the PCHF rule went into effect for processors of all sizes in January 2020, preliminary data based on both FDA inspections and reports show fewer than expected qualified exempt attestations filed, suggesting that many small processors are not aware of these regulations *(3, 16)*. The "qualified facility" exemption requires these firms to submit a form that attests that they comply with the modified requirements to be considered a qualified exempt facility. More importantly, the number one inquiry reported within the FDA's Technical Assistance Network inquiries (cumulative 10 September 2015 through 30 June 2020) is focused on PCHF (39.9%) *(17)*.

A survey and one-on-one consults were the preferred delivery methods for technical support of food safety regulators, and educators outlined some of the leading barriers to PCHF compliance among qualified exempt facilities: a lack of awareness of food safety risks associated with various products and strategies to mitigate the risks, a lack of capital for training, a lack of understanding of laws that pertain to processing, and a lack of knowledge of food safety allergens and mandatory labeling *(12)*.

In addition, a food safety needs assessment, conducted with small processors operating in shared-use processing facilities within the northeastern United States, reported knowledge deficiencies for hazard analysis and preventive controls required for food safety *(14)*. More recently, Gilbert et al. *(10)* reported that food safety communicators believe that "most small and every small processor (97%) had no to average awareness of PCHF requirements" and recommended targeted training workshops.

Although preventive control (PC)-exempt facilities do not need to comply with the full rule, it is imperative that qualified exempt facilities are aware of the PC rule, know what hazard(s) is associated with their respective food product, and have identified a means to control the hazard(s). To better raise awareness of food safety practices and introduce key food safety concepts to small and emerging food businesses that are considered qualified exempt facilities, customized training for food entrepreneurs was designed. The goal of this program was to increase food safety preparedness by integrating food safety into product development training to increase market opportunities for local food businesses. The program, titled "Successful Food Product Development for New Food Businesses: Managing Food Quality & Safety," was deployed in real time (live) and was delivered in person and virtually. It included eight modules and approximately 12 h of instruction time. There were hands-on engagement activities to enhance the skills of workshop participants. Program evaluations were used to measure understanding of concepts presented, applicability and usefulness of the content, and preparedness in developing and implementing food safety programs and/or practices.

MATERIALS AND METHODS

Program development

Before the development of this program, we conducted a needs assessment of new and emerging food businesses operating at shared-use kitchens; this assessment identified the need for targeted training to prepare participants for food safety regulatory compliance, particularly with the FSMA PCHF rule *(5)*. An eight-module food safety educational program (ca. 12 h of instruction) was then designed. This program was developed to introduce preliminary food safety concepts to establish foundational awareness and understanding of the FSMA PCHF rule to increase preparedness for appropriate compliance *(14)*.

Program module topics were determined based on the needs assessment and through support from an industry advisory board. Using a variety of engagements throughout each module, the training program aimed to increase food safety preparedness by integrating food safety into product development training to increase market opportunities for local food businesses. The training content intentionally emphasized that all processors, regardless of exemption status, are still responsible for knowing the regulations and are responsible for knowing and controlling the associated hazards within their respective products and facility.

The Introduction module welcomed participants to the course, provided a program overview, and defined program expectations. The Hazards module introduced the concept that all foods have hazards and provided examples of different types of hazards so that participants would be more prepared to recognize hazards in their respective foods. The Product Development Life Cycle module demonstrated that food safety is a critical consideration throughout developing a new food product. With a focus on many business-driven decisions, this module discussed how and why food safety decisions can impact business outcomes. The Controlling Food Quality and Safety module introduced the concept of establishing controls and demonstrated available tools to monitor food quality and safety that help to maintain product consistency. The Labeling module provided basic

regulatory requirements for product labels and demonstrated how product labeling decisions impact food safety risk management. Finally, the course wrapped up by introducing the different food safety management systems so that qualified exempt facilities are more prepared for regulatory compliance in the future. The program was delivered using a PowerPoint (Microsoft, Redmond, WA, USA) slide presentation with engaging activities that included the following: group-based discussions, hands-on exercises, and real-time demonstrations. *Table 1* illustrates information about each module, including the learning objectives and specific activities conducted. In brief, the overall program aim was to increase food safety awareness and preparedness for regulatory compliance.

This educational program was offered in person twice (Ballston Spa, NY, in 2019 and Warren, RI, in 2020) and virtually six times during 2020 to 2021 during the coronavirus pandemic. Program group-work activities were modified for the virtual delivery, as noted in *Table 1*. Overall, the program was presented to 143 participants for in-person and virtual programming combined.

Assessment of the program through participant evaluation

A postprogram evaluation tool was developed to assess program participant background information (i.e., food production status, food commodities produced, years working in industry), intent to apply knowledge and skills learned in the course, usefulness and understanding of module content, and interest in and preparedness regarding implementation of key food safety activities. For in-person workshops, interest and preparedness were assessed before and at the completion of the workshop. Because of time constraints and limitations with virtual formats, this was not assessed before program delivery when the content was delivered online. The evaluation tool was approved by the University of Rhode Island Institutional Subjects Review Board (reference 1119582-2). Question formats included multiple choice, open-ended text, and Likert scales. A 5-point Likert scale was used to assess understanding of concepts (1 = strongly disagree, 2 = disagree, 3 = neutral, 4 = agree, 5 = strongly agree) and a 4-point scale was used to assess course usefulness (1 = not useful, 2 = slightly useful, 3 = moderately useful, 4 = extremely useful).

Data analysis

Data were analyzed using SPSS statistical software (version 27; IBM Corp., Armonk, NY, USA). Analysis of descriptive statistics (e.g., frequency, percent, mean and standard deviation) and *t* tests were performed to determine statistical significance between means (where the *P*-value for significance was set at $P < 0.05$). For some open-ended questions, responses were categorized (e.g., the types of food products being produced, level of experience, and/or training).

RESULTS AND DISCUSSION

Participant profile

The course was delivered a total of eight times (twice in person and six times virtually) to 143 participants. There were 90 survey respondents (27 were in person and 63 were virtual), yielding a 62.9% response rate. The program evaluation response rate was lower when the program was delivered virtually than in person. The higher survey response rate for in-person events could be attributed to direct monitoring of participants for complying with the request because in-person participants could be physically seen submitting their surveys into a confidential envelope, whereas the Web-delivery methods deployed to virtual participants often result in lower response rates *(8)*. Workshop participants were split among "planning" to develop (32%), currently developing (36%), and currently processing (36%) food products *(Fig. 1)*. Many participants (47%) had less than 5 years of experience working in the food industry, and most were considered "early-stage" developers, that is, they have been developing their food products for 1 to 5 years *(Table 2)*.

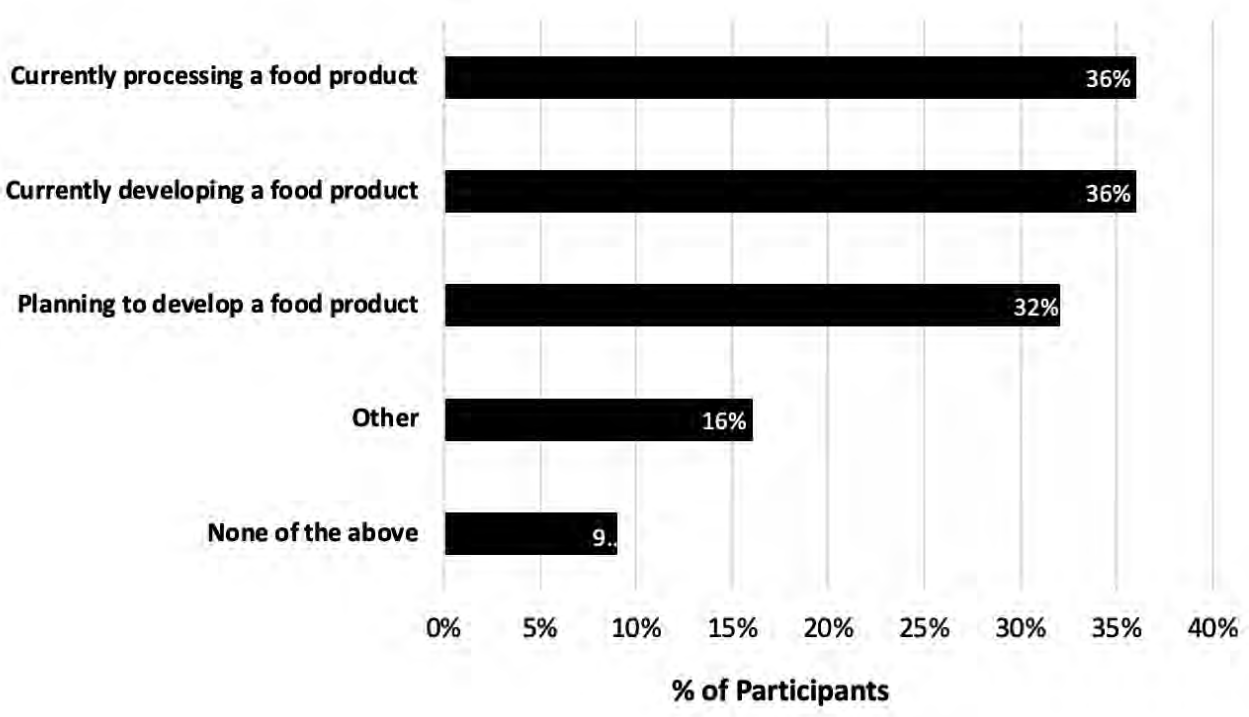
Products produced

The top three food categories produced were condiments (25%); value-added produce (25%); and grains, cereals, and baked goods (19%) *(Table 3)*. Condiments included sauces, pesto, hummus, and spreads. Value-added produce included acidified canned products (11%), dried products (6%), fresh-cut or prepared products (7%), and frozen products (2%). The food safety risks associated with value-added produce include items with higher food safety risks (i.e., low-acid canned foods) and others with lower risks (i.e., jams and jellies, many baked goods). Food safety risk factors and process controls vary, depending upon the type of food products produced. This training speaks broadly about food safety considerations related to product development. The course introduced the PC regulation and illustrated what is involved when conducting a hazard analysis. It is essential to explain different food safety considerations for various food products/processes to enhance learning and increase awareness of the factors that must be considered to produce safe food.

Another study found that canned goods (25%), value-added produce (11%), and pickled vegetables (9%) were the most frequently cited food categories produced by producers who also process value-added products on a small scale *(4)*. Similar products were reported by small processors operating out of shared-use facilities with the top products reported being cereal and bread and baked goods, followed by condiments and beverages (nonjuice) *(14)*. A national study by Econsult Solutions Inc. in 2020 reported that ready-to-eat foods (67%) and baked goods (65%) were the most common products made at shared-use kitchens, followed by sauces and spreads (40%), jams and jellies (33%), and spices and rubs (33%) *(9)*.

TABLE 1. Summary of course module concepts, key learning objectives, and hands-on activities for in-person and virtual education

Module name	Module description	Learning objective(s)	Activities, in person	Activities, virtual
Introduction			Product demonstration: cookie taste test, cookie production video	Product demonstration: cookie preference survey, cookie production video
Hazards		Identify the types of food safety hazards and their potential sources and growth parameters	Glo Germ™ demonstration to illustrate microbial cross-contamination on surfaces	Glo Germ™ video to illustrate microbial cross-contamination on surfaces
Product Development Life Cycle	Demonstrate that food safety is a critical consideration throughout developing a new food product; by focusing on many of the business-driven decisions, this module discusses how and why food safety decisions can impact business outcomes	Introduce the key components of the product development life cycle, including market opportunity, concept, prototype, scale-up, product evaluation, shelf life, cost assessment, and commercialization	Scale technique demonstration, recipe to formula videos, and recipe conversion exercise	Scale technique and recipe to formula videos, and recipe conversion exercise
Controlling Food Quality and Safety		Introduce key factors for controlling product quality and safety and explain how to control and measure them	Food quality and safety case studies	Food quality and safety case studies
Labeling	Provides the basic regulation requirements for product labels and demonstrate how product labeling decisions impact food safety risk management	Introduce labeling regulations for food products, the required information for food and nutrition labels, and the criteria for making product claims	Labeling basics and product claims exercise	Labeling basics and product claims exercise
Food Safety Management		Introduce food safety regulation, employee training and GMP requirements, and the parts of a food safety plan	Identify basic GMPs activities (pictures)	Identify basic GMPs activities (pictures)
Hazard Analysis		Introduce the steps for completing an effective hazard analysis, and the process for determining preventive control implementation	Hazard analysis activity, baking step	Hazard analysis activity, baking step
Preventive Controls		Introduce the four types of preventive controls and the considerations that must be taken for implementation	None	None



[a]Participants checked all that applied.

Figure 1. Workshop participant's food product development or production status (n = 90).[a]

TABLE 2. Workshop participant number of years working in food industry and on food product(s)

	Frequency	%
Years working in food industry (n = 87)		
None	10	11
<1	6	7
1–5	35	40
6–10	14	16
11–20	14	16
≥21	8	9
Years working on food product(s) (n = 80)		
Not applicable	7	9
None	7	9
<1	9	11
1–5	45	56
6–10	5	6
11–20	5	6
≥21	2	3

TABLE 3. Food product categories produced by workshop participants businesses (*n* = 80)[a]

Food product category	Frequency[b]	%
Condiments	27	25
Value-added fruits and vegetables	27[c]	25[c]
Canned	12	11
Dried	6	6
Fresh cut or prepared	7	7
Frozen	2	2
Grains, cereals, and baked goods	20	19
Beverages other than juice	6	6
Meat/poultry	5	5
Entrée	4	4
Confections/candy	3	3
Maple syrup and honey	3	3
Oils and fats	3	3
Soups	3	3
Dairy products	2	2
Juice and cider	2	2
Coffee	1	1

[a]Values in this figure are based on N = 80 that indicated they process food while there was N = 7 that reported that they are not currently processing food not currently processing food products.

[b]Respondents checked all that applied.

[c]Sum of value-added fruits and vegetables.

The diversity of the different types of products processed within the small and emerging food businesses (qualified exempt from PCHF) is important to consider because the training materials provided need to introduce basic food safety concepts while also providing enough detail for the participant/student to understand that each food, process, and facility has its own specific food safety risks. In addition, it is important for this audience to understand that different processed foods may need to comply with different food safety regulations. For example, beverage companies that prepare juice products and juice blended drinks need to comply with juice hazard analysis for critical control points (21 CFR 120) and PCHF (21 CFR 117) *(6, 18)*. Processors that manufacture acidified shelf-stable foods such as sauces, salsas, or vinegar-based pickles would need to comply with both the acidified foods regulation (21 CFR 114) and the PCHF (21 CFR 117). Small and emerging entrepreneurs (qualified exempt) must navigate local and state regulations, which may have different food safety requirements. For example, cottage food laws may allow for food products processed in home-based cooking operations to be sold in retail markets. In Massachusetts and Rhode Island, cottage laws only allow non-potentially hazardous foods to be prepared in licensed residential kitchens, whereas states such as Vermont allow for additional food categories, such as prepared meals, ready-to-cook foods, and salad dressings *(19, 20)*. These are important considerations that were introduced as part of the training program.

Food safety experience and training background

Most participants (74%, *n* = 67) indicated that they have had little to no food safety–related training or experience, whereas 21% indicated they had moderate training or experience *(Table 4)*. Manager certification (i.e., ServSafe (National Restaurant Association, Chicago, IL, USA)) was most frequently mentioned as the type of training received and is most often referenced as the training for early-stage food processors. However, it may not be the most appropriate content because it was developed to align with the retail food regulations (FDA Food Code) *(6)*, rather than the process conditions specific to the needs and regulatory compliance of wholesale distribution (food processors). Interestingly, none of the respondents indicated that they received

TABLE 4. Frequency of workshop participant's level of food safety experience versus the number of years working in the food industry (*n* = 67)[a]

Level of experience[b]	Years					
	None	<1	1–5	6–10	11–20	≥21
None	1	2	2	3	1	0
Little experience/training	2	5	19	6	6	4
Moderate experience/training	2	0	6	0	2	2
Extensive experience/training	0	0	2	0	2	0

[a]*n* = 16 respondents did not indicate their level of training and experience related to food safety and were therefore excluded from the analysis.

[b]Level of experience and training related to food safety was categorized based on responses, where little experience represented one food service-related training, moderate represented one food manufacturing-related training, and extensive represented multiple food manufacturing-related training opportunities.

TABLE 5. Workshop participant's rating of educational course content for overall performance/expectations, applicability, and usefulness (*n* = 88 to 90)[a]

	Average ± SD		
	Combined (*n* = 90)[b]	In person (*n* = 27)[b]	Virtual (*n* = 63)[b]
Overall, this course met my expectations[c]	4.3 ± 0.8	4.2 ± 0.9	4.4 ± 0.8
I will apply the knowledge and skills learned in this course to food applications[c]	4.5 ± 1.0	4.7 ± 0.7	4.5 ± 1.2
Module usefulness[d]			
Hazards	4.2 ± 0.9	4.4 ± 0.8	4.2 ± 0.9
Product Development Life Cycle	4.2 ± 0.9	4.4 ± 0.8	4.2 ± 0.9
Controlling Food Quality and Safety	4.3 ± 0.7	4.4 ± 0.7	4.3 ± 0.7
Labeling	4.3 ± 0.8	4.3 ± 0.8	4.4 ± 0.8
Food Safety Management	4.2 ± 0.9	4.3 ± 0.8	4.2 ± 0.9
Hazard Analysis and Preventive Controls	4.3 ± 0.9	4.4 ± 0.9	4.2 ± 0.9
Total usefulness	4.3 ± 0.7	4.4 ± 0.7	4.2 ± 0.7

[a]Respondents did not answer every question. The range represents the number of respondents who answered the questions.

[b]No significant differences were found between workshop format (i.e., virtual vs. in-person).

[c]The average score is based on 5-point Likert scale: 1 = not useful, 2 = slightly useful, 3 = moderately useful, 4 = very useful, 5 = extremely useful.

[d]The average score is based on 5-point Likert scale: 1 = not useful, 2 = slightly useful, 3 = moderately useful, 4 = very useful, 5 = extremely useful.

training in GMP, a rule with which all food processors must comply. Although many participants reported some food industry experience *(Table 4)*, it was specific to food service/retail. Therefore, this may have impacted their level of understanding because there are significant differences in food safety management in food processing (wholesale distribution) expectations. Although food service experience and ServSafe training may help small processors with basic safe food handling, it does not provide sufficient training to account for all required processing regulations, including GMPs (such as personnel; plant and grounds; sanitary operations; sanitary facilities and controls; equipment

and utensils; processes and controls; warehousing; and distribution, holding and distribution, and defect action levels) and specific process, environmental, and supplier hazards. Gilbert et al. *(10)* reported that food safety communicators felt that small and very small processors had below-average knowledge about basic food safety and sanitation procedures. Most small and very small food processors had no-to-average awareness of the PCHF requirements (97%), had average- or less-than-average knowledge of the basic food safety and sanitation procedures (79%), and felt that a lack of awareness and understanding of the regulation was very or extremely challenging (74%) *(13)*. This suggests that there is a strong need to improve food safety–related outreach to small and very small processors to improve their preparedness for conducting important activities.

Overall program evaluation

Participants evaluated the program, provided feedback on specific modules, and indicated their level of preparedness regarding specific food safety-related concepts. The majority (87%) of workshop participants agreed/strongly agreed that overall, the course met their expectations, where the average combined score was 4.3 ± 0.8 (based on a 5-point Likert scale) *(Table 5)*. Furthermore, 93% of participants agreed/strongly agreed that they will apply the knowledge and skills learned in the course to food applications, where the average combined score was 4.5 ± 1.0 (based on a 5-point Likert scale) *(Table 5)*. Although only a few participants (n = 34) indicated how they would use their new knowledge, the most frequently cited application was to develop food safety plans, followed by label review and GMP procedures. Finally, participants agreed that the course was very useful. There were no differences between the evaluation scores for courses offered in person and virtually, indicating that the delivery format did not impact the program.

Although program content delivery was the same for in-person and virtual training, there were some modifications needed for virtual trainings to maintain engagement. Specifically, when delivering the virtual sessions, the program had additional team members involved in an effort for instructors to better connect with the virtual learners. This included having one presenter and alternating the speakers in every module, maintaining one person responsible for managing the chat room so that instructors could respond to questions, and having a third person responsible for the virtual platform production (i.e., Zoom) to manage the virtual classroom attendance, manage the content sharing and screen share, and monitor hand raising for questions and provide technological assistance. As described in *Table 1*, the hands-on learning activities had modifications to demonstrate the concepts. One large difference is that the hands-on learning activities involved video demonstrations and various online shared digital files where participants could collaborate in the same file to complete exercises. Interestingly, the overall self-rated level of understanding of concepts presented in the modules was high (average score at or above 4.4 on the Likert scale, where 5 strongly agreed), and there were no observed differences between in-person and online instruction. Although there were some modifications in the overall delivery of the training between in person and online, the virtual training appeared to be as effective as the in-person training. Participants most frequently commented that the most valuable part of the course was regarding labeling and hazard analysis. Some topic areas that participants would like to learn about in the future included a deeper coverage of microbial hazards and appropriate control measures and more real-world food product examples. Similarly, Gilbert et al. *(10)* reported the top rank ordered informational needs of small processors included food safety plan models, food safety training, process authority directory, and where to find PCHF courses and private food safety consulting directory information.

The self-rated level of understanding of key concepts presented in the workshop was assessed for each module. Workshop participants had a high level of understanding of the concepts presented, where the average module score (over all workshop events) was 4.4 to 4.6 *(Table 6)*. The hazards and hazard analysis and preventive controls modules had lower levels of understanding *(Table 6)*. Although not statistically significant, participants had a higher self-rated level of understanding of the modules on quality/safety and labeling. The module about labeling was highly valued, and label review was one of the frequently mentioned ways that participants planned to apply their newfound knowledge.

A survey with processors in the state of Ohio found that although most processors understand the concept of a hazard analysis as it relates to their business, smaller processing facilities lacked written plans (that would include a hazard analysis) and sufficient food safety training *(2)*. Limited experience, resources, and training are contributing factors to the lack of written food safety plans *(2)*. Additional programming or coaching in food safety management systems would increase the likelihood of implementation of written programs *(11)*. Furthermore, when food safety concepts are introduced to small-scale processors more frequently and in smaller content doses, with additional technical support from food safety experts provided, the self-reported knowledge confidence increased significantly *(21)*. Therefore, this product development training program introduced many of the food safety concepts early in the food business development cycle in hopes of increased awareness of these critical considerations to enable increased preparedness in developing scale-appropriate food safety plans in the future.

Preparedness and interest in implementing key food safety practices

When comparing pre- and postsurvey responses, workshop participants felt significantly more prepared to

TABLE 6. Workshop participant self-rated level of understanding of concepts presented in the modules

Module	No. of module concepts (n^a)	Average ± SD[b]		
		Combined (n = 87–89)[c]	In person (n = 25–26)[c]	Virtual (n = 62–63)[c]
Hazards	6	4.4 ± 0.6	4.5 ± 0.6	4.4 ± 0.5
Product Development Life Cycle	5	4.5 ± 0.5	4.6 ± 0.6	4.5 ± 0.5
Controlling Food Quality and Safety	4	4.6 ± 0.5	4.7 ± 0.6	4.5 ± 0.5
Labeling	4	4.6 ± 0.5	4.7 ± 0.5	4.6 ± 0.6
Food Safety Management	6	4.5 ± 0.5	4.6 ± 0.5	4.5 ± 0.6
Hazard Analysis and Preventive Controls	6	4.4 ± 0.6	4.4 ± 0.7	4.4 ± 0.6

[a]*n* represents the number of items participants rated for each module.

[b]Average score is based on a 5-point Likert scale: 1 = strongly disagree, 2 = disagree, 3 = undecided, 4 = agree, 5 = strongly agree.

[c]No significant differences were found between workshop format (i.e., in person versus virtual).

TABLE 7. Self-rated level of preparedness regarding implementing key food safety strategies and requirements to support a food safety management system

Food Safety-Related Activity	Average Preparedness[a] ± Standard Deviation		
	Pre-class In person (N = 17–22[b])	Post-class In person (N = 20–23[b])	Post-class Online (N = 60–62[c])
Assessing the food safety hazards in my product	2.4 ± 0.8[1]	3.0 ± 1.0[2]	2.8 ± 0.7[2]
Incorporating food safety factors across the product development and commercialization process	2.3 ± 0.7[1]	3.0 ± 0.9[2]	2.7 ± 0.8[2]
Implementing a written recipe formulation	1.9 ± 0.8[1]	3.3 ± 0.9[2]	3.0 ± 0.9[2]
Implementing an ingredient sourcing plan	1.9 ± 0.9[1]	3.0 ± 1.0[2]	2.7 ± 0.9[2]
Implementing assessments for shelf life	1.9 ± 0.9[1]	3.0 ± 1.0[2]	2.5 ± 1.0[3]
Implementing a quality monitoring program for my products	1.8 ± 0.8[1]	2.9 ± 1.1[2]	2.7 ± 0.9[2]
Implementing nutritional labeling on my product	1.8 ± 0.8[1]	3.1 ± 1.0[2]	2.7 ± 0.9[2]
Ensuring my labels meet the minimum state/federal requirements	1.9 ± 0.9[1]	3.2 ± 0.9[2]	2.9 ± 0.9[2]
Ensuring that all label claims made meet the federal requirements	2.1 ± 0.8[1]	3.2 ± 0.9[2]	2.8 ± 0.9[2]
Assessing my product to determine food safety control strategies	1.8 ± 0.9[1]	3.1 ± 1.0[2]	2.7 ± 0.9[2]
Implementing GMPS to support my food safety management system	2.0 ± 0.8[1]	3.0 ± 1.1[2]	2.7 ± 0.9[2]
Conducting employee training activities	1.9 ± 1.0[1]	3.1 ± 1.0[2]	2.7 ± 0.8[2]
Implementing a product recall plan	1.9 ± 0.9[1]	3.0 ± 1.2[2]	2.4 ± 1.0[2]
Implementing a record keeping program for food safety parameters.	2.1 ± 0.9[1]	3.1 ± 1.1[2]	2.7 ± 0.9[2]
Learning more about implementing a food safety plan for my product	2.0 ± 0.9[1]	3.1 ± 1.0[2]	2.7 ± 0.8[2]

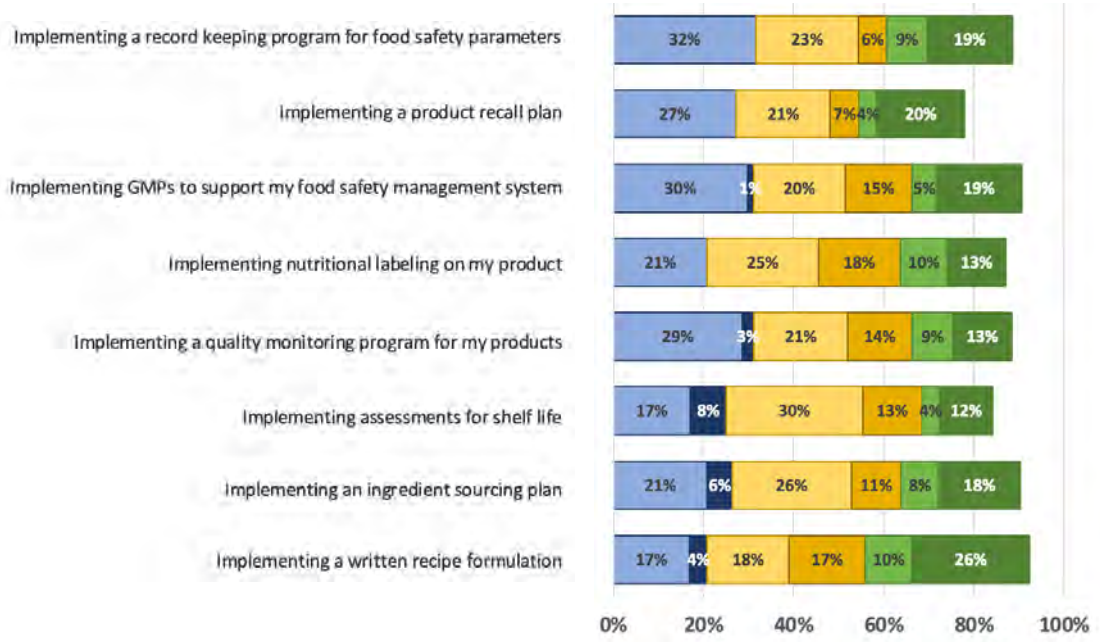
[a]Based on a 4-point scale: 1 = Not at all prepared, 2 = Slightly prepared, 3 = mostly prepared, 4 = entirely prepared.

[b]Respondents who answered "undecided" were not included in the analysis (N = 1-3).

[c]Respondents who answered "undecided" were not included in the analysis (N = 1).

[1,2]Different numbers indicate significant differences at $P < 0.05$.

A. Participant self-assessment of the implementation of key food safety strategies for food production



B. Participant self-assessment regarding preparation for ensuring food safety requirements and strategies are incorporated

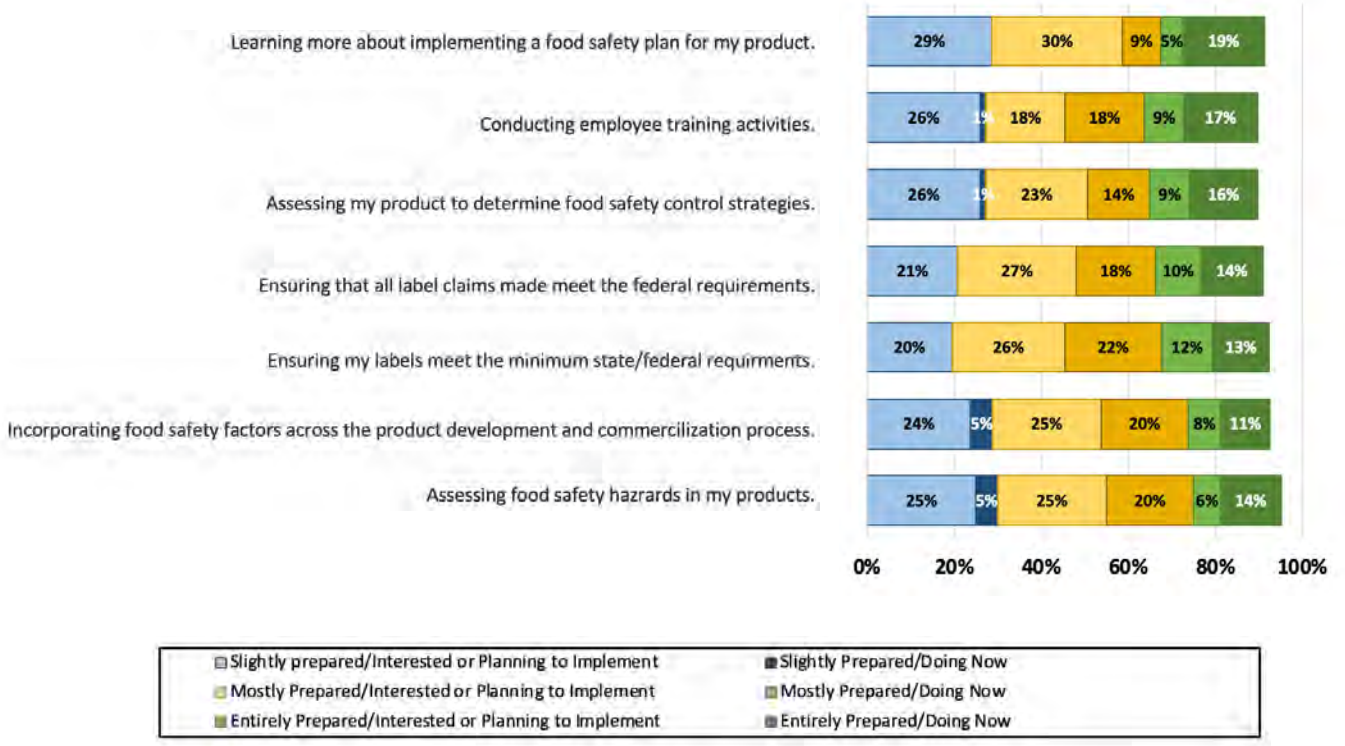


Figure 2. Participant self-assessment regarding preparation for and implementation of key food safety strategies for production (A) and ensuring food safety requirements and strategies are incorporated (B) to support a food safety management system (N = 72–80).

conduct all food safety–related activities after attending the workshop *(Table 7)*, indicating that the information received was useful. Overall, many participants felt slightly to mostly prepared to conduct key food safety activities *(Fig. 2)* and were interested in or planning to implement them. Some participants indicated that they were currently conducting the activities and felt mostly to entirely prepared to do so *(Fig. 2)*. Training opportunities to enhance FSMA PCHF regulatory compliance are particularly important for qualified exempt processors who may not come under the full impact of the regulation. In a survey of Ohio processors, smaller facilities with fewer employees were less likely to have written food safety or HACCP plans *(2)*. These smaller scale facilities often struggle with developing food safety systems, but could benefit from both applicable standardized training (e.g., FSPCA PCHF, Better Process Control School course) and nonmandatory training to improve learning outcomes and regulatory compliance *(2)*.

CONCLUSIONS

The Successful Food Product Development for New Food Businesses: Managing Food Quality & Safety training program increased self-ranking understanding of key food safety concepts presented to qualified exempt facilities that are just starting to build their business, increased their overall preparedness, and enhanced confidence in developing food safety programs. However, there is a strong need to continue to provide more targeted food safety training to this audience. This is a hard-to-reach audience with an added challenge that this community has limited basic food science or food safety knowledge. This audience often needs to have additional technical support to determine the appropriate risks associated with their product. The aim of this training program was to enhance the overall awareness of small processors about basic food safety and quality concepts throughout the product development process to prepare them to develop scale-appropriate food safety plans and food safety management systems. Although the program evaluations indicate that participants felt more prepared about the concepts introduced during this program, future work should include additional concept-specific training opportunities to provide additional technical support that would enhance the participants understanding, increase their confidence, and provide stronger support for implementation and assess actual (real) knowledge/competencies.

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