

Systematic Review of Food Safety Training Outcomes among Food Handlers across Diverse Food Service Settings

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INTRODUCTION & AIM

Food safety is a global public health concern, causing millions of illnesses and significant economic losses each year. The food service sector is a critical area for **foodborne disease (FDB)** outbreaks, especially in developing countries where poor sanitation, limited resources, and inadequate training heighten risks. Although **food handlers** play a crucial role in preventing contamination, gaps often persist between their knowledge and actual practices [1-3]. Using the **Knowledge-Attitude-Practice (KAP)** framework, this systematic review examines studies from 2019 to 2024 on the effectiveness of training and educational interventions.



Knowledge



Attitude



Pactice

METHOD

This study followed the PRISMA guidelines for systematic reviews to analyze literature on food handling. To obtain relevant, high-impact, peer-reviewed articles, several databases were consulted, and search strategies were designed using PICO elements. **Figure 1** shows the selection process and the PRISMA checklist outlines the covered requirements. The review is registered in PROSPERO (ID: CRD42024575260).

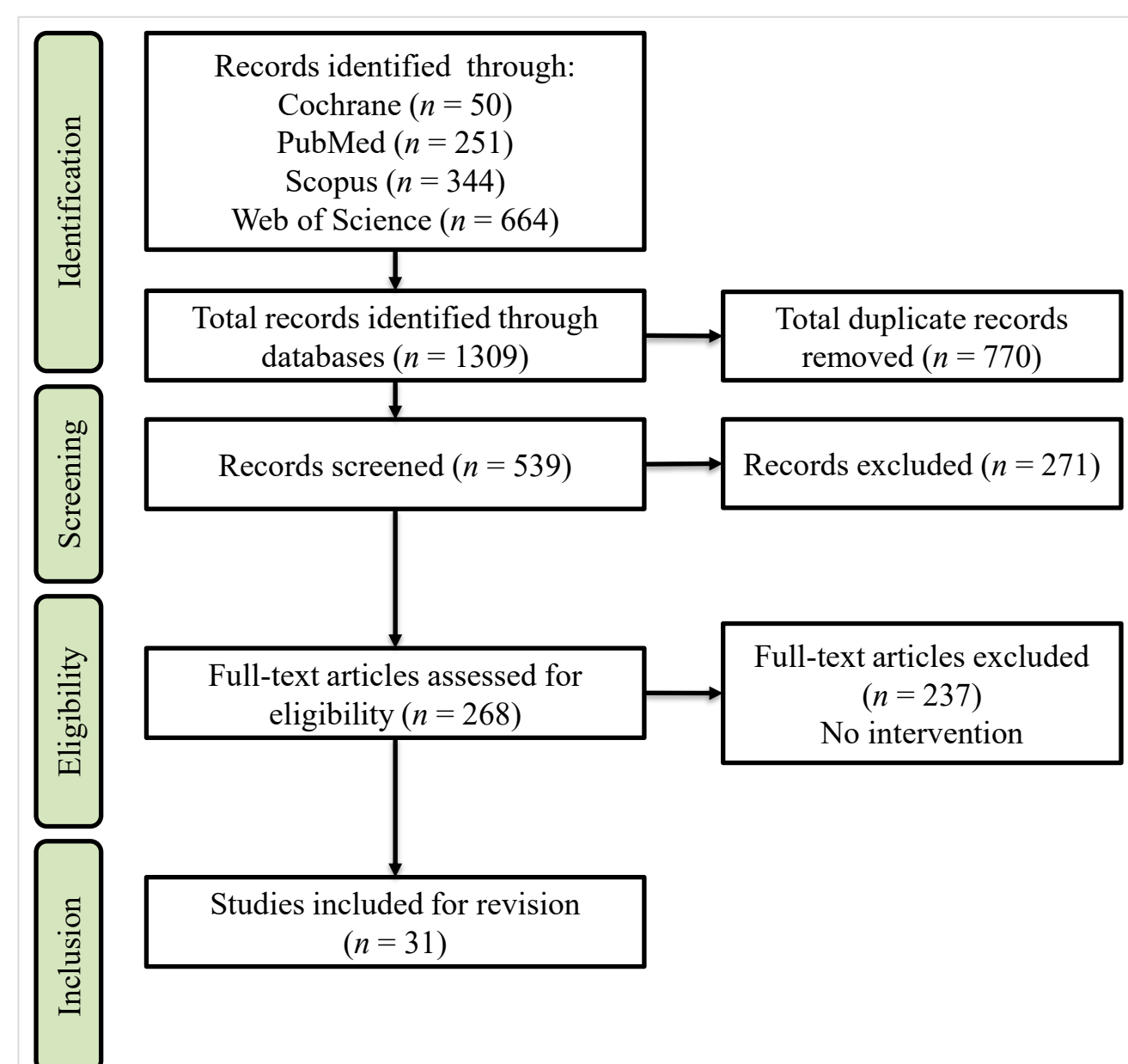


Figure 1. The PRISMA flowchart

RESULTS & DISCUSSION

- From **1,309** articles, **31 studies** met inclusion criteria (2019-2024).
- Publications trends fluctuated since 2019, with a slight decline in recent years (**Figure 2**).
- Most studies showed improvements in **knowledge (28)**, followed by **attitudes (17)** and **practices (21)**.
- Research was mainly conducted in **Bangladesh, Brazil, and USA** (**Figure 3**) across settings like **street vendors, restaurants, and hospitals** (**Figure 4**).
- Interventions:** face-to-face, coaching, and virtual training; assessed mainly through questionnaires.
- Key issues:** poor hygiene practices, knowledge-practice gap, and low motivation.
- Effective programs** combined interactive and practical methods with supervision and feedback.
- Main takeaway:** Training improves knowledge but sustained behavioral change requires ongoing support, strong organizational structure, and a “**culture of prevention**”.

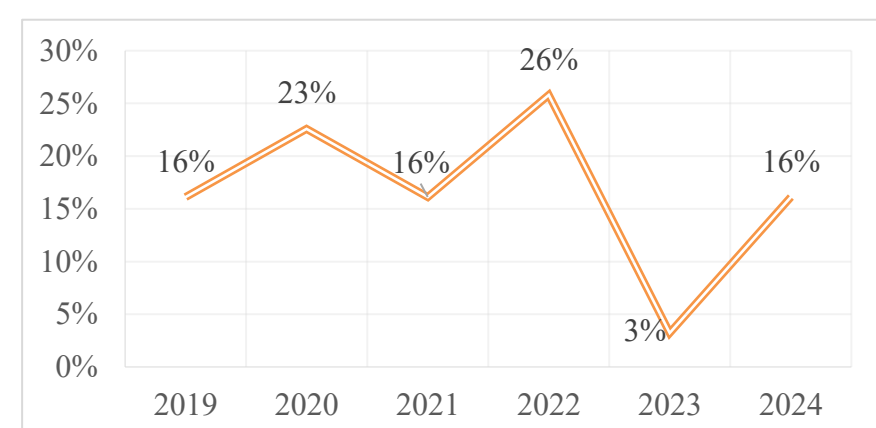


Figure 2. Distribution of included studies by publication year (%)

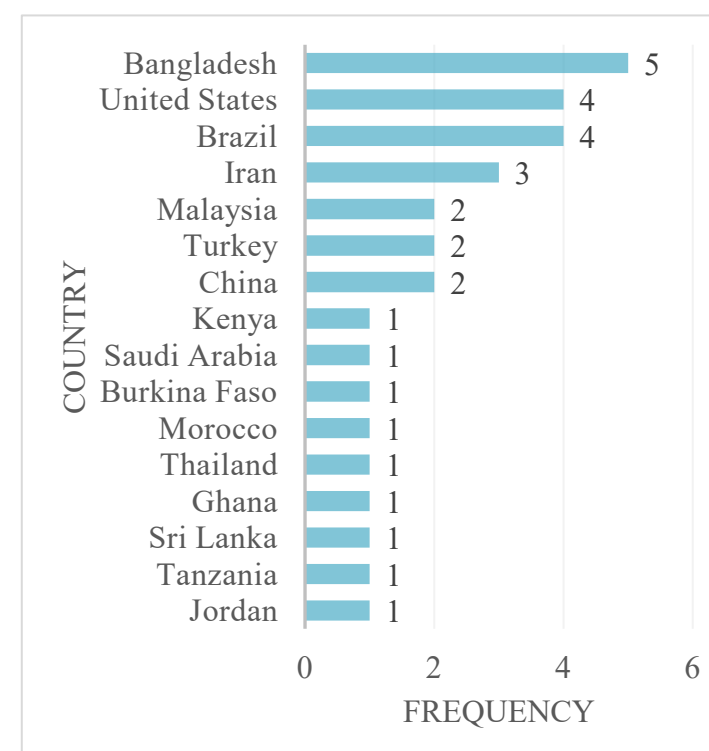


Figure 3. Distribution of included studies according to country of publication



Figure 4. Settings of included studies

CONCLUSION

While education improved food handlers' **KAP**, gaps remain between learning and consistent behavior. Addressing poor hygiene and unsafe handling requires continuous, context-specific training, strong supervision, and a culture of food safety supported by management and policy enforcement.

REFERENCES

- [1] da Cunha, D. T. (2021). Improving food safety practices in the foodservice industry. *Current Opinion in Food Science*, 42, 127–133. <https://doi.org/10.1016/j.cofs.2021.05.010>
- [2] De Lima, D. P., Medeiros, C. O., Dardin, F. D., & Stangarlin-Fiori, L. (2019). Implementation of good hygiene practices in food trucks with and without the intervention of a food safety expert. *Journal of Food Safety*, 39(3), e12637. <https://doi.org/10.1111/jfs.12637>
- [3] Pattono, D., Petey, M., Covarino, A. M., Gea, M., & Schilirò, T. (2023). Training for Food Handlers at Production Level in Italian Regions. *International Journal of Environmental Research and Public Health*, 20(3), 2503. <https://doi.org/10.3390/ijerph20032503>