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Review Article

The Sensitivity and Specificity of Loop-Mediated Isothermal Amplification and PCR Methods in Detection of Foodborne Microorganisms: A Systematic Review and Meta-Analysis

Yasaman Sadeghi [1,2], ***Pegah Kananizadeh*** [1], ***Solmaz Ohadian Moghadam*** [3], ***Ahad Alizadeh*** [4,5], ***Mohammad Reza Pourmand*** [1], ***Neda Mohammadi*** [6], ****Davoud Afshar*** [7], ***Reza Ranjbar*** [8]

1. *Department of Pathobiology, School of Public Health, and Urology Research Center, Tehran University of Medical Sciences, Tehran, Iran*
2. *MAHAK Hematology Oncology Research Center, MAHAK Hospital, Shahid Beheshti University of Medical Sciences, Tehran, Iran*
3. *Uro-Oncology Research Center, Tehran University of Medical Sciences, Tehran, Iran*
4. *Health Products Safety Research Center, Qazvin University of Medical Sciences, Qazvin, Iran*
5. *Medical Microbiology Research Center, Qazvin University of Medical Sciences, Qazvin, Iran*
6. *Department of Epidemiology and Biostatistics, School of Public Health, Tehran University of Medical Sciences, Tehran, Iran*
7. *Department of Microbiology and Virology, School of Medicine, Zanjan University of Medical Sciences, Zanjan, Iran*
8. *Molecular Biology Research Center, Systems Biology and Poisonings Institute, Baqiyatallah University of Medical Sciences, Tehran, Iran*

***Corresponding Author:** Email: afshar.d@zums.ac.ir

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Abstract

Background: The loop-mediated isothermal amplification (LAMP) method is frequently used for identifying many microorganisms. The present review aimed to evaluate the sensitivity and specificity of LAMP method for detection of food-borne bacteria and to compare these features with those of polymerase chain reaction (PCR), as an alternative molecular diagnostic procedure, and with cultivation method, as the gold standard method.

Methods: The literature was searched in electronic databases (PubMed, Scopus, Web of Science, and EMBASE) for recruiting publications within Jan 2000 to Jul 2021. We used the combinations of keywords including foodborne disease, LAMP, PCR, Loop-mediated isothermal amplification, and polymerase chain reaction. Meta-analysis was used to adjust the correlation and heterogeneity between the studies. The efficiency of the methods was presented by negative likelihood ratio, positive likelihood ratio, sensitivity, specificity, and odds ratio using forest plots. A *P*-value less than 0.05 was considered as statistical significance cut off. The confidence intervals were presented at the 95% interval.

Results: Overall, 23 relevant studies were analyzed. The sensitivities of LAMP and PCR methods were estimated to be 96.6% (95% CI: 95.0-97.7) and 95.6% (95%CI: 91.5-97.8), respectively. The specificities of LAMP and PCR were also estimated to be 97.6% (95%CI: 92.6-99.3) and 98.7% (95%CI: 96.5-99.5), respectively.

Conclusion: The specificities of LAMP and PCR assays were determined by comparing their results with cultivation method as the gold standard. Overall, the specificity of both PCR and LAMP methods was low for detection of fastidious bacteria. Nevertheless, LAMP and PCR methods have acceptable specificities and sensitivities, and their application in clinical practice necessitates more studies.

Keywords: Food-borne pathogen; Specificity; Sensitivity; Loop-mediated isothermal amplification (LAMP); Polymerase chain reaction