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Enhancing Food Safety Awareness through Digital Education on Preservative Use among MSMEs: A Case of Srikandi Cipta Bahari Semarang

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Abstract

This community service program aimed to enhance the knowledge and awareness of micro, small, and medium enterprises (MSMEs) regarding the safe use of food preservatives through a digital education approach. The activity was conducted with UMKM Srikandi Cipta Bahari in Semarang, using a participatory action research method consisting of surveys, preparation of digital learning modules, Google Sites-based e-learning development, training, mentoring, and evaluation. The materials covered safe use of natural and synthetic preservatives, Good Manufacturing Practices (GMP), and food hygiene principles. Evaluation through pre-test and post-test showed a 32% increase in participants' understanding of preservative safety and hygienic food handling. The developed Google Sites platform and digital modules enabled flexible, accessible learning. The novelty of this program lies in integrating food safety education with digital literacy empowerment, demonstrating that digital-based learning can effectively strengthen MSME capacity in producing safe and competitive food products.

Keywords: digital education, food preservatives, food safety, Google Sites, MSMEs

1. INTRODUCTION

Micro, small, and medium enterprises (MSMEs) play a crucial role in supporting the national economy, particularly in the food processing sector. In Indonesia, the majority of MSMEs produce traditional and modern food products, both dry (such as chips, smoked fish, and dried spices) and wet (such as meatballs, nuggets, and processed meat). However, one of the major challenges faced by food MSMEs is the lack of understanding of food safety practices, especially regarding the use of food preservatives and the implementation of *Good Manufacturing Practices* (GMP). Inappropriate use of synthetic preservatives not only lowers product quality but also poses potential health risks to consumers, thereby reducing the competitiveness of MSME products in the modern market.

Food preservatives, both synthetic (e.g., sodium benzoate, potassium sorbate) and natural (e.g., plant extracts, essential oils), are essential in extending shelf life and preventing microbial spoilage. However, their use must comply with regulatory limits as stated by the Indonesian Food and Drug Authority (BPOM) and the *Codex Alimentarius* standards. According to Cedillo-Olivos et al. [1], improper dosage and selection of preservatives remain prevalent among small producers in developing countries, leading to safety and quality concerns. Similarly, Yu, Chin, and Paik [2] emphasized that consumer preferences are shifting toward food products that are not only palatable but also healthy and free from excessive synthetic additives.

Recent studies have explored the application of natural preservatives as sustainable alternatives. Lima, Azevedo, and Carvalho [3] reported that bio-preservatives from plant and microbial sources can effectively maintain food safety while reducing dependence on chemical additives. Wijayasekara and Abeyrathne [4] also found that the integration of bio-preservation techniques into small-scale food industries could enhance product quality and consumer trust. Nevertheless, Oktaviani and Soetjipto [5] revealed that a significant gap remains between academic findings and their practical implementation among micro-enterprises, particularly in the absence of appropriate training and digital literacy.

Digital-based education has emerged as an innovative solution for bridging knowledge gaps between academia and MSME practitioners. Anatan and Nur [6] demonstrated that digital literacy can increase MSME capacity to access information, adopt innovations, and improve competitiveness. Despite this potential, most existing studies focus on digital marketing and entrepreneurship training, rather than integrating digital learning with food safety education. Consequently, the application of e-learning tools to teach preservative safety and GMP practices remains underexplored.

A few researchers have developed digital literacy programs for MSMEs [6], [7]; however, limited studies have specifically targeted food safety aspects such as preservative usage and hygiene practices in small food industries. Moreover, conventional face-to-face training often fails to reach wider MSME communities due to time, cost, and accessibility constraints. Therefore, there is a need for an innovative, flexible, and sustainable learning model that combines food safety education with digital technology.

Previous studies have primarily focused on technological or marketing aspects of MSME digitalization, with minimal emphasis on food safety and preservative management. Few researchers have investigated the integration of digital education platforms to enhance MSME understanding of safe preservative use based on regulatory standards. Therefore, this study introduces a novel approach through digital education using a Google Sites-based e-learning platform that provides accessible modules, video tutorials, and interactive learning for food MSMEs. This study further proposes an innovative digital education model integrating food safety and digital literacy for MSMEs, which has not been previously explored. The objectives of this research are to (1) improve MSME knowledge and awareness regarding the safe use of food preservatives and GMP practices, (2) develop a digital learning platform that supports flexible and continuous food safety education, and (3) evaluate the effectiveness of digital education in increasing literacy and behavioral change among MSME food producers.

2. METHODS

2.1 Study Design and Educational Framework

This community service program adopted a participatory educational approach using a quasi-experimental one-group pretest–posttest design. The educational intervention

was implemented among the *UMKM Srikandi Cipta Bahari* community in Tanjung Mas, Semarang, during September–December 2025. The program combined digital education through Google Sites with synchronous and asynchronous mentoring to improve literacy on food preservatives, hygiene, and Good Food Production Method (CPPB). The framework followed the Participatory Action Education Model emphasizing *learning-by-doing*, collaborative reflection, and continuous digital access. This design was selected to ensure learning sustainability and self-paced participation within the MSME context. This approach was chosen to ensure active participation and empowerment among MSME participants, aligning with the principles of community-based learning.

2.2 Participants and Educational Context

Fifteen active food MSME producers were purposively selected from the *Srikandi Cipta Bahari* network. Inclusion criteria included: (1) engagement in small-scale food processing (wet or dry foods), (2) willingness to participate throughout the program, and (3) access to digital devices and internet connectivity. The participant's learning needs were assessed through an initial educational needs survey, which revealed limited knowledge of safe preservative use and weak digital literacy, confirming the relevance of an integrated digital educational model.

2.3 Educational Intervention and Learning Content

The digital education intervention comprised three integrated learning themes:

1. Preservative Literacy: Understanding natural and synthetic preservatives, dosage limits, and BPOM/Codex standards [1], [8].
2. Food Safety Practices: Application of CPPB and hygiene in MSME food production [9].
3. Digital Empowerment: Development of digital literacy through self-access learning modules on Google Sites [10].

The Google Sites platform hosted profile description, e-learning modules, infographics, and quizzes that enabled participants to learn flexibly. The educational materials were contextualized to MSME food practices, such as handling of smoked fish, meatballs, and fried snacks.

2.4 Implementation Stages

The educational process consisted of five structured stages:

1) Preparation: Coordination with MSME partners, assessment of educational needs, and development of digital learning materials (module).
2) Implementation: Online and offline delivery of educational content through Google Sites and community workshops emphasizing food safety and preservative use.
3) Mentoring and Support: Continuous assistance via WhatsApp groups to facilitate discussion and problem-solving related to preservative selection, hygiene, and labeling.
4) Evaluation: Administration of pretest and posttest questionnaires to assess changes in knowledge and awareness.

2.5 Data Collection and Analysis

A 20-item multiple-choice knowledge test was developed based on food safety criteria guidelines, and the data were analyzed using a paired t-test to compare the pretest and posttest results.

3. RESULTS AND DISCUSSION

3.1. Improvement of Knowledge and Awareness

The implementation of digital education on the safe use of food preservatives through the Google Sites platform resulted in a significant increase in participants' knowledge and awareness. The mean pretest score was 52.73%, which increased to 84.60% in the posttest, representing an average improvement of 32 percentage points ($t(14)=61.86$, $p<0.05$). This finding indicates that the digital education model was highly effective in enhancing MSME understanding of preservative safety, hygiene, and regulatory compliance.

Figure 1 shows that posttest scores improved substantially across all indicators after the digital education intervention. The results confirm that the use of interactive, context-based digital modules enables MSMEs to access learning flexibly and understand key principles of food safety. This finding supports the argument of Ikram et al. [11] that digital learning media can strengthen the adoption of safety practices in small-scale food industries by improving comprehension and retention through self-paced modules.

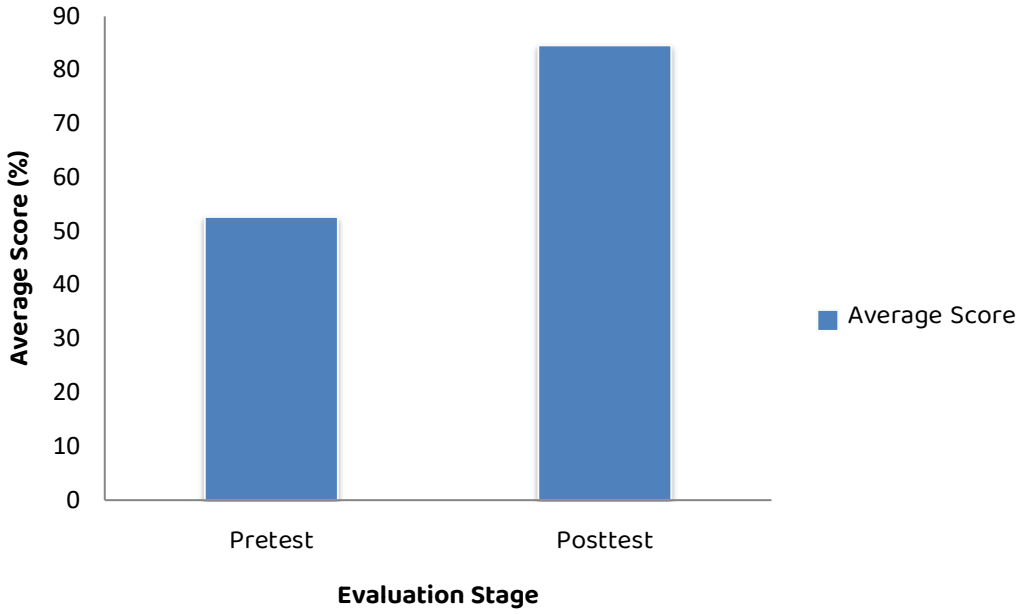

Figure 1. Changes in MSME participants knowledge before and after digital education

3.2. Effectiveness of Digital Education Model

The Google Sites platform facilitated both self-learning and community mentoring, enabling participants to repeatedly access learning materials, videos, and infographics. This approach proved suitable for MSME actors who often face time and mobility limitations. Similar findings were reported by Anderson and Barcinas [12], who demonstrated that asynchronous learning environments significantly improve user engagement in community-based food education.

Participant's qualitative feedback highlighted increased confidence in identifying safe preservatives (e.g., sodium benzoate, potassium sorbate) and the ability to distinguish between legal and prohibited additives. The integration of case-based examples (e.g., smoked fish, meatballs, and fried snacks) improved contextual learning relevance. These outcomes are consistent with Nugroho et al. [3], who found that contextualized digital education programs enhance learner motivation and real-life applicability among MSMEs.

3.3. Behavioral Change and Practical Impact

The program also influenced behavioral attitudes toward hygiene and production practices. Observation results showed that most MSMEs began applying Good Food Production Method (CPPB) principles, including sanitation of utensils and appropriate

labeling. Figure 1 shows the implementation of digital learning and follow-up mentoring through Google Sites.

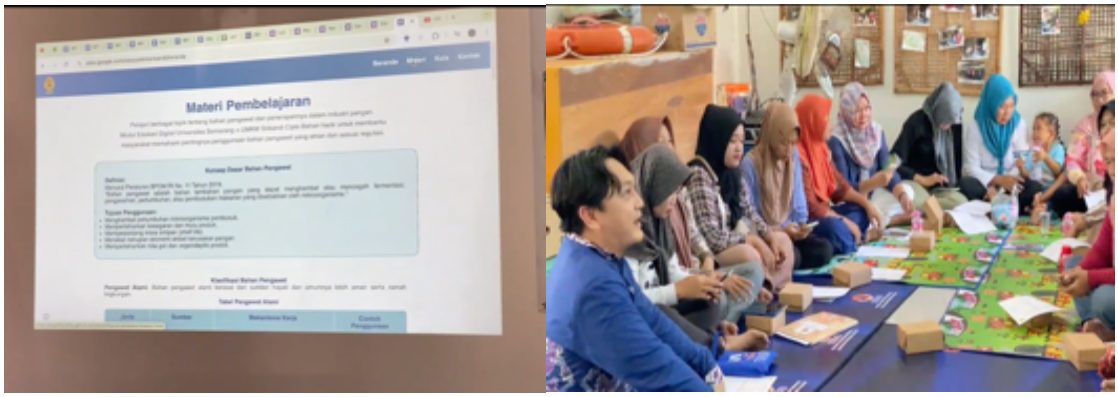

Figure 1. Implementation of digital education and mentoring through Google Sites platform

Such behavioral changes align with [4], who reported that digital mentoring can enhance food handler behavior when combined with participatory reflection. The hybrid method (digital education + online mentoring) introduced in this study thus provided a balanced model between flexibility and accountability. Furthermore, participants acknowledged that increased awareness of preservative regulations (BPOM) and hygiene has improved consumer trust and product acceptance. The approach also contributed to MSME empowerment in digital literacy, enabling them to utilize digital tools beyond education, for marketing, documentation, and certification purposes.

3.4. Discussion

The results clearly demonstrate that digital education provides a sustainable alternative to conventional face-to-face training for MSMEs. Unlike traditional workshops that depend on physical presence, the Google Sites–based platform offered interactive, continuous, and inclusive learning opportunities. This confirms the findings of [11], which emphasized that e-learning interventions for MSMEs significantly improve post-learning retention and compliance with safety standards.

The educational innovation in this study lies in its integration of food safety content with digital literacy enhancement, allowing learners to master both technological and practical aspects of safe food production. Compared with previous studies focusing solely on

digital marketing Anatan and Nur [6], this program fills the existing gap by targeting food safety behavior, a critical but often neglected area in MSME development.

From a community impact perspective, this program supports the goals of Indonesia's Gerakan Pangan Aman (Safe Food Movement) and the UN Sustainable Development Goals (SDG 3 & SDG 8) through health protection and MSME capacity building. Hence, digital-based community education can serve as an effective strategy for widespread dissemination of food safety practices, particularly in regions with limited access to formal training facilities. These findings address the research gap identified in the introduction, demonstrating that digital education effectively bridges MSME limitations in accessing food safety training and digital literacy programs that were previously unavailable through conventional methods.

4. CONCLUSION

This community service study concludes that digital education through the *Google Sites* platform is an effective and sustainable approach to improving MSME knowledge, awareness, and behavior regarding the safe use of food preservatives and hygiene practices in food production. The integration of food safety content with digital literacy successfully bridged the knowledge gap caused by limited access to conventional training, resulting in a 32% increase in understanding of preservative safety and CPPB implementation among participants. The educational model encouraged behavioral change, particularly in hygienic processing, labeling accuracy, and compliance with BPOM standards, thereby enhancing product safety and consumer trust. The impact of this research lies in its demonstration that digital education can serve as a scalable model for food safety empowerment within MSME communities, supporting the national agenda for safe food production and contributing to sustainable community development aligned with the Sustainable Development Goals on health, innovation, and economic growth. Future programs may integrate mobile-based learning or certification modules to ensure broader adoption among MSMEs.

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