



## **The Evolution, Impact and Future of SFDA Laboratories:**

Reference and Central Laboratories  
Play a Key Role in Promoting Quality  
and Sustainability



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The SFDA laboratories' core mission is to provide scientific assistance to the technical departments of the SFDA, which in turn helps the authority in its regulatory decision-making. The laboratories consist of two main departments: Central Laboratories and Reference Laboratories.

### **Central Laboratories**

The Central Laboratories perform testing for food, feed, drugs and medical devices. This is done for three main purposes: routine inspection, post-marketing surveillance and ensuring compliance. Within the Central Laboratories category, there are three food labs – one in Riyadh, one in Jeddah and one in Dammam – as well as one drug lab and one medical devices lab in Riyadh. The Central Laboratories performed more than 5000 tests on food, drugs and medical devices in 2022.

### **Reference Laboratories**

The Reference Laboratories are the scientific backbone of the SFDA. They are responsible for research and development (R&D), as well as advanced confirmatory testing. The Reference Laboratories are accredited with ISO 17025 and ISO 1743 certifications. They are also in charge of method validation and standardisation and quality testing. The Reference Laboratories fall under three categories: microbiology, food chemistry, and drugs and cosmetics. To date, the Reference Laboratories have conducted a combined 47 proficiency tests with 518 participants from around the Kingdom, spanning food chemistry, microbiology and cosmetics.

The Reference Laboratories have proven to be a driving force for innovation and improvement in the fields of food safety and drug and cosmetics regulation. They have extensive scope, engaging in diverse areas of R&D, making meaningful contributions to education and scientific literature, ensuring regulation and compliance, providing invaluable assistance to industry, harnessing technological advancement, offering scientific advisory, and perpetually diversifying and expanding their reach.

### **Regulation and Compliance**

An essential function of SFDA laboratories lies in their role in regulation and compliance. They are actively involved in evaluating industrial laboratories by ensuring a high standard of practice. Externally, the Reference Laboratories evaluate industrial laboratories to ensure compliance and high standards. To date, 144 private laboratories have been evaluated by the SFDA Reference Laboratories.

In addition to their supervisory role, SFDA Reference Laboratories play a critical role in assisting the private sector by providing workshops, training and technical assistance to these labs, as well as proficiency testing. They provide help with certification for private

laboratories in the food, drug and cosmetics industries. This guidance accelerates product development and encourages industry growth through a focus on economies of scale, quality control and exportability.

### **Research and Innovation**

The Reference Laboratories use cutting-edge technology to ensure food and drug safety, utilising risk assessment to identify microbial and chemical hazards. To help laboratories stay up to date on new methods and technologies, the Reference Laboratories run workshops and training sessions to build local capacity. The SFDA employs 16 graduate students at both the master's and the PhD level in its Reference Laboratories to perform their graduate research projects. In addition, the Reference Laboratories oversee more than 100 visiting scientists, which collectively have contributed to over 25 publications in highly reputable journals.

In an industry with wide-reaching environmental and societal implications for the Kingdom's growing population, it is essential to establish a sustainable approach to work. To achieve this, the Reference Laboratories collaborate with national organisations to adopt a "one health" approach, which aims to sustainably and simultaneously balance and optimise the health of humans, animals, food and ecosystems. A vital part of this approach is the establishment of the first biobank at the SFDA, which serves as a biorepository – a collection for the preservation of diverse microbial species. This includes not only well-known pathogenic microorganisms, but also those with beneficial or unknown properties. This promotes research and public health, facilitates the treatment of disease, and ensures the availability of standardised samples for various applications, from pharmaceuticals to biosecurity.

SFDA Reference Laboratories have shown an impressive capacity for expansion and diversification. The SFDA is continuously evolving and has demonstrated its willingness to explore new areas and respond to emerging needs and challenges.

### **Focus: Antimicrobial Resistance Laboratories**

The issue of antimicrobial resistance (AMR) holds increased significance in the post-Covid-19 era due to the extensive use of antibiotics during the pandemic, which has augmented the risk of antibiotic-resistant bacteria. In addition, the ease of international travel and trade has facilitated the rapid spread of resistant organisms, making monitoring and control functions related to this problem indispensable.

To this end, the AMR division at the Reference Laboratory of Microbiology (RLM) is establishing the first national AMR surveillance system (NARSS). The NARSS database will be accessible to the scientific and medical communities and policymakers in order to tackle the AMR issue. In addition, through next-generation sequencing, the AMR laboratory is leveraging the power of biogenomics to delve deeper into the genetic mechanisms of resistance. Using genomic data, the AMR laboratory can predict the resistance profile of specific infections, thereby tailoring more effective treatment plans. This maximises the efficacy of drugs and minimises the development of resistance.

Due to the slow and costly nature of drug development and the rapid evolution of AMR, the AMR Reference Laboratory is diversifying its approaches to the issue. Through metagenomics, the RLM is pioneering the study of genetic material directly from food samples. Metagenomics is also employed to enhance food safety, and is providing to be a powerful tool for investigating outbreaks and providing insights for the food industry. Metagenomics circumvent the need for individual microbial culturing and allow for comprehensive AMR surveillance across various environments.

### **Focus: Food Chemistry Laboratories**

The Reference Laboratories for Food Chemistry (RLFCs) are a driving force in food safety research, education and nutritional testing. They adhere to the highest international standards of food analysis. Their work encompasses extensive research in food safety, providing pivotal data that guides regulations and policies to protect public health. They also play a key role in education, disseminating valuable information about food safety standards and practices to industry stakeholders and the broader public. The nutritional testing carried out in these laboratories is vital to verifying the nutritional content of food products, which is integral for accurate labelling and consumer information. Working with the highest standards and techniques, the Food Chemistry Laboratories are often solicited to provide analytical services to the government, industry and academia.

### **Focus: Drugs and Cosmetics Laboratories**

The Reference Laboratories for Drugs and Cosmetics (RLMC) effectively provides laboratory-based scientific evidence in response to the drug department's inquiries. This has been accomplished through the creation of technical reports concerning drug safety regulatory issues. In addition, these laboratories have made substantial progress in developing and validating techniques, with a particular focus on establishing a robust method for determining the presence of nitrosamine contamination in pharmaceutical products, glycol concentrations in cough syrups and benzene impurities in cosmetics. Recently, the laboratory conducted a pilot study to investigate the presence of pesticides in herbal supplements, and the results were shared with the appropriate authorities. Furthermore, the RLMC developed a new methodology for detecting 28 allergens in various personal care products, including fragrance. The new optimised analytical method is believed to be a valuable analytical tool to be used in surveillance studies covering a wide range of cosmetic matrices.

### **Latest Advancements**

By utilising the latest generation of microbiology and genomics instruments, chemical analysis instruments and computational tools, SFDA laboratories are at the forefront of technological advancement. In the field of microbiology and genomics, instruments like the MALDI-TOF Biotyper SMART System, Sensititre, the Oxford Nanopore System and the Illumina MiSeq System enable the understanding of microbial communities, the detection of pathogenic organisms and the study of AMR.

Chemical analysis instruments like the LC-QTOF, FTIR and the ICP-MS form the backbone of rigorous analysis in food, drug and cosmetic safety. The LC-QTOF offers high-resolution mass spectrometry for detecting and identifying compounds in complex mixtures, which is essential in food and drug testing. FTIR, meanwhile, allows for the rapid identification of chemical compounds based on their infrared spectra, useful in substance identification in food, drugs and cosmetics. The ICP-MS, for its part, measures trace levels of metals and non-metals in samples, which is critical for ensuring they are within safe limits.

In tandem, computational tools like the SFDA's High Performance Computer (HPC) support data-intensive research. The HPC enables the Reference Laboratories to perform sophisticated simulations and analysis, such as bioinformatics for genomics studies and complex modelling in drug discovery and food safety research. Leveraging this computational power, the Reference Laboratories are also exploring the application of artificial intelligence and machine learning in detecting antimicrobial resistance patterns, which could revolutionise the approach to managing infectious disease. In addition, the RLFC employed artificial intelligence and machine-learning techniques to predict unknown chemical compounds in food using well-established scientific libraries.

### **Conclusion and Outlook**

The SFDA's Reference Laboratories are pillars of innovation, regulation, education and advancement in Saudi Arabia and in the broader MENA region. As they continue to drive R&D, foster education, enforce regulation, support industry and embrace technological advancements, they stand poised to make great contributions to science, industry and society at large.

The integration of cutting-edge tools like artificial intelligence, metagenomics and state-of-the-art equipment is a testament to the SFDA's commitment to excellence and regional leadership R&D. Ongoing expansion and diversification signals an exciting future and highlights the SFDA's pivotal role not only to Saudi Arabia's public health, but also to its scientific and industrial landscape of food, feed, drugs and cosmetics.

