



GUIDELINES ON MYCOTOXIN CONTROL IN SOUTH AFRICAN FOODSTUFFS: FROM THE APPLICATION OF THE HAZARD ANALYSIS AND CRITICAL CONTROL POINT (HACCP) SYSTEM TO NEW NATIONAL MYCOTOXIN REGULATIONS

BACKGROUND

Mycotoxins are secondary metabolites produced by fungi that naturally contaminate agricultural foodstuffs either in the field, during improper storage or during food processing. The toxicological effects in animals, which have been known for many years, include the following outcomes: *carcinogenic* (ability to cause cancer), *genotoxic* (causing genetic damage), *teratogenic* (interfering with embryo or fetal growth), *oestrogenic* (duplicating the function of female hormones), *immunotoxic* (damages the immune system), and *nephro-* and *hepatotoxic* (kidney and liver damage, respectively).

Consumption of foods contaminated by mycotoxins such as aflatoxin, fumonisin and ochratoxin A, have also been linked to various adverse health outcomes in human populations (Shephard, 2008). For these reasons, health authorities worldwide regulate mycotoxin levels in human food and animal feed (FAO, 2004).

The presence of mycotoxins in food is, however, often overlooked due to:

- ♦ public and manufacturer ignorance about their existence,
- ♦ the absence of adequate regulatory mechanisms,
- ♦ dumping of below-grade food products in developing countries, and
- ♦ the introduction of contaminated commodities into the human food chain during chronic food shortages.

The Hazard Analysis and Critical Control Point (HACCP) system is one that identifies, evaluates and controls hazards, including mycotoxins, which pose significant health risks in terms of food safety. It is a structured, systematic approach throughout the commodity system and can be applied from the field to the consumer's plate. It requires a good understanding of the relationship between cause and effect in order to be more pro-active and it is a key element in Total Quality Management. HACCP builds on the foundations of well established quality management systems such as Good Agricultural Practices (GAP), Good Storage Practices (GSP) and Good Manufacturing Practices (GMP).

CURRENT NATIONAL TRENDS IN THE HANDLING/ PROCESSING OF FOOD COMMODITIES

The current national system of agricultural product deregulation (viz. the absence of control boards for specific commodities) and worldwide free trade in both raw and processed foodstuffs, have led to the emergence of certain adverse situations in the South African food industry:

- ♦ Exports rejected by foreign countries due to excessive mycotoxin levels in commodities.

- ♦ Low cost imports accepted onto the local markets without proper consideration for consumer safety in the absence of adequate national mycotoxin regulations compared to those enforced by EU countries, the USA and Japan.
- ♦ The manufacture of foodstuffs at the lowest possible cost, with the highest financial benefit to the manufacturer, but without consideration for the consumer's health. This scenario appears to be common in South Africa due to the lack of regulation enforcement.
- ♦ The promotion of self-processing of agricultural commodities by small-scale or emerging farmers, without sufficient training in the production of foodstuffs which are safe for human consumption.
- ♦ Unscrupulous manufacturers sometimes dilute contaminated agricultural products with good quality produce, so as to reach an "acceptable" level of a certain mycotoxin. This practice can still lead to excessive levels of multiple mycotoxins in certain batches due to the specific combination of mycotoxins present and the inadequate mixing of these different batches to produce a totally homogeneous product.

A NATIONAL GUIDELINE BOOKLET ON MYCOTOXIN CONTROL

A project, entitled "Assistance in the definition of a monitoring programme and assessment of mycotoxins in agricultural food commodities" was undertaken from 2006-2008 by the National Department of Health (Food Control Directorate), with technical/financial assistance from the Food and Agriculture Organization (FAO) of the United Nations [Project Reference Number: TCP/SAF/3001(T)]. One of the outputs of the project was the compilation of a booklet by Dr JP Rheeder of the PROMEC Unit, entitled "Guidelines on the application of good agricultural practices (GAP) and the HACCP system in mycotoxin prevention and control in South Africa."

The purpose of this booklet is to assist national stakeholders in government and industry, as well as commercial and emerging farmers, in understanding and implementing a united monitoring programme for the prevention and control of mycotoxins in foods in South Africa. This programme can be applied from the most sophisticated food manufacturing



industries, to the least sophisticated systems of subsistence farming and small-scale food processing.

The current mandate of the Food Control Directorate (NDoH), according to the FAO project directive, is that attention should be given to the following three mycotoxins, their regulation on a national basis and the food commodities identified as most important at this stage due to import and export requirements:

- ♦ **DEOXYNIVALENOL** in maize and wheat flours,
- ♦ **OCHRATOXIN A** in coffee and currants (dried fruit), and
- ♦ **PATULIN** in apple-based fruit juices.

Furthermore, due to national and international importance, attention should also be given to two additional mycotoxins, **AFLATOXIN** and **FUMONISIN**.

Under the South African national regulations (Act No. 54 of 1972, as amended by Government Notice No. R. 1145 of 8 October 2004), the only two mycotoxins considered are:

- ♦ Aflatoxin in all foodstuffs, but specifically peanuts and dairy milk. The legal maximum limit for aflatoxin B₁ is 5 µg/kg or 5 ppb (parts per billion), with a total aflatoxin limit not exceeding 10 µg/kg or 10 ppb. In milk the maximum limit of aflatoxin M₁ is 0.05 µg/L or 0.05 ppb.
- ♦ Patulin in apple juice and apple juice-based commodities is set at a maximum legal limit of 50 µg/L or 50 ppb.

RECOMMENDATIONS FOR POLICY

With the current international focus set on food security and food safety, it is deemed an ideal opportunity for South Africa to broaden its mycotoxin regulations, thereby setting adequate standards which would begin to have positive outcomes for food safety in Africa. The emphasis should also be on instituting the necessary regulatory changes as soon as possible, following on from the momentum brought about by the abovementioned FAO funded project.

In accordance with the guidelines adopted by most other mycotoxin-regulating countries (FAO, 2004), it is recommended that the following should be added to the existing South African regulations:

- ✓ **Deoxynivalenol:** A maximum level of 750 µg/kg (= 0.75 parts per million) in maize and wheat flours.
- ✓ **Ochratoxin A:** Cereals are considered the major source of human exposure to ochratoxin A, but many other foodstuffs, such as coffee, dried fruit products and wine, can be contaminated with this mycotoxin. A level of 5 µg/kg (= 5.0 parts per billion) is recommended for all these foodstuffs.
- ✓ **Fumonisin:** Very few countries have officially adopted regulations pertaining to this group of maize-based mycotoxins, due to the controversy surrounding the “ideal” or economically viable regulatory limits. In 2003, four out of six countries regulating for fumonisins in human foodstuffs, applied a maximum limit of 1000 µg/kg (= 1.0 part per million) in maize and maize-based raw materials. As maize is a staple food in South Africa, with much higher consumption patterns compared to many other countries in North America and Europe, a proposed limit of 1000 µg/kg is debatable as it would put human health at risk under South African conditions when considering the Provisional Maximum Tolerable Daily Intake (PMTDI) of 2 µg/kg bw/day (JECFA, 2001).

The biggest constraining factors in this endeavour are, however, the costs involved in the more extensive monitoring programme of foodstuffs (viz. laboratory analyses) and the policing of such revised mycotoxin legislation by health inspectors.

PREFERRED OUTCOMES OF A REVISED MYCOTOXIN REGULATORY POLICY

- ♦ More comprehensive measures to protect South Africans from the known harmful effects of chronically high levels of mycotoxins in commercially available foodstuffs.
- ♦ Raised awareness among government and industry stakeholders on the health hazards posed by mycotoxins through the dissemination of published scientific data and by conducting information seminars for interested parties.
- ♦ Increased availability of educational information to the general public on the primary mycotoxins of concern, as this will create a climate of understanding and not one of confusion due to sensational media reports.
- ♦ Food safety information being made available to rural subsistence communities to enable them to produce and consume staple foodstuffs which have the lowest mycotoxins levels possible under their circumstances.
- ♦ Regulations to prevent the “dumping” of unsafe (with respect to mycotoxins) food commodities in southern Africa by developed countries.
- ♦ A policy that would be more aligned to that of South Africa’s trading partners and would assist, rather than hamper, the export and import of food commodities.

RECOMMENDED LITERATURE

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