ECP 2024 Conference
The 3rd International Electronic Conference on Processes
29–31 May 2024 | Online

Sensors in Alternative Samples: A Powerful Tool in Forensic Toxicology

L.M. Rosendo[1,2], M. Antunes[1,2], A. Y. Simão[1,2], A.T. Brinca[1,2], G. Catarro[1,2], R. Pelixo[1,2], J. Martinho[1,2], B. Pires[1,2], S. Soares[1, 2], J. F. Cascalheira[1,3], L. Passarinha[1,2,4,5], T. Rosado[1,2,6], M. Barroso[7], E. Gallardo [1,2,6]

[1] Centro de Investigação em Ciências da Saúde, Universidade da Beira Interior (CICS-UBI), 6200-506 Covilhã, Portugal;
[2] Laboratório de Fármaco-Toxicologia, UBIMedical, Universidade da Beira Interior, EM506,6200-000 Covilhã, Portugal
[3] Departamento de Química, Universidade da Beira Interior, 6200-001 Covilhã, Portugal
[4] Associate Laboratory i4HB-Institute for Health and Bioeconomy, NOVA School of Science and Technology,Universidade NOVA de Lisboa, 2819-516 Caparica, Portugal
[5] UCIBIO-Applied Molecular Biosciences Unit, Chemistry Department, NOVA School of Science and Technology, 2829-516 Caparica, Portugal
[6] Centro Académico Clínico das Beiras (CACB)—Grupo de Problemas Relacionados com Toxicofilias, 6200-000 Covilhã, Portugal
[7] Serviço de Química e Toxicologia Forenses, Instituto de Medicina Legal e Ciências Forenses—Delegação do Sul, 1169-201 Lisboa, Portugal

INTRODUCTION & AIM

The identification of drugs of abuse in biological samples is an essential component of forensic toxicology, which benefits both criminal investigations and public health initiatives. However, due to the limited advancement of immunoassays, the field faces difficulties, especially in the detection of drug biomarkers. The growing importance of sensor technologies as practical alternatives in forensic toxicology is addressed in this review. These technologies provide accurate, effective, and real-time detection capabilities for a range of sample types.

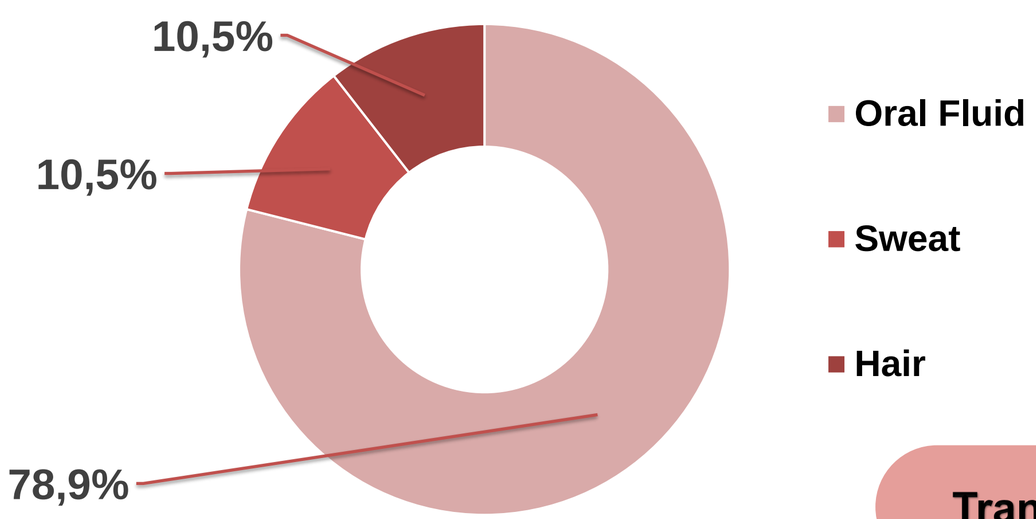
METHOD

The search keywords utilized within the PubMed and ISI Web of Science databases encompass the terms "sensors for the detection of drug abuse," "oral fluid or saliva," "sweat," "hair," within all fields.

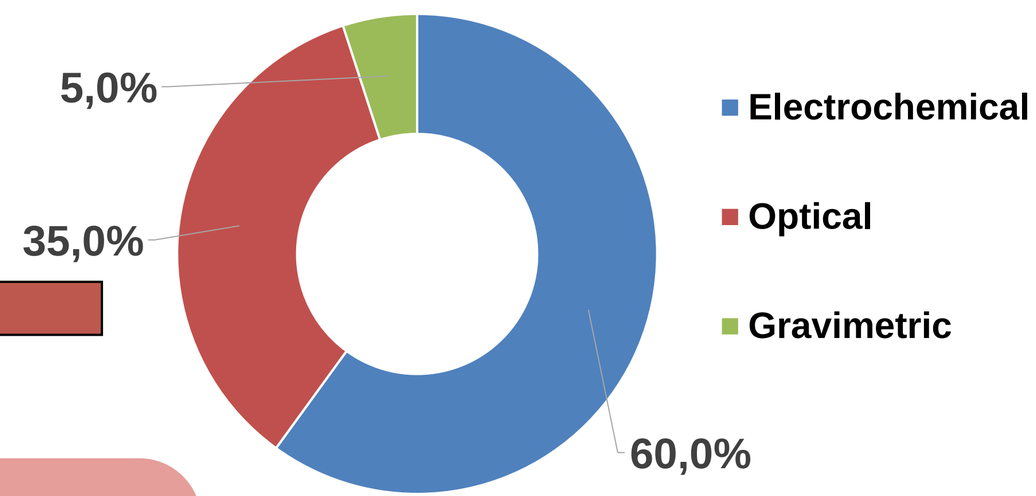
Samples	Advantages	Forensic Significance
Oral Fluid	Easily collected; reflects recent intake	Detects drugs, alcohol, toxins; valuable in roadside testing
Sweat	Reflects recent exposure; continuous excretion	Identifies recent drug use, complements other sample analyses
Hair	Long-term history of substance exposure	Reveals chronic drug use, retrospective analysis of substance use

RESULTS & DISCUSSION

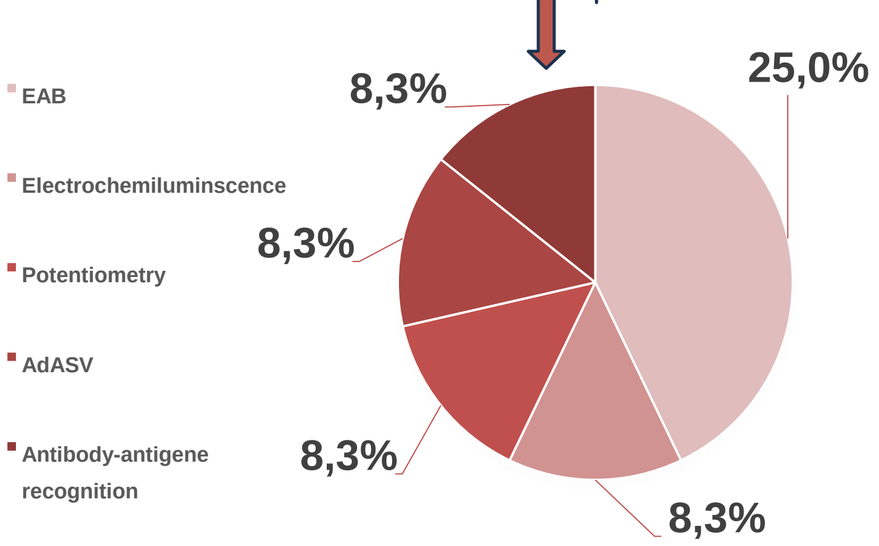
Sensor in alternative matrices

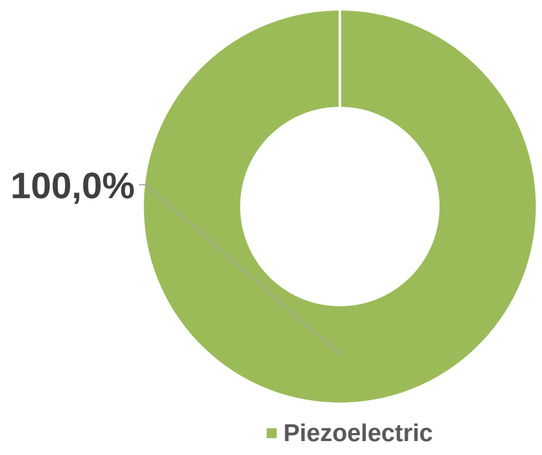


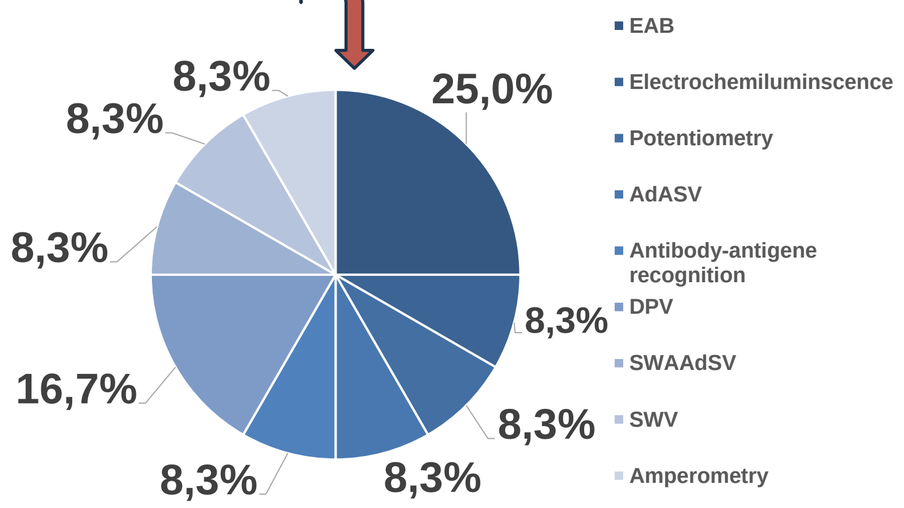
Type of sensors



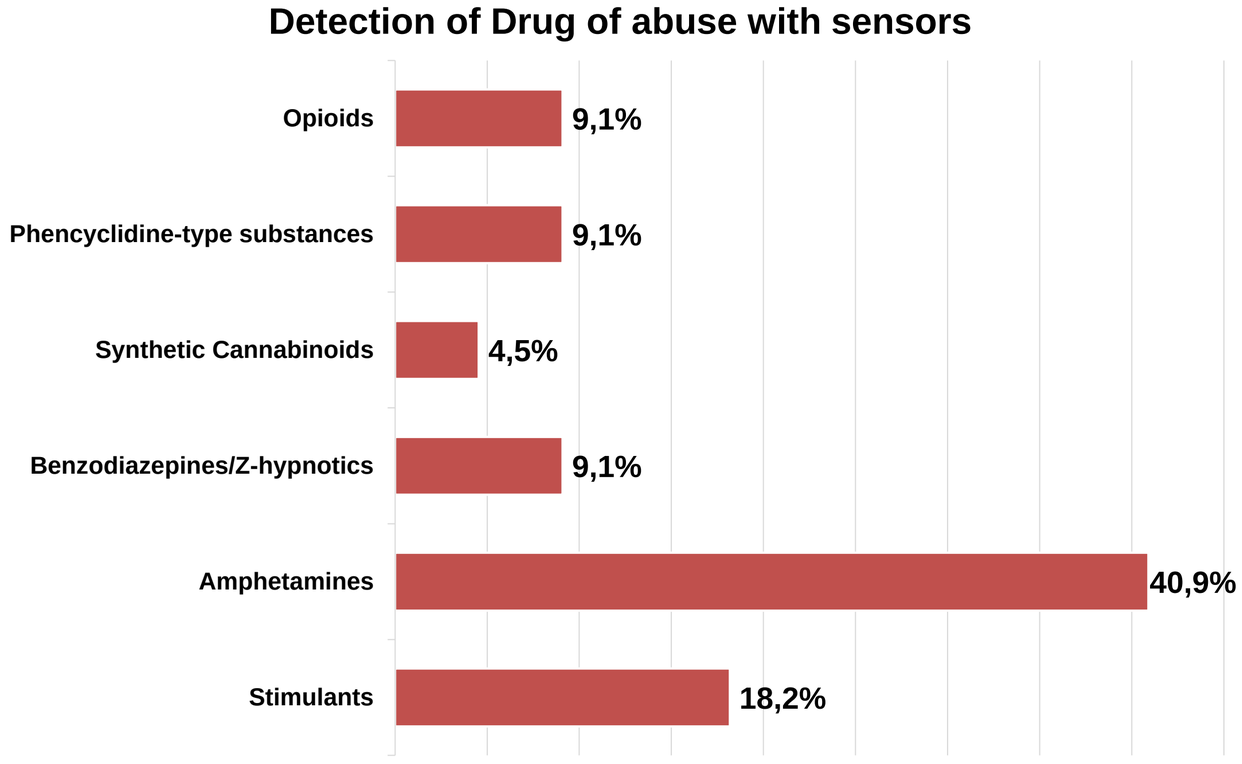
Transducing Mechanism







Detection of Drug of abuse with sensors



CONCLUSION

The electrochemical sensor stands out as the most widely used sensor type, demonstrating its versatility and effectiveness in detecting drugs of abuse across different sample matrices. This prevalence speaks to its reliability and suitability for a wide range of applications.

The landscape of hair and sweat analysis remains relatively unexplored, with only limited research available. These matrices hold promise for long-term drug exposure monitoring, and further research is imperative to unlock their full potential.

As technology continues to advance, forensic toxicologists can expect even more precise and efficient methods for detecting drugs of abuse in various sample matrices, ultimately enhancing the field's ability to contribute to criminal investigations and public health initiatives.

Acknowledgments

This work was partially supported by CICS-UBI, which is financed by National Funds from Fundação para a Ciência e a Tecnologia (FCT) and by Fundo Europeu de Desenvolvimento Regional (FEDER) under the scope of PORTUGAL 2020 and Programa Operacional do Centro (CENTRO 2020), with the project's references (CICS-UBI) UIDB/00709/2020 and UIDP/00709/2020; UCIBIO (UIDB/04378/2020 and UIDP/04378/2020) and i4HB (project LA/P/0140/2020). Ana Y. Simão, Sofia Soares and Mónica Antunes acknowledge the PhD fellowships from FCT (2020.09070.BD, SFRH/BD/148753/2019 and 2020.05765.BD, respectively).