Executive Summary
Risk Assessment on the "Total Aflatoxins (AFT) and Aflatoxin B1 (AFB1) through the Consumption of Peanut and Corn"

This risk assessment was undertaken by the Scientific Panel of the ASEAN Risk Assessment Centre for Food Safety (ARAC) in response to a request from the ASEAN Health Cluster 4: Ensuring Food Safety. The aims of this risk assessment work are:

i. To estimate the level of exposure to Total Aflatoxins (AFT) and Aflatoxin B1 (AFB1) from peanuts and corn in four ASEAN Member States (AMS): Indonesia, Malaysia, Philippines and Thailand

ii. To estimate the health risks of exposure to AFT and AFB1 from consumption of peanuts and corn, in the four AMS; and

iii. To recommend effective measures for controlling AFT and AFB1 contamination in such commodities among AMS based on findings from the risk assessment.

The scope of this risk assessment was confined to peanuts and corn only in view of the limited data available on food consumption and level of AFT and AFB1 in peanut and corn products in the selected countries. The exposure assessment was conducted using the deterministic approach for each country. The target population for the exposure assessment was adults aged between 18-65 years old. The data used for consumption was average consumption in total population. For estimation of exposed level of AFT and AFB1, range (minimum and maximum), mean (if available), as well as maximum limit (ML) from the respective countries were used. Since not all countries provided both the AFT and AFB1 data, conversion factors were used.

Aflatoxins often occur in raw agricultural commodities especially corn, peanuts and other dried foods such as cereals, dried fruits, spices etc, which are also important export commodities for AMS. Tropical or subtropical climates wherein the AMS are located are favourable for aflatoxins production. Once the molds of Aspergilla species contaminated and/or re-contaminated in food commodities and feed or feed raw materials, removing of aflatoxins is very difficult. Knowledge and technology for managing and controlling aflatoxins pre and post-harvest and during storage of food commodity have been focused on prevention and decontamination measures.

AFB1 is the most potent naturally-occurring chemical liver carcinogen known. P450 enzymes in the liver metabolize aflatoxin into aflatoxin-8,9-
epoxide, which then binds to proteins and cause aflatoxicosis, or to deoxyribonucleic acid (DNA) and induce liver cancer.

Many countries have established regulatory controls to reduce aflatoxins intake by removing contaminated products from the market. These regulations and guidelines are expected to reduce aflatoxins contamination in human food and animal feed to levels with no adverse consequences on both human and animal health.

Food consumption data used for this study were obtained from national surveys conducted by each of the countries involved. Malaysian food consumption data were obtained from the National Health and Morbidity Survey 2014: Malaysian Adult Nutrition Survey (MANS). Indonesia’s data were from the National Socio-Economic: Survey 2011 Quarter 1, January 8th of 2015. Data on corn consumption among Thai adults was obtained from the Food Frequency Questionnaire Survey conducted in 2002-2004 initiated by the National Bureau of Agricultural Commodity and Food Standards (ACFS) while data on peanuts consumption were obtained from a 24-hour dietary recall survey by ACFS in collaboration with the Institute of Nutrition, Mahidol University in 2012. Data for the Philippines were obtained from the 8th National Nutrition Survey conducted by the Food and Nutrition Research Institute (FNRI), Manila. The findings showed that consumption of corn in the AMS involved, ranges from 1.89 to 11 g/person/day, which is more than five times the consumption of peanuts which ranged between 0.34 to 1.86 g/person/day.

AFT levels in analysed samples were estimated based on published data provided and selection was based on number of samples analysed and the positive samples, reported Limit of Detection (LOD)/ Limit of Quantification (LOQ) and the range from data reported between years 2001 to 2015. Ranges of AFT and AFB1 levels were obtained from LOD values of method analysis and the maximum levels reported by selected published studies from each country. Average data for AFT and AFB1 analysed in both peanut and corn samples were available from Thailand only. For countries that had only AFT data, AFB1 exposure assessment was calculated based on conversion factors calculated using Indonesia’s data for corn, and Malaysia’s data for peanuts.

The minimum AFB1 levels in peanuts (0.153 µg/kg) and corn (0.042 µg/kg) from Indonesia were the lowest of the five countries. The maximum level of AFB1 was 1,030.05 µg/kg in peanuts (from Malaysia) and 1,450.86 µg/kg in corn (from Indonesia). The range of AFB1 level for
both countries is very wide, when compared to other countries. Only Thailand reported AFB1 data for both commodities with additional of an average levels.

The estimated minimum dietary exposure to AFB1 was between 0.0018 to 0.0181 ng/kg bw per day from consumption of peanuts, and between 0.0023 to 0.2705 ng/kg bw per day from corn. The estimated maximum dietary exposure ranged between 1.9165 to 30.5809 ng/kg bw per day from peanuts, and between 2.8497 to 79.7974 ng/kg bw per day from corn. Based on maximum levels, Malaysians had the highest intake of AFB1 from peanuts while Indonesians had the highest exposure to AFB1 from consumption of corn.

For Thailand, the average dietary exposure of AFB1 from peanuts was 0.34 ng/kg bw per day which is 23 times lower than the maximum (7.7221 ng/kg bw per day). Indonesia had the highest estimated maximum dietary exposure to AFB1 from consumption of corn at 79.7974 ng/kg bw per day. However, Thailand’s maximum estimated value was nearly five times the average level (0.5720 ng/kg bw per day).

The maximum risk estimate of liver cancer cases per year for Malaysia from the consumption of peanuts was the highest (0.371 out of every 100,000 populations) of the four AMS, followed by Thailand (0.191 out of every 100,000 population), the Philippines (0.045 per 100,000 population) and Indonesia (0.043 per 100,000 population). From corn, the maximum risk estimated for Indonesia was extremely high (about 17 times as high as Thailand). On the other hand, the estimated potency of the maximum level of peanut consumption in Indonesia is almost 100 times the regulatory limit.

The Margin of Exposure (MOE) calculated from the minimum exposure of peanut consumption from the Indonesian, Thai and Philippine populations were above the safe margin of 10,000. The only country with MOE from consumption of peanuts which was near the safe margin (9,381) was Malaysia.

However, the MOE values from the minimum exposure of corn consumption were above the safe margin for the Indonesian and Thai populations, but below the safe margin for Malaysia and Philippines. The MOE values for the maximum consumption of peanuts and corn were far below 10,000, which indicated a public health concern. Similar results were shown for the average consumption by the Thailand population.
The percent Tolerable Dietary Intake (%TDI) from minimum exposure to aflatoxins from peanuts and corn were 0.18 to 1.81% and 0.23 to 27.05%, respectively. The %TDI from maximum exposure of AFB1 in peanut and corn were extremely high. The %TDI calculated from the average exposure for peanuts and corn in Thailand were 33.98% and 57.22%, respectively.

Based on the maximum exposure of AFB1 from peanuts and corn in the 4 AMS, it can be concluded that the AFB1 in these commodities could contribute to liver cancer cases. Considering the carcinogenicity properties of AFB1, the findings of this study raises concerns for the health of the 4 AMS populations from consumption of peanuts and corn. The implementation of good practices along the supply chain could contribute to a reduction in liver cancer cases.

It was noted that the health risk may be an overestimate and may not reflect the actual situation due to limited data available. Both data gaps and data quality need to be addressed for future consideration to refine so as to have more accurate risk assessment output.

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