

Future topics of common interest for EU and Egypt in food quality, safety and traceability

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POLICY REPORT

Abstract

The objective of the project was to organise an expert committee between Egypt and European Union partners with the aim of producing a document which duly justified proposals for food safety hazard resolution in Egypt. This paper presents the results of the discussion of the expert committee on 'Food safety and traceability'. The meeting was organised at the University of Mansoura in Egypt from 15th to 17th February 2014. It enables an increase in the quality, quantity, profile and impact of bi-regional science and technology cooperation between Egypt and members of the European Union in the field of food safety and traceability.

Keywords: additives, antibioresistance, bacteriophages, consumers attitudes, food supply chain, heavy metals, mycotoxins, national agency, parasites, pathogens, pesticides, traceability

1. Introduction

The present paper summarises the outputs from the experts meeting organised on 15-17 February 2014 at Mansoura University, Egypt, to tackle the thematic 'Food quality, safety and traceability'. It was organised by CIRAD (France) and Mansoura University (Egypt), and sponsored by the

Presidency of Mansoura University (STDF fund) and the French Embassy. The workshop gathered together 27 invited experts from Egypt and three European experts from France and Portugal. The specific objectives of the meeting were to identify mid- to long-term research issues which could be taken-up eventually by EU and Egypt because of the international dimension of the topics.

2. Methodology

For the selection of research topics where both EU and Egypt partners would benefit by cooperation, the following methodology was used within the workshop:

- The first day was a session of presentations. Three key-note speakers from EU (2 experts) and Egypt (10 experts) addressed presentations on a wide range of science and technology issues related to food quality, safety and traceability in the EU and Egypt. Each expert concluded their key-note address with recommendations on the knowledge gaps and research needs identified through their experience and expertise.
- On the second day, the total expert group was separated in two: (1) chemical specialists; and (2) biological specialists. They worked in their groups for a full day and prepared a first list of topics that seemed particularly relevant to EU-Egypt cooperation, including some elements of justification.
- A selection of 14 of the most relevant topics was made based on three criteria: (1) relevance of the topic for Egypt and added value for the EU; (2) pertinence of the topic regarding EU and/or Egypt policy guidelines and drivers; and (3) importance of the knowledge gaps and the need for research with reference to recent international scientific publications.
- Finally, on the third day, each of the proposed topics was summarised and discussed in a plenary session with the totality of experts. The groups drafted as deliverables the Terms of Reference of the topics. There was also a discussion concerning social problems such as how to feed the poor with safe food and the creation of a sustainable system of food safety in Egypt taking in account the actual system.
- Discussions between experts showed that there is a lot of converging research and development topics between the needs of the two continents related to consumers' health. They also highlighted the problems encountered during import-export activities and tried to find common topics of interest to solve some of these problems.

3. Results and recommendations for highly relevant topics for EU and Egypt cooperation in food safety

This section details the outcomes from the different work groups and summarises (in 14 tables) recommendations for topics which are relevant for international cooperation between Europe and Egypt in food safety.

Identification of important topics in chemistry

In this activity, the experts found that pesticide residues were the most problematic field due to their extensive use and impact on the human and animal health. Proposed projects focussed on practical handling in order to reduce the use of pesticides in agriculture and to identify alternatives to the prophylactic use of drugs and other materials used to increase yield and prevent disease in plant production.

Another interesting aspect that could be treated by new projects could be the reduction of excessive heavy metal contamination (in particular cadmium and mercury) in food and water and to model the effects of factors such as heavy metal source and climate change on the prevalence of such contamination both now and in the future.

Direct contact between plastic packaging materials and food may lead to the migration of low molecular weight additives from packaging materials and certain of them are not well identified in Egypt into foodstuffs and may cause harmful effects on consumer health. Different scientific solutions were proposed to solve these problems and in addition, the experts proposed the creation of a reference packaging safety laboratory and the improvement of regulations and specifications. In general experts proposed the replacement of food additives by natural products or traditional compounds. Moreover experts highlighted the need to develop techniques for the detection of contaminants in water and food.

Table 1-5 give a description of those topics.

Table 1. Topic 1: minimise pesticide residues in Egypt

Description	More than 890 synthetic pesticides are approved throughout the world and represent 20,700 commercial products. Consumers are exposed via food and water to a cocktail of pesticides. In Egypt, the majority of assayed milk samples (60-80%) contained pesticide residues, 18.5% of fruit and vegetable samples contained detectable residues of pesticides and 1.9% of them exceeded their maximum residue limits (MRL). In the summer season of 2011, 81.2% of 32 fresh grape samples contained detectable residues of pesticides, and 21.9% of them exceeded their MRL. 35 pesticides were detected in grape and the most frequent were arbendazim, acetamiprid, boscalid, λ -cyhalothrin, profenofos and pyraclostrobin. It is thus a health concern to find a way to reduce pesticide use in agricultural practice.
Proposal	• Hold workshops for farmers and consumers to increase awareness of the hazards of using pesticides, respecting the safety period for harvesting and handling by consumers. • Announcements in the media about hazard of pesticides to public health and steps that have to be taken by consumers to minimise residues of pesticides in foods. • Encourage the farmers to go to organic farming through visits to a model farm. • Better application of the regulations/needs to compare the various existing regulations in EU. • Find alternative methods to using pesticides (bio pesticides in food processing increase in organic agriculture).
Impact	Reduction of pesticides residues in food, better information for the general population and farmers on the harmful effects of pesticides. Decreasing the cost of remedying case of poison. Farmers could find alternative methods to the use of pesticides and be informed about organic agriculture.

Table 2. Topic 2: adopting strategies to reduce heavy metal concentration in food and water.

Description	Pollution of the aquatic environment by inorganic chemicals has been considered to be a major threat to humans, aquatic organisms, fish and food plants. Agricultural drainage water may contain pesticides, fertilisers and effluents of industrial activities supply water and sediment with huge quantities of inorganic anions and heavy metals. Much research has been carried out in Egypt to detect the concentration of heavy metals in drinking water and soil irrigation water and plants crops. The results showed that heavy metals are present at concentrations over the permissive limits and might be the cause of several illnesses in Egypt. Moreover old processing technologies increase the likelihood of heavy metal residues. They come also from food material and packaging, from metal-containing pesticides, from external sources such as from cleaning painting fabricants. The most anthropogenic sources of metals are industrial, petroleum contamination and sewage disposal.
Proposal	• To develop methods to prevent or minimise the presence of heavy metals in food (use of biopolymers like chitosan, cellulose), biological biofilters (algal biofilm) and methods of coating to avoid migration to food. • To develop green farming to reduce the use of metal pesticides.
Impact	Reduce the level of heavy metals in water which could have deleterious effect on human health.

Table 3. Topic 3: replace food additives by natural products or traditional compounds.

Description	Many synthetic chemicals are used as additives for food preservation. Investigations have revealed adverse effects related to the interaction between some additives and the raw material of food or to their degradation or all these factors together. Food additives may make the behaviour of children become dependent of the taste of food. The objective is to find different ways and materials for preserving food that come from natural sources or which have no harmful effects. The aim is to use mostly natural products and to reduce the use of sodium monoglutamate. Research into the use of natural colours to be used in food is necessary.
Proposal	• To find natural food additives and novel methods for extraction of natural compounds. • New methods for preservation/antimicrobial action. • To compare the list of food additives used in Egypt and the authorised products in the EU or proposed by Codex Alimentarius.
Impact	Food safety and health issues by replacement of food additive by natural or traditionally safe compounds.

Table 4. Topic 4: techniques for detection of contaminants in water and food.

Description	Pesticides, heavy metals, food additives are the main contaminants of food and may exert adverse effects on human health. Developing methods for the rapid detection of these compounds at low doses in foodstuffs and water will contribute to decision making either to accept or reject these products before handling by consumers.
Proposal	• To develop analytical methods for the rapid detection of low doses of pesticides, heavy metals, antibiotics, algae toxins, chemical plastic material like polyphenol, some monomers, dioxin polyethylene polychlorinated biphenyl. • To measure the overall toxicity using Microtox[®] analyser (R-Biopharm AG, Darmstadt, Germany) for example.
Impact	Improve knowledge on food contamination in Egypt in order to take political decisions on their use and the replacement of contaminants to minimise levels in food and drinking water.

Table 5. Topic 5: level of packaging material residues in food and their impact.

Description	• Egypt does not have specifications for packaging materials (cans paper, cardboard, glass and plastic) and needs to improve consumer health protection and product quality. • Direct contact between plastic packaging materials and food may lead to the migration of low molecular weight additives from packaging materials into foodstuffs and may have harmful effects on consumer health. Not all packaging is toxic but some become toxic after recycling.
Proposal	• To identify toxic compounds from packaging by developing methods for their detection in food. • To evaluate their effect on liver and kidney, including writing a report on the biological effects of these compounds based on existing bibliography. • To find and improve safe biodegradable packaging. • To create packaging safety laboratories. • To create regulations and specifications related to the specific migration limits of these substances into the foods. • To evaluate such migration in the determination of shelf life of the foods packaged in plastic containers.
Impact	Diminish the health risks created by chemical migration from packaging materials to the food products. Reduce the use of unsafe packaging and replace existing packaging materials by safe biodegradable ones.

Identification of important topics in biology

In this activity, the experts discussed issues of food safety in Egypt. Their discussions included areas as different as the use of antagonistic bacteria to control food spoilage, GMOs and health, and biosecurity. The needs for rapid and reliable methods, verification of their applicability, quantification and sensitivity in different products were also discussed.

The experts found that reviewing current rapid and reliable methods should be investigated in the market to study the contribution of mycotoxin contamination of crops (e.g. cereals, vegetables and fruits) in the food chain. It was also considered necessary to verify methods

of microbial quantification and sensitivity in susceptible selected products of relevance to health and trade. Another potential field of research was the study of the effect of climate change on food safety, namely on what are the real food safety changes and what will be the measures that could be adopted to mitigate risks.

Six main topics were selected by all the participants as being the most relevant ones for Egypt and that at the same time would be so global that could be researched together with EU partners. Table 6-11 give a description of those topics.

Table 6. Topic 1: developments of sensitive methods for screening of some foodborne parasite diseases in Egypt.

Description	• Estimation of foodborne parasitic diseases is helpful for allocating resources and prioritising interventions. In previous Egyptian surveys, many foodborne parasites were detected in human and water supplies with moderate to high occurrences, such as: <i>Toxoplasma gondii</i>, <i>Sarcocystis</i> sp., <i>Encephalitozoon</i> sp., <i>Cryptosporidium</i> sp., <i>Giardia</i> sp., <i>Entamoeba histolytica</i>, <i>Cyclospora cayetanensis</i>, <i>Isospora</i> sp., <i>Fasciola hepatica</i>, <i>Heterophyes heterophyes</i>, <i>Trichinella</i> spp., <i>Capillaria philippinensis</i> and <i>Ascaris lumbricoides</i>. • In Egypt, <i>T. gondii</i> has been reported in humans (51%) and cattle (10.7%). In turkeys, chickens, and ducks it was 59, 47 and 50%, respectively. <i>T. gondii</i> has been reported in ostrich (9%) and camels (17%). High incidences of <i>Sarcocystis</i> sp. of cattle were reported, 84 and 100% in adult healthy and emaciated cattle. The incidence of <i>Sarcocystis</i> sp. was recorded as 79% in goats and 88% in sheep at Aswan. In water tanks 100% of samples from Alexandria were positive for <i>Giardia</i> cysts and <i>Cryptosporidium</i> oocysts. In humans, nested real-time polymerase chain reaction (PCR) showed 58% males and 24.4% females infected with <i>Giardia</i>.
Proposal	Diagnostic tests are very important for detecting parasitic infections. The enzyme-linked immunosorbent assay (ELISA) is the most specific detection system but the use of whole antigens may result in false-positives due to cross-reaction with other closely related parasites. Pathogen specific recombinant antigen protein-based ELISA is necessary to develop a reliable, sensitive and specific diagnostic test using parasite specific antigens. The molecular diagnostic assay PCR can be used to monitor the presence or absence of antigen accurately.
Impact	Recombinant Ag proteins and their related genes could be good diagnostic candidates for the detection of parasitic infections. The project will provide additional information on the presence of the parasitic infection in Egypt and will assist in developing strategies for controlling these diseases.

Table 7. Topic 2: the use of bacteriophage and their products for the biocontrol of food spoilage and pathogenic bacteria.

Description	Antibiotic resistant bacteria, such as specific <i>Escherichia coli</i> (O104 and O107) and methicillin-resistant <i>Staphylococcus aureus</i> , are a serious public health problem. Such bacteria increase the cost of healthcare, increase the rate of infection with serious antibiotic resistant bacteria among people and result in treatment failure and sometimes death. A need for alternative treatments arises. Bacteriophage therapy is currently considered to be an important alternative antibacterial treatment. Phages are very specific and are able to recognise and infect a single bacterial strain and they are known to be inactive against eukaryotic cells. All available results indicate that the oral consumption of phage is harmless to humans since they are present as a normal component in everyday diet.
Proposal	To isolate bacteriophage from different environments in Egypt and characterise them. Cocktails of isolated lytic phages should have a broad host range by infecting a large number of the target pathogens.
Impact	Such cheap and quick methods are very applicable in Egypt to reduce food spoilage and pathogenic bacteria with low cost to enhance the food safety in Egypt and improve the public health.

Table 8. Topic 3: novel approaches to detect pathogenic bacteria in food using bacteriophages.

Description	Delayed or incorrect laboratory diagnostic data of food spoilage and pathogenic bacteria in food industries due to the lack of accurate tests is a significant problem and frequently result in prolonged empiric antimicrobial therapy. PCR is the fastest detection method but still takes time, needs more identification at the species level, and is a quite expensive. The most recent technique is a biosensor which converts a biological response into an electrical signal. It consists of two main components: a bioreceptor which can be a microorganism, cell, enzyme or antibody and the transducer which could be optical, piezoelectric, thermometric, electrochemical, magnetic and micromechanical or a combination of these techniques. Another technique is flow cytometry or the modified direct epifluorescent filter technique which depends on the absorption of fluorescently stained bacteriophages to the host bacterium in a mixed culture.
Proposal	To develop a tool to detect food spoilage and pathogenic bacteria through the application of phage as a bioreceptor.
Impact	Such a quick, low cost and high accuracy method will help to detect small numbers of pathogens without difficulty and as such improve the public health.

Table 9. Topic 4: detection and control of algae toxins in drinking water and in fish.

Description	Water safety in Egypt is facing many challenges. One of these is the presence of algae in large numbers in drinking water and their toxins, especially in drinking water stored in tanks for the majority of residences in Egypt. These toxins could be also transferred to fish. Due to lack of cleaning of these tanks, as well as not applying the proper measures to neutralise the algae toxins in water, has become a direct hazard for consumers.
Proposal	Algae viruses are known to be the most abundant life form in aquatic systems. Some of these viruses can cause predation to algae and thus could be used to control these algae and minimise their presence in aquaculture and drinking water in household tanks. Neutralisation of algae toxins could be achieved using bacteriophages as antibodies. Phages could display antibodies for algae toxins and neutralise them. Algae viruses and bacteriophages are highly specific to their hosts; thus, they are no harm when consumed by humans and animals. Immunoassays could be used to detect algae toxins in water in order to secure suitable treatment.
Impact	Availability of an effective technology to detect levels of algae toxins and a methodology to neutralise them. This should be a priority for the Egyptian population and households and is also an increasing problem in other geographical areas.

Table 10. Topic 5: development of rapid methodologies for qualitative and quantitative of food pathogens.

Description	Food products from Egypt are sometimes stopped at borders due to pathogens. Rapid detection methods are needed so that products are tested before being shipped.
Proposal	To develop rapid analytical methods to detect foodborne diseases (bacteria, fungi, yeasts), starting with extraction procedures. It could be made by technology transfer from the EU or by producing a Lab-on-a-chip to detect pathogens (immunoassays, spectrophotometer based measurements) that are be user friendly, rapid, sensitive and cheap methodologies.
Impact	This will improve food exports and improve food safety in local markets.

Table 11. Topic 6: establishment of a national traceability and bio-surveillance system for foodborne diseases.

Description	When there is major food production, such as for dairy products, fruits and vegetables that are distributed to different markets, contamination problems arise due to retailers with no proper transportation or. The producers use processes and products that guarantee shelf-life but reduce the nutritional value, in some particular cases foodstuffs could be contaminated by toxicogenic fungi. Antibiotics could be added to raw milk before going to the market. In addition, climate changes could produce an increase in temperature and humidity. Statistical data concerning all these problems are absent in Egypt.
Proposal	• To establish a national traceability and bio-surveillance system for foodborne diseases. • To establish different expert committees that could provide government with scientific advice. • To create simulation models for predicting animals and plant diseases. • To check if new microbial strains and toxins are appearing due to extreme conditions so that preventive measures can be established. • To establish a correlation between the presence of microorganisms and the addition of preservatives to diminish the risks and diseases. • To follow the microorganisms along the food chain by analytical techniques like polymerase chain reaction denaturing gradient gel electrophoresis. It will help to follow factors related to climate change (humidity, ultraviolet light or temperature). • To follow the effect of geographical origin on microbial ecology.
Impact	Knowing the statistics and the evolution of pathogens in the population will help the Egyptian government take preventive measure in food safety.

Identification of important topics in social science

Education and training of food handlers and producers was considered to be a need in Egypt. Although in some areas work is starting with the Food and Agriculture Organization of the United Nations, more initiatives should be established. Certain health risks related to food and water are greater among poor people, due to inadequate access to

potable water and lack of appropriate information on food safety risks. Surveillance, gathering of data and research could be conducted to generate knowledge to increase the accessibility of safe food for insecure poor. Table 12-14 give a description of those topics.

Table 12. Topic 1: integrated pathogen control – education, surveillance and training.

Description	Egypt lacks a surveillance system and education which are the main tools used to improve food safety. A national surveillance system has to be created in order to have statistical data that will permit a real food safety politic for all of the Egyptian population. All stakeholders involved in the food chain have to be trained in the implementation of food safety.
Proposal	• To create a national agency for the surveillance of disease controls. • To create an updated data base on foodborne diseases. • To create a national training plan for all stakeholders involved in the food chain and in particular street vendors (by media, training of trainers).
Impact	Safe food for all Egyptians. Public knowledge on diseases.

Table 13. Topic 2: creation of a national food safety system.

Description	Improvement of food safety in Egypt by the establishment of a national policy between government and stakeholders from civil society. The set-up of a national coordination committee on all the issues related to the food safety.
Proposal	• The review and assessment of the legislative framework for food safety and of current control structures. • Tools for strategic and documental surveillance • The creation of a quality label, and the pre-definition of a rapid alert system. • Information and training of stakeholders, namely professional and consumer organisations. • Strengthening the national health risk assessment device by mastering the quality of food circulating in the country and the creation of expert committees that will become a source of proposals for public policies on food safety. • Diagnostic of the systems and legislation on food safety, and of the enforcement difficulties and analysis of malfunctions. • Establishment of the National Coordinating Committee of Food Safety. • Implementation of a monitoring system and national health surveillance. • Generalisation of food safety systems (hazard analysis and critical control points, traceability and good hygiene practices). • Dissemination of information to public authorities, socio-economic factors, consumers, experts. • Strengthening of the national assessment system on health risks through the creation of expert committees.
Impact	On the Egyptian population as a whole, weakened by the deterioration of living standards due to the political crisis and the difficulties of eating healthily.

Table 14. Topic 3: accessibility of safe food to food insecure people.

Description	Food safety is of particular concern among food insecure households in Egypt due to the high prevalence of food-borne illness and other hazards associated with food. Certain risks are greater among the poor, because of poor sanitation, inadequate access to potable water and lack of appropriate information on food safety risks.
Proposal	To increase the accessibility of safe food by the food insecure households by improving the awareness of these households and local social leaders towards food safety.
Impact	Improvement of the accessibility of safe food among the poor, understanding of their awareness, perception and attitudes and the constraints that they are facing is crucial. Generating effective communication programs for the local social leaders and the food insecure households which ultimately will decrease the food safety risks and health care costs.

4. Conclusions

These topics were submitted to the French Embassy, the European Commission (DG RTD, Unit Food, Health, Well-being) and the Directorate of International Cooperation, and to the government of Egypt via the universities. It is expected, that some of the proposed topics will be included in the revisions of the thematic work programs

of EU, dedicated to Egypt and Mediterranean countries. All in all, the workshop was an informal get-together of internationally recognised scientific experts which was a good pre-requisite for future collaborations and partnerships related to the next project calls.

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