A COMPREHENSIVE MULTI-YEAR FOOD SAFETY ASSESSMENT OF INDUSTRIALLY-PROCESSED COMPLEMENTARY FOODS CONSUMED BY INFANTS AND YOUNG CHILDREN UNDER AGE FIVE IN NIGERIA

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INTRODUCTION

- Complementary foods are critical to the growth and development of infant and young children.

- In Nigeria, the hot and humid climatic conditions, poor agricultural and food handling practices, poor personal hygiene and inadequate food regulations encourage frequent contamination of complementary foods by pathogenic bacteria, toxigenic moulds and toxic chemical contaminants (FAO/WHO, 2018; Makinde et al., 2020).

- Children are at risk of exposure food contaminants because of their poorly developed immunity and lower detoxification capacity (Lombard, 2014).

- This could lead to adverse health effect such as poor child growth and development, lowered immunity and increased susceptibility to infections amongst many other adverse effects (IARC, 2015; De Ruyck et al., 2015; Shirima et al., 2015; Kamala et al., 2017).

STATEMENT OF PROBLEM

- According to WHO, children in sub-Saharan Africa such as Nigeria are more than 15 times more likely to die before the age of 5. These mortality rates could be as a result of exposure to food contaminants. Recently in Nigeria, 109 microbial metabolites and 28 major mycotoxins were quantified in 137 baby food samples (Ojuri et al., 2018). The study did not give account for other chemical contaminants such as pesticides and veterinary drug residues let alone studying the toxicological effect of these food contaminants within a living system. Also, there is paucity of data on the profile of pathogenic bacteria in an industrially processed complementary food.

- Therefore, there is an urgent need to carry out a nation-wide survey of industrially-processed complementary food sold in different supermarkets and retail outlets across Nigeria (Abia, Lagos and Abuja) in order to assess their safety status for consumer protection and public health.
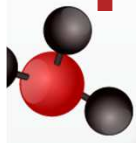
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RESEARCH OBJECTIVES

The objectives of the study are to:

- Conduct a comprehensive longitudinal (quarterly) and multi-year (for two years) survey to sample industrially-processed complementary foods retailed across Nigeria.

- Isolate and characterize, by molecular methods, pathogenic bacteria and toxigenic fungi in the sampled foods.

- Determine the spectrum and quantify the levels of toxic microbial metabolites, pesticides and veterinary drugs in the foods by LC-MS/MS methods.

- Conduct *in vivo* toxicological assessment of mixtures of the chemical contaminants extracted from selected complementary food samples on young animal models.

- Estimate the dietary exposure and assess the risk for each class of hazard, and attempt the development of a combined risk assessment approach/model for all hazards identified

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METHODOLOGY

- **Study design**: the proposed project is a longitudinal study comprising of 4 sampling points over 2 years.

- **Sampling**: a total of 800 industrially-processed complementary foods will be purchased from major supermarkets in Abia, Abuja and Lagos state, Nigeria.

- **Microbiological analysis**: pathogenic bacteria and toxigenic fungi will be isolated and characterized by molecular methods (Houbraken et al., 2012) .

- **Multi-mycotoxin/Veterinary drug analysis**: a robust LC-MS/MS based multi-target method currently validated by collaborators in Austria will be applied to determine the spectra and quantities of bacterial and fungal metabolites as well as pesticides and veterinary drug residues in the food samples (Steiner et al., 2020; Sulyok et al., 2020).

- **Determination of biological/toxicological activity (*in vitro*/*in vivo*)**: Extracts of selected samples representing different mixtures of chemical contaminants as obtained during sample preparation for LC-MS/MS analysis will be tested for their biological/toxicological activity *in vivo* (animal models).

- **Risk assessment**: Dietary exposure and risk assessment estimations for individual chemical contaminants will be performed by the deterministic approach taking into account the identified hazards, food intake and IYC body weight.

EXPECTED RESULTS

- Bacterial and fungal diversities in industrially-processed complementary foods in Nigeria will be explicated.

- Comprehensive data on mycotoxin, pesticides and veterinary drug residues in industrially-processed complementary foods will be provided.

- Novel toxicological data for compound mixtures in the foods on animal models will be documented.

- The findings will be published in high impact peer-reviewed journals.

- The technical competencies of the PhD student will be built in the areas of analytical chemistry, exposure and risk assessment, food safety, molecular microbiology, and toxicology.