STRENGTHENING AFLATOXIN CONTROL IN MALAWI: POLICY RECOMMENDATIONS

BASED ON FINDINGS OF THE COUNTRY-LED SITUATION ANALYSIS AND ACTION PLANNING (C-SAAP) CONDUCTED FROM 2014 TO 2018 BY THE PARTNERSHIP FOR AFLATOXIN CONTROL IN AFRICA (PACA)

PACA

Partnership for Aflatoxin Control in Africa

Partenariat pour lutter contre l'aflatoxine en Afrique

Parceria para o Controle da Aflatoxina em África

الشراكة من أجل مكافحة الافلاتوكسين في أفريقيا

1. WHAT ARE AFLATOXINS?

Aflatoxins are highly toxic metabolites that affect the safety of food and feed in tropical and subtropical regions of the world, including Malawi. They are mainly produced by *Aspergillus flavus* and *Aspergillus parasiticus* fungi that reside in soil. There are four types of aflatoxins that are important in health and agriculture: aflatoxin B_1, B_2, G_1 and G_2. Aflatoxin B1 is the most common of the four types.

2. WHAT ARE THE HEALTH EFFECTS OF AFLATOXINS?

The health effects of aflatoxins can be categorized into two general forms: acute and chronic aflatoxicosis. Acute aflatoxicosis results from ingestion of food containing moderate to high levels of aflatoxins and is characterized by a rapid and obvious onset of toxic responses, including hemorrhaging, acute liver damage, edema (swelling), digestive difficulties, and possibly death, usually within a week of exposure. Chronic aflatoxicosis is experienced when individuals ingest low levels of aflatoxins in food over a long period. This is associated with immune suppression, low birth weight, impaired child growth and liver cancer. The biggest and best known health effect of aflatoxin is liver cancer. It is estimated that globally about 782,200 new cases of liver cancer occur yearly, and that 83% (648,200) of them occur in less developed countries, including Africa[1]. According to Liu and Wu[2], as high as 28.2% of the annual global liver cancer cases may be attributable to aflatoxin exposure and 40% of these cases occur in Africa. Aflatoxin B1 is recognized by the International Agency for Research on Cancer of the World Health Organization (WHO) as one of the most toxic and carcinogenic substances found in nature.

3. WHAT ARE THE TRADE IMPACTS OF AFLATOXIN CONTAMINATION?

The Food and Agriculture Organization (FAO) of the United Nations estimates that 25% of the food produced worldwide is contaminated with aflatoxins. Due to the increasing recognition of the impact of aflatoxins on human health, food regulatory authorities have set and enforced limits for aflatoxins in traded food. Stringent limits of 2 ppb for aflatoxin B1 and 4ppb for total aflatoxins in foods are enforced in the European Union (EU). In countries that fail to meet aflatoxin standards, foreign income from aflatoxin prone foods falls as exporters cannot access strategically important international markets. Africa is reported to lose more than US$ 670 million per year in export earnings due to the presence of aflatoxins in farm produce. If a country does not have or enforce aflatoxin regulations, contaminated foods which do not meet export standards will be sold in the domestic market or used for household consumption, increasing the health risks associated with aflatoxin exposure in local communities.

4. WHAT TYPES OF FOOD ARE PRONE TO AFLATOXIN CONTAMINATION?

Aspergillus spp. can colonize and contaminate a wide variety of food commodities with aflatoxins, including maize, sorghum and groundnuts, which are staple foods in Malawi.

5. WHAT ARE THE GLOBAL REGIONS MOST AFFECTED BY THE AFLATOXIN CONTAMINATION PROBLEM?

Fungal growth and the formation of aflatoxins in food is influenced by climatic conditions. Regions and countries such as Malawi, located between 40ºN and 40ºS, have a climate that favors growth of the aflatoxin producing *Aspergillus* spp. and are thus chronically affected by aflatoxin contamination of food and feed.

6. AT WHAT STAGE ALONG THE FOOD CHAIN DOES AFLATOXIN CONTAMINATION OCCUR?

The risk of aflatoxin contamination begins during pre-harvest and can be worsened by inappropriate harvesting, handling, storage, processing, and transport practices. Drought, high temperature, low soil fertility, pest infestation and other stresses that affect plant growth and vigor increase the likelihood of fungal infection as well as the levels of aflatoxins produced by the *Aspergillus* fungi. Aflatoxin contamination can thus be prevented by application of good agricultural practices in crop cultivation and good management practices in post-harvest food handling.

7. TO WHAT EXTENT ARE MALAWIAN FOODS CONTAMINATED WITH AFLATOXINS?

Aflatoxin analysis in 1,371 groundnut samples collected from markets and homestead in 19 districts of Malawi, between 2009 and 2016, showed detectable levels of aflatoxins in about 95% of the samples. Levels of contamination in the samples were up to 7, 745 ppb. In general, 64% of the groundnut samples contained aflatoxin levels exceeding the national regulatory limit of 3 ppb. Proportions of groundnut exceeding the limit of 3 ppb varied from 30 – 100% across agro-ecological zones of Malawi (Table 1). In Chitipa, Dedza and Karonga, 100% of samples contained aflatoxin contents above the national regulatory limit of 3 ppb.

1 Ferlay, J., Soerjomataram, I., Dikshit, R., Eser ,S., Mathers, C., Rebelo, M., Parkin, D., Forman, D. and Bray, F., 2015. Cancer incidence and mortality worldwide: sources, methods and major patterns in GLOBOCAN 2012. International Journal of Cancer, 136(5):E359-E386. Doi:10.1002/ijc.29210.

2 Liu, Y. and Wu, F. 2010. Global burden of aflatoxin-induced hepatocellular carcinoma: a risk assessment. *Environmental Health Perspectives* 118(6): 818-824

TABLE 1: OCCURRENCE OF AFLATOXIN IN GROUNDNUT SAMPLES FROM DIFFERENT DISTRICTS OF MALAWI, 2016 CROP SEASON

District	Aflatoxin positive samples (%)	Maximum concentration (ppb)	Percent of samples exceeding aflatoxin MLa		
			Malawi (3ppb)	EU (4 ppb)	US (20ppb)
Blantyre	96	220	83	78	70
Chikwawa	100	5926	83	82	24
Chitipa	100	250	100	91	82
Dedza	100	110	100	100	17
Dowa	98	2580	61	53	10
Lilongwe	97	4131	65	58	29
Karonga	100	160	100	100	45
Kasungu	95	3756	61	54	19
Machinga	100	600	62	54	23
Mchinji	89	4040	50	39	12
Mulanje	100	860	79	79	21
Mzimba	94	2433	55	46	11
Nkhotakota	97	6480	73	69	38
Ntcheu	94	4362	62	59	24
Ntchisi	94	4855	54	45	8
Phalombe	90	987	38	38	33
Rumphi	100	46	94	94	50
Salima	95	7742	73	67	35
Zomba	100	12	85	62	0
National	95	7742	64	57	23

[a] ML, Maximum limit

TABLE 2. OCCURRENCE OF AFLATOXIN IN MAIZE FROM DIFFERENT DISTRICTS OF MALAWI

District	Aflatoxin positive samples (%)	Maximum concentration (ppb)	Percent of samples exceeding aflatoxin MLa		
			Malawi (3ppb)	EU (4 ppb)	US (20ppb)
Chikwawa	95	800.0	91.1	91.1	69.6
Kasungu	41	138.6	11.1	11.1	3.7
Lilongwe	8	56.0	8.1	8.1	8.1
Mchinji	48	228.80	36.0	32.0	8.0
Mzimba	7	9.5	6.7	6.7	0.0
Nkhotakota	30	61.0	11.1	11.1	7.4
Ntchisi	19	11.9	9.5	9.5	0.0
Phalombe	100	483.6	100.0	100.0	81.8
Salima	74	107.4	32.3	26.2	10.8
Mulanje	77	230.0	73.3	66.7	26.7
Zomba	75	299.4	32.5	27.5	17.5
Blantyre	80	440.0	51.4	40.0	17.1
Dedza	24	96.6	13.5	8.1	5.4
Karonga	75	113.3	50.0	50.0	25.0
Mangochi	78	877.5	61.5	55.1	29.5
Thyolo	100	107.3	65.2	60.9	17.4
Balaka	50	49.4	21.4	14.3	7.1
Nkhotakota	33	587.0	33.3	33.3	20.8
Nsanje	85	288.9	80.0	80.0	60.0
Total	60	877.5	42.2	38.6	21.9

a ML, Maximum limit

TABLE 3: OCCURRENCE OF AFLATOXIN IN SORGHUM FROM DIFFERENT DISTRICTS OF MALAWI

District	Proportion (%) of samples above maximum limit (ML)		
	Malawi (3ppb)	EU (4ppb)	US (20ppb)
Chikwawa	100	100	89
Dedza	67	0	0
Karonga	57	57	57
Mulanje	100	100	88
Nkhotakota	100	100	100
Salima	88	88	50
Zomba	100	100	25
Country-wide	90	86	68

Overall, about 60% of maize from 20 districts of Malawi contained detectable levels of aflatoxins. Aflatoxin contamination levels in maize samples collected in 2011, 2012 and 2016 reached up to 878 ppb and exceeded the national regulatory limit of 3 ppb in about 42% of samples. Phalombe, Chikwawa, Nsanje and Mulanje districts had higher proportions of maize samples exceeding the maximum limit for aflatoxin (Table 2).

In Sorghum, majority (90%) of samples collected in 2016 contained aflatoxin levels greater than the national tolerable limit of 3 ppb. In Chikwawa, where it is the primary staple, almost 100% of sorghum contained aflatoxin levels exceeding 3 ppb. The highest contamination in this district was 560 ppb (mean, 100 ppb). The national mean contamination level was 32.14 ppb.

8. TO WHAT EXTENT ARE MAIZE, SORGHUM AND GROUNDNUT IMPORTANT FOR FOOD SECURITY AND TRADE IN MALAWI?

In Malawi, groundnut, maize and sorghum are produced for both household consumption and market. About 40-45% of the annual groundnut production is marketed. Groundnut production has been increasing over the years from around 54,000 MT in 1983 to about 397,000 MT in 2014. During that period, maize production reached 3.8 million MT. About 10-13% of the maize production is marketed[3]. Sorghum is also a staple cereal crop in Malawi particularly in the Lower Shire districts of Nsanje and Chikwawa. In the Lower Shire Valley, sorghum accounts for up to 60% of the cultivated area.

3 Jayne, T. S., Sitko, N., Gilbert, J.R., and Mangisoni, J. 2010. *Malawi's Maize Marketing System*. A study report submitted to DFID Malawi. Unpublished.

9. WHAT IS THE EXTENT OF AFLATOXIN EXPOSURE AMONG THE PEOPLE OF MALAWI?

The higher the daily per capita consumption of aflatoxin prone food, the higher the risk of aflatoxin exposure. The C-SAAP study estimated that per capita maize consumption in Malawi is about 356 g/day. The study indicated further that all the surveyed households in Malawi consumed both maize and groundnut. Per capita groundnut consumption was 30.4 g/day. The mean daily exposure to aflatoxins as estimated based on the maize and groundnut consumptions was 261 ng/kg body weight (bw)/day.

10. WHAT IS THE RISK OF DEVELOPING AFLATOXIN-INDUCED LIVER CANCER IN MALAWI?

The risk of developing liver cancer (when individuals are exposed to aflatoxins) is 30 times higher in individuals exposed to hepatitis B Virus (HBV) compared to those who are not. Based on mean daily exposure to aflatoxins 261 ng/kg bw/day[4] and the HBV+ prevalence of 12.2%[5], the risk of aflatoxin-induced liver cancer cases was estimated to be 11.89 per 100,000 population which translates to a national total of 2,171 aflatoxin-induced liver cancer cases per year, based on the Malawi population of 18,244,451[6].

4 PACA. 2018. *Country-led Aflatoxin and Food Safety Situation Analysis and Action Planning for Malawi: Final Report*, Partnership for Aflatoxin Control in Africa, African Union Commission

5 Schweitzer, A., Horn, J., Mikolajczyk, R. T., Krause, G., and Ott, J. J. 2015. Estimations of worldwide prevalence of chronic hepatitis B virus infection: a systematic review of data published between 1965 and 2013. *The Lancet* 386(10003): 1546-1555

6 NSO. 1999. *Projected Population based on 1998 Malawi Population and Housing Census*. National Statistical Office, Lilongwe, Malawi.

11. WHAT IS THE NUMBER OF HEALTH LIFE YEARS LOST DUE TO AFLATOXIN-INDUCED LIVER CANCER IN MALAWI?

With assumption that each liver cancer case results to death within a year, it was estimated that the aflatoxin-induced liver cancer cases would lead to **a loss of 75,437 healthy life years, annually**. The healthy life years lost were estimated using the disability adjusted life years (DALYs) approach.

12. WHAT IS THE ECONOMIC IMPACT OF AFLATOXIN-INDUCED LIVER CANCER IN MALAWI?

Monetization of the risk for aflatoxin-induced liver cancer cases results in a **loss of up to US$ 392.6 million, annually**. This economic impact of aflatoxin-induced liver cancer was estimated using the Value of Statistical Life (VSL) as described in Narayan et al[7]. The loss represent the amount of money that could be saved, annually, by adopting measures to curb aflatoxin contamination in Malawi.

13. WHAT IS THE LOSS OF INCOME IN MALAWI DUE TO AFLATOXIN CONTAMINATION IN GROUNDNUTS?

It is estimated that, if Malawi was able to comply with the stringent aflatoxin limit of 4 ppb set for the European market for groundnuts, the country's groundnut production for the period 2012-14 could have been 49.2% (175,450 MT) higher. If this additional volume, combined with the volume sold to the Eastern and Southern Africa (ESA) market, which is not aflatoxin sensitive, could be sold to the EU market, Malawi could earn at least US$31 million more, yearly. During the 2012-14 period, Malawi sold her groundnuts to the ESA market where export prices averaged US$ 0.38/kg, earning on average US$ 55.0 million, annually. The average international price of groundnut during that period was US$ 0.51/kg.

14. WHAT ARE THE PACA SUPPORTED INITIATIVES TO CONTROL AFLATOXINS IN MALAWI?

PACA supported a country-led situation analysis and action planning (C-SAAP) for control of aflatoxins along the groundnut, maize and sorghum value chains in Malawi. The policy recommendations in this document are based on the outcomes of the C-SAAP. Additionally, in partnership with key institutions in Uganda, PACA is generating and sharing data under the framework of the Africa Aflatoxin Information Management System (AfricaAIMS) initiative. AfricaAIMS generates data on aflatoxin contamination in groundnut, maize and sorghum, as well as on other aflatoxin related issues in the health and trade sectors. The initiative's key objective is to provide locally relevant, home grown and reliable evidence to facilitate informed decisions on policies, food safety regulations and standards, mitigation interventions (e.g. educational and technological), resource allocation, and advocacy and awareness raising activities by the Malawian government and other stakeholders. Local capacity building, through the provision of equipment and training of personnel, is central to AfricaAIMS.

PACA also provided catalytic support to develop a resource mobilization strategy and convene business meetings to enhance ownership and financing of the national aflatoxin control plan. PACA's catalytic support extends to convening aflatoxin working groups to spearhead planning and implementation of aflatoxin mitigation actions at the country level. In order to ensure that these efforts are well coordinated, PACA has hired a country officer who is hosted at Ministry of Industry, Trade and Tourism to provide ongoing support to track progress in the implementation of the national aflatoxin control plan.

15. WHAT ARE THE ROLES OF KEY INSTITUTIONS INVOLVED IN THE DELIVERY OF FOOD SAFETY CONTROL SERVICES IN MALAWI?

In Malawi, only a few national and sectoral policy and strategic frameworks do specifically recognize and make reference to aflatoxins. Most of such frameworks are under agriculture and trade sectors. None of the policy frameworks under health and environment sectors address aflatoxin regulation. Importantly, Malawi does not have a specific food safety law that would ensure enforcement of food safety standards in the country.

16. WHAT IS THE LEVEL OF AWARENESS OF AFLATOXINS AMONG VALUE CHAIN ACTORS IN MALAWI?

There is a fair level of awareness about the aflatoxin challenge amongst traders in Malawi. About 42% of traders interviewed had heard about aflatoxins and their health impacts. The main source of information was radio. There is no information on awareness levels of other value chain actors.

7 Narayan, T., Stene, A., Belova, A. and Brown, L., 2013. *A Conceptual Framework for Conducting Country and Economic Assessment of Aflatoxin Contamination*. Prepared for Meridian Institute in support of Partnership for Aflatoxin Control in Africa, Washington, D.C., Abt Associates Inc., pp. 1 -69

17. EVIDENCE-BASED POLICY RECOMMENDATIONS FOR THE MITIGATION OF THE AFLATOXIN PROBLEM IN MALAWI

Based on the identified gaps in aflatoxin control in Malawi, a set of recommendations were developed by the C-SAAP and validated by stakeholders. The recommendations are categorized under five major areas where Malawi should focus interventions for the control and management of aflatoxins (Table 2).

TABLE 4: POLICY RECOMMENDATIONS FOR MITIGATION OF THE AFLATOXIN PROBLEM[8]

Recommendations for agriculture sector
1. Develop and validate feasible practices, such as bio-control technology, for management of aflatoxin in crops and livestock production chains
2. Integrate aflatoxin control measures in the guidelines for Good Agricultural Practices (GAP) and Good Animal Husbandry Practices (GAHP) for control and management of aflatoxin in crops and livestock production chains.
3. Train agricultural extension and food inspection agents on aflatoxin prevention and control
4. Equip farmers with knowledge on aflatoxin prevention and management practices and the socio-economic and health benefits of adoption of such practices.
5. Publish and disseminate guidelines on Good Agricultural Practices (GAP), Good Animal Husbandry Practices (GAHP), and Good Post-harvest Management Practices to all public and private agricultural extension agents, including summaries in local languages.
Recommendation for health sector
6. Mainstream aflatoxin control measures in all relevant policies and strategies such as Public Health and Food and Nutrition Policies under the Ministry of Health.
7. Incorporate aflatoxin avoidance measures in the Guidelines on Infant and Child Nutrition
8. Distribute the new guidelines on Infant and Child Nutrition to all districts
9. Train all district nutrition officers on aflatoxin issues and aflatoxin control measures prescribed in the Infant and Child Nutrition Guidelines
10. Develop and disseminate guidelines on dietary diversification as an aflatoxin exposure reduction strategy
11. Equip all referral and district hospitals with facilities for screening patients for aflatoxin exposure
12. Equip the National Public Health Laboratory (CHSU) with aflatoxin analysis capacity
13. Train health practitioners and technicians in the need and techniques for screening patients for aflatoxin exposure.
14. Build capacity of clerks on importance of capturing and achieving aflatoxin related data
15. Promote and support research on relationship between aflatoxin exposure and health burden
16. Train all HSAs on aflatoxin exposure control
17. Introduce universal vaccinations against HBV
Recommendations for the education sector
18. Incorporate aflatoxin related issues in primary, secondary and tertiary education
19. Train the trainers for teachers of secondary and primary schools in each district, on aflatoxin issues

Recommendations for the Trade sector
20. Train lead aggregators, traders, exporters, and processors in control and management of aflatoxin in the value chains with emphasis of traceability.
21. Review aflatoxin regulatory framework to ensure aflatoxin control measures are adequately incorporated
22. Develop regulation and guidelines for treatment and disposal of contaminated food commodities
23. Develop innovative regulatory system for the informal internal market where most of the aflatoxin unsafe foods are being traded and consumed
24. Establish aflatoxin screening capacity at least in each district
25. Equip the laboratory of Malawi Bureau of Standards (MBS) with aflatoxin analysis capacity
26. Identify and promote market-based incentives for production of aflatoxin safe foods
27. Develop and disseminate guidelines of Good Manufacturing Practice (GMP) and Hazard Analysis Critical Control Point (HACCP) plan for aflatoxin control in the food industry
28. Develop and promote a voluntary mechanism for self-regulation of food safety and quality
29. Undertake in-depth analyses such as general equilibrium and price transmission analyses that should inform policy makers on the poverty, income distribution and economic growth effects of economic losses emanating from failure to manage the aflatoxin challenge.
Recommendations for awareness raising and advocacy
30. Support operationalization of the Aflatoxin Communication strategy
31. Sensitize the public about the aflatoxin problem including causes, impacts and corrective measures that need to be undertaken based on findings from the existing and forthcoming empirical analyses
32. Advocate aflatoxin control and management measures to the Management of the Mninitry of Health with special emphasis on the synergistic effects between aflatoxin exposure and Hepatitis B Virus (HBV)
33. Provide training to communication personnel from all key sectors relevant to aflatoxin management 34. Work with other key sectors such as climate change and environmental management to ensure that their policy and strategic frameworks do incorporate aflatoxin control and management issues
35. Undertake systematic and systemic sensitization campaigns with the District Council governance structures including District Executive Committees (DEC), District Agriculture Committee (DAC) and full Councils
36. Assist the districts to ensure that their monitoring and evaluation (M&E) frameworks include aflatoxin control and management issues.
Recommendations to improve food safety coordination
37. Mainstream aflatoxins into the district council policy and strategic frameworks including annual work plans and budgets in order to translate the national policies to the community level for more impact
38. Formulate Food Safety Policy and Law to provide a firm and clear legislative foundation for the food control system
39. Support development of district specific aflatoxin control and management strategies
40. Facilitate implementation and monitoring of aflatoxin control and management at district level
41. Engage NGOs and special action groups to collaborate at district and national level to promote aflatoxin control and management
42. Formulate a strategy to ensure sustainable financing of aflatoxin management

8 Based on the findings of the C-SAAP: PACA. 2018. *Country-led Aflatoxin and Food Safety Situation Analysis and Action Planning for Malawi: Final Report*, Partnership for Aflatoxin Control in Africa, African Union Commission

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