REPORT

REGIONAL TRAINING WORKSHOP ON QUALITY ASSURANCE AND QUALITY CONTROL (QA/QC) FOR FLOUR FORTIFICATION

Lusaka, Zambia, 15-18 May 2017

Supported by:

INTRODUCTION

Many countries in Africa are implementing mandatory maize and wheat flour fortification or are considering the adoption of this intervention at national level. The success of the fortification programme hinges on industry participation and good quality assurance and quality monitoring systems by which the private and public sectors collaborate to produce quality-fortified food that ensures that the consumers get all the nutrients they are supposed to get from the food. The need for a smart partnership and collaboration between government, industry, academia and the civil society is imperative for each has a key role to play in the success of food fortification and the fight against malnutrition.

To foster these smart partnerships and ensure effective quality assurance and quality control, training on quality assurance and quality control, based on the Wold Health Organization (WHO) and Food and Agriculture Organization (FAO) *Guidelines on Food Fortification with Micronutrients* (*2006*) is an essential requirement for countries that are implementing or planning to embark on flour fortification. Since 2009, Smarter Futures, a Partnership for Africa of the Food Fortification Initiative (FFI), The International Federation for Spina Bifida and Hydrocephalus (IFSBH), AkzoNobel, and Helen Keller International (HKI) with co-financing from the Dutch Government has offered technical training in quality assurance and quality control of fortification programmes for millers, food control regulatory personnel and public health laboratory personnel from countries in Africa. The QA/QC concept has been proven to be very effective and such Regional Training workshops have been held in Senegal (Dakar, 2009), Tanzania (Dar Es Salaam, 2011), Morocco (Casablanca, 2014), Zimbabwe (Harare, 2015) and Uganda (Kampala, 2016).

OBJECTIVE OF THE WORKSHOP

The overall objective of the Training on Quality Assurance and Quality Control in Flour Fortification was to provide training to those that have been identified by the national stakeholders in countries in Central, Eastern and Southern Africa (government food control officials, regulatory inspectors, milling industry personnel, academia) as responsible for the key components in the national maize and wheat flour fortification programme.

EXPECTED OUTPUTS

The workshop expected to achieve the following outputs by the end of the training sessions:

- Maize and wheat flour millers will have increased capacity and commitment to implement adequate quality control and quality assurance systems to consistently produce a safe and quality product that meets national standards and specifications.
- Regulatory authorities will have increased capacity and commitment to monitor fortified food production in an effective, efficient and sustainable way. For most countries, this is expected to include a greater emphasis on monitoring the quality and safety of premix/fortificant.
- Production/fortification and internal quality assurance systems and the fortified food at production level as opposed to market and retail level surveys.

- An improved dialogue between maize and wheat flour millers, government authorities and universities; and an improved understanding of requirements, roles and responsibilities of the national stakeholders.
- Documentation of existing national regulatory monitoring systems and practices and proposals for improvement from selected countries.
- Those trained in the workshop will provide training on the components of national flour fortification programmes for other personnel and employees in their respective countries and stakeholder organizations.

WORKSHOP FORMAT

The meeting followed the WHO/FAO schematic for regulatory monitoring as published in the WHO and FAO *Guidelines on Food Fortification with Micronutrients*, 2006. The workshop was separated into sessions covering (i) food fortification legislation, regulations and standards, (ii) internal monitoring, and (iii) external and commercial monitoring. International experts and national experts from participating countries made presentations. One day was set aside for practical exposure and training on fortification and quality control of both maize and wheat flour at African Milling Limited and the Zambian Food and drugs control laboratory (FDCL). On the last workshop day, participants worked in groups by background and area of interest before reconvening into their respective countries to prepare a presentation on the inventory of what is currently available in their countries and develop recommendations and next steps which were then presented.

PARTICIPANTS

Workshop participants were drawn from the region with the following countries being represented: Botswana, Lesotho, Malawi, Namibia, Nigeria, Swaziland, Zambia, and Zimbabwe. The countries were represented by their food industry, universities, government nutrition and regulatory monitoring staff from Ministries of Health, and Trade and Industry. The following is a summary of attendance of workshop:

Facilitators	8
Participants (government/industry)	65
Partners	22
TOTAL	**95**

AGENDA

The detailed agenda of the workshop can be found here. The website includes hyperlinks to the pdfs of all presentations.

QA/QC MEETING SUMMARY

Day 1: registration, official opening and plenary sessions

Registration of participants was being done as they arrived, and they received their workshop package, which included a programme, notepad, pen, and a small bag from one of the partners. All facilitators, partners and participants introduced themselves. Pre-test questionnaires were handed out to participants to get a view on the current knowledge of the participants and their expectations towards the training.

Official Opening:

Anna Verster started by launching a welcome statement on behalf of Smarter Futures, the organizing committee and the supporting organizations.

Felistus Mugambi (GAIN/Kenya) then gave an overview of the Global Alliance for Improved Nutrition (GAIN) role in supporting large-scale food fortification and the cooperation with the Eastern Central and Southern Africa (ECSA) Health Community in the initiative to strengthen human capacity to monitor fortified and nutritious food in the region. She stated how GAIN has over the years worked with Smarter Futures in support of quality assurance and quality control as well as reviewing coverage and compliance using the Fortification Assessment Coverage Toolkit (FACT).

Doreen Marandu of the ECSA Health Community (ECSA-HC) said that ECSA's mandate as regional intergovernmental organization is to promote and encourage efficiency and relevance in the provision of health services in the ECSA's member states, i.e. Kenya, Lesotho, Malawi, Mauritius, Swaziland, Tanzania, Uganda, Zambia, and Zimbabwe. One example is the joint capacity building effort with GAIN in which ECSA provides a platform for regional exchange on promising practices, gaps, and challenges, for which four working groups have been formed to address production, quality assurance and quality control, inspection and enforcement, laboratory networking and consumption and impact monitoring.

Lieven Bauwens, the Secretary General of the International Federation for Spina Bifida and Hydrocephalus (IF), and as the project-holder for Smarter Futures, thanked the Ministry of Health for hosting this meeting and for their support to organising it. Without their invaluable support, this workshop could not have taken place.

He informed the audience that Smarter Futures is a Partnership for Africa of FFI, IF, AkzoNobel, Helen Keller International (HKI) with co-financing from the Dutch Government. In addition to these core partners, many other organisations and companies are regular technical and/or financial supporters of Smarter Futures, notably the World Health Organization (WHO); the World Food Programme (WFP); Project Healthy Children (PHC); UNICEF; ECSA-HC; the West African Economic and Monetary Union (UEMOA in French); the Economic Community of West African States (ECOWAS); the West African Health Organisation (WAHO); premix suppliers DSM, Hexagon and Muehlenchemie; GAIN; BioAnalyt; the Department of Food Safety and Food Quality of Ghent University in Belgium; Bühler, and Nutritional International.

Smarter Futures is indeed a partnership that works across borders and across sectors. It has no intention of starting fortification programmes in a specific country. Lieven emphasized that Smarter Futures does not fortify foods ourselves; we support national alliances to fortify effectively in their country.

Staple food fortification, including wheat flour and maize flour, is an effective component of an integrated strategy to address health problems of micronutrient malnutrition in many countries, including those in Africa. Without interventions, both iron deficiency anaemia and folic acid insufficiency cause significant economic losses due to lower productivity in both the adult population and the future productivity of children as adults.

Lieven informed the audience that last week Smarter Futures were pleased to support a two-day workshop on Cost Benefit Analysis of maize flour fortification for Zambia. The participants represented the Zambia Millers Association, Ministry of Health officials, Ministry of Industry, Zambia Revenue Authority, Zambia Food and Nutrition Commission, Zambia Bureau of Standards, Consumers Association of Zambia, and international agency partners. Participants presented the result of the cost benefit analysis at this workshop.

Mr **Simon Cammelbeck**, WFP Country Director, spoke on behalf of WFP as well as the broader United Nations (UN) in Zambia. He said fortification of various staple foods is of paramount importance in the push towards achieving Sustainable Development Goal #2: Zero Hunger. He mentioned that fortification is listed as a priority intervention in Zambia's National Food and Nutrition Strategic Plan, as well as in the country's first 1000 days programme. Further he stated that in the cost:benefit analysis meeting, it was found that for every 1 kwacha invested in maize flour fortification in Zambia, there is a potential return of 6.9 kwacha to the economy through improved health and higher productivity, which makes it an excellent investment in the future of the Zambian people. Mr Cammelbeck expressed his excitement at the opportunity to learn in the QAQC training workshop from the successes and experiences of countries across the region and to see how these lessons can be applied to the own national contexts to really drive the fortification agenda forward, for the benefit of the countries but also for the region. Finally he looked forward to exploring how the UN could further support the roll out and implementation of this critical initiative.

Mr **Andrew Chintala**, chairman/president of the Millers Association of Zambia (MAZ) addressed the meeting by stating that the Millers Association of Zambia, wished to applaud Government, Smarter Futures, and its cooperating partners for successfully hosting this important event in Zambia, mentioning that MAZ was delighted to be part of the team sharing ideas to this noble workshop on flour fortification. The Zambian millers have heard on several occasions about the devastating effects of micronutrient deficiencies in children and women in Zambia, the region and worldwide. They have equally heard of, and seen, initiatives by the Zambian government and other stakeholders that are aimed at mitigating such deficiencies that are primarily driven by the public sector. They are also aware of the positive outcomes of such initiatives. On behalf of the MAZ members, Mr Chintala applauded government for the successes attained to date, whilst recognizing that much more effort still needs to be done through the combined effort of all well-meaning stakeholders locally and worldwide.

To ride on this momentum created by government and cooperating partners, MAZ believed that to make sustainable headways in fighting a social challenge such as deficiencies, strong partnerships between the public and private sector are needed. As the private sector, they often were accused of being profit focused.

However, at the core of our business models, are people and the challenges they face. What affects the country socially, affects the industry's businesses and so they identify their businesses with the common shared values on a healthy and thriving nation.

It is for this reason that when, as a private sector member organization MAZ was informed of the scope and ideals of the flour fortification initiative, they did not hesitate to jump on this fantastic opportunity to solve a social problem that primes the private sector as an important partner. They viewed the flour fortification initiative as a good example of the public – private partnership with common shared values on a social problem. Their role, as processors in the food value chain, places them at the core Centre of flour fortification initiative in that they are the actual implementers, to make it work.

Focusing on the Objective of this gathering; which is to equip national advocates with the tools to effectively make the economic case for wheat flour and maize meal fortification to national policy makers; Mr Chinatla called upon the Government, requesting for incentives and duty/tax relief on fortificants (premixes) and dosifiers (equipment).

On behalf of the MAZ members and the sector; he would like to assure the Government, Cooperating partners and indeed the Consumers that they have sufficient capacity and qualified personnel to successfully implement the fortification program with full support and contribution of the government, cooperating partners and the consumers.

The MAZ members remain committed to the successful implementation of the flour fortification on a sustainable and cost-effective basis, for the benefit of their esteemed customers and the public at large.

Finally, the media plays a very significant role in the dissemination of information to the public. Mr Chintala therefore called upon the media to assist in sensitizing the public about the benefits of consuming fortified flour.

On behalf of the **Honourable Minister of Health of Zambia, Dr Chitalu Chilufya**, Dr Wezi Kaonga, Deputy Director of Health gave the opening speech to the joint Ministry of Health and Smarter Futures training workshop on Quality Assurance and Quality Control for Flour Fortification, stating that the objective of this training workshop is to equip Millers and Regulatory Staff with knowledge and skills on Quality Assurance and Quality Control on maize and wheat flour fortification. This is critical to the effective monitoring of micronutrients in fortified foods as fortification is among the interventions in tackling micronutrients deficiencies. Furthermore, this meeting has been called to share experience on the quality assurance and quality monitoring.

Micronutrient deficiencies are public health problems in Zambia: Anaemia, a proxy of iron deficiency is still a severe public health problem. The country's estimated prevalence of anaemia for children 6-59 months is high, in 1998, it was at 60%; in 2003, it was at 53%; in 2009, it was at 2009; in 2012, it was at 55% and in 2015, it was at 60%. From these statistics, this is clearly a public health problem.

However, Zambia has seen an improvement in the average coverage of households consuming adequately iodated salt from 20% in 2002 to 53% in 2011, though they are still below the recommended coverage of above 90% Households.

His Excellency was pleased to state that his Government has put in place measures to address some of the micronutrient deficiencies through supplementation, food fortification, bio-fortification and nutrition awareness campaigns.

Zeroing in on food fortification he stated that fortification is one of the most sustainable strategies in the control of micronutrient deficiencies. Zambia now attests to the fact that through fortification of salt with iodine, iodine deficiency disorders have almost been eradicated in the country. Therefore, the Government looks further to fortify other foods to address other micronutrient deficiencies. For example, Zambia was the first African country to fortify sugar with Vitamin A and this is an achievement that Zambia is proud of. To support this strategy, a Statutory Instrument was put in place making sugar fortification mandatory and all the three sugar companies in the country produce fortified sugar for domestic consumption.

Plans are under way to fortify other food vehicles such as wheat and maize flour to contribute to combating deficiencies such as iron deficiency anaemia, which has remained a public health concern especially among women of reproductive age and in children under five years of age.

Issues of quality monitoring are of paramount importance in any programme, so this training is intended to equip the participants with knowledge and skills on wheat and maize flour fortification programmes for an effective public health impact. In addition, legislation and standards as well as cost-benefit of flour fortification, monitoring and surveillance of national food fortification programmes will be covered.

Currently, 27 countries in Africa have mandatory wheat flour fortification and nine (9) of them also have mandatory maize flour fortification. Countries that are fortifying their staple foods are making much faster progress in combating malnutrition due to micronutrient deficiencies including stunting among children.

Zambia and certainly other countries within the region represented here therefore stand to benefit from this workshop through exchange of information especially from those countries that are already fortifying wheat and maize flour. The expected outputs from this workshop include:

1. Increased capacity and commitment to implement quality control and quality assurance systems to consistently produce products that meet national standards and specifications by wheat and maize flour millers.

2. Increased capacity and commitment to monitor fortified food production in an effective, efficient and sustainable way.

3. Improved dialogue between wheat and maize flour millers and government regulatory authorities.

4. Improved understanding of requirements, roles and responsibilities of the national stakeholders.

In concluding, His Excellency stated that he would like to take this opportunity to urge all participants to take this workshop seriously and to consider it as an important step in the food fortification programme within the region and in our respective countries.

He reiterated the Zambian Government's commitment to further scale up food fortification efforts in the most cost effective and efficient manner. In this regard, he called upon the national food and nutrition commission together with the national fortification alliance and other partners to work expeditiously towards development of a comprehensive plan on food fortification that will ensure the needy at community and family level get the nutrition benefits from these efforts.

Thanking the nutrition partners for the support to the food fortification programme in Zambia and the region, and thanking all who have contributed to this initiative, including the East, Central and Southern Africa – Health Community (ECSA-HC), Global Alliance on Improved Nutrition (GAIN), Smarter Futures, Food Fortification Initiative, Nutrition International, the private sector including the premix manufacturers and flour mill equipment suppliers, for their overwhelming support towards the food fortification programme, the Honourable Minister then declared the QAQC training workshop opened.

Plenary Session 1: Introducing the workshop

Introduction to the workshop – the basics of flour fortification **– Filip Van Bockstaele, Ghent University/Smarter Futures**

Food fortification has been defined as the addition of one or more essential nutrients to a food, whether or not it is normally contained in the food, to prevent or correct a demonstrated deficiency of one or more nutrients in the population or specific population groups (FAO/WHO 1994). However, food fortification does involve more than just adding some micronutrients into flour or oil. An overview of the fortification chain and all the stakeholders was presented. Also, the agenda and goals of the workshop were introduced. Different aspects of food fortification will be discussed in depth during the workshop.

Plenary Session 2: Rationale for fortification

Faces of Anaemia **- Ronald Afidra, FFI**

The prevalence of anaemia, its consequences, and fortification as an intervention was provided. Evidence of effectiveness of fortification in reducing anaemia and iron deficiency from Costa Rica was presented. Successful fortification programs are, 1) well implemented and monitored, 2) optimize coverage and consumption, 3) use recommended iron compounds and concentrations.

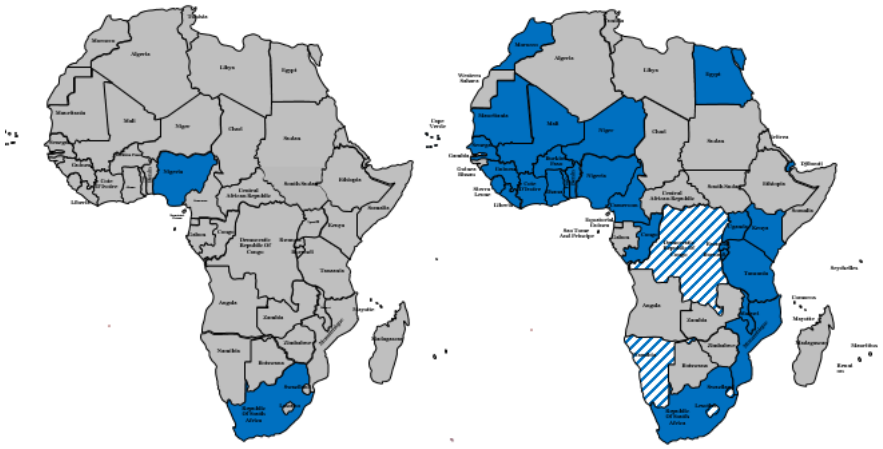
Folic acid and neural tube defects: what do we actually prevent? **– Lieven Bauwens, IFSBH**

Neural tube defects (NTDs) were explained, including prevalence, causes and their link with folic acid deficiency. NTDs are preventable with adequate folic acid intake pre- and peri- conceptionally. In 1991, a study done in the United Kingdom showed that 400 micrograms of folic acid daily taken from 8 weeks before conception till 12 weeks into the pregnancy can help reduce the risk of NTD's by up to 70%. This provided impetus for folic acid fortification. Use of folic acid supplements by pregnant women is low, and prevention of

NTDs needs to occur early in pregnancy. Countries that made fortification mandatory have experienced between 31 and 78% reductions in NTD prevalence. Globally an estimated 38,417 birth defects were prevented in 2012 where flour was fortified with folic acid. That is an average of 105 a day. Countries can avert millions of dollars in healthcare expenditures when spina bifida is prevented.

Flour Fortification Overview- Global and Regional Update - Ronald Afidra, FFI

Ronald provided an introduction to the Food Fortification Initiative (FFI). FFI supports national partnerships as they work toward grain fortification. FFI supports their advocacy efforts and provide technical assistance for planning, implementing, and monitoring programs. Provided an overview of the wheat, maize and rice fortification legislation globally and for the Africa region. In 12 years time, 27 countries across Africa implemented mandatory flour fortification.



2004
Mandatory in two countries: Nigeria and the Republic of South-Africa

May 2016
Mandatory in 27 countries across Africa, 5 countries do voluntary fortification

Plenary Session 3: cost-benefit of flour fortification

Economic consequences of deficiencies – Potential economic benefit of fortification - Quentin Johnson, FFI

"One of the most compelling investments is to get nutrients to the world's undernourished. The benefits from doing so – in terms of increased health, schooling, and productivity – are tremendous." The Copenhagen Consensus reported in 2012 that micronutrient fortification is one of the important strategies in the fight against malnutrition. Folate deficiency can result in higher incidences of spina bifida and other malformation health issues. The cost of this can be calculated and in Chile, the cost to benefit ratio for prevention of spina bifida is 12 dollars saved for each dollar spent on spina bifida. In the US, this is as high as 48 dollars for every dollar spent on prevention.

Remark: An extensive cost-benefit tool is available in the report of a Cost and Economic Benefit workshop, held by Smarter Futures in Dar Es Salaam, Tanzania in December 2013: http://www.ffinetwork.org/about/calendar/2013/CostBenefit2013.html

Introducing a modelling tool for cost benefit analysis - Reporting on an exercise using country data and experiences - the case of Zambia – Clevinah Ilambe Mizanda (on behalf of Zambia team)

The results were presented of the CBA-workshop organized some days before the QA/QC-meeting. The goals of this workshop were to carry out the CBA for maize flour fortification in Zambia, to demonstrate that a public health intervention has both a health benefit and an economic benefit for the national population, to demonstrate the importance of an effective monitoring system and to sensitize millers and government on the economic benefits of fortification. The outcome of the CBA was that for every 1 Kwacha invested in flour fortification, there is a potential return of 6.9 Kwacha to the Zambian economy through improved health and higher productivity.

Plenary Session 4: Monitoring, surveillance and evaluation of food fortification programmes

FACT (Fortification Assessment Coverage Tool) – Lynette Neufeld, GAIN

GAIN developed a fortification assessment coverage toolkit to assess the coverage of large-scale food fortification interventions. Already 14 of these studies have been performed in countries all over the world. The FACT surveys try to answer following questions: what is the potential for impact of food fortification in a country and how is this potential distributed across population groups and particularly among those who might be most vulnerable to inadequate nutrient intakes. Results and implications were presented.

Opportunities and Constraints that affect national food control systems effectiveness in Africa - Philip Randall, P Cubed

Standards and Regulations on fortification are often being written with little or no knowledge of the food production process, fortification practices and its variability and critical control points. Legislative tools tend

to be work in progress or amendments or patches to a new problem. Best practices for establishing effective national food control systems were discussed.

Monitoring and Surveillance of Food Fortification Programmes (FORTIMAS) - Anna Verster, Smarter Futures

FORTIMAS is a monitoring and surveillance tool that helps track trends in the effectiveness of a flour fortification programme over time in populations known to regularly consume fortified flour however it doesn't provide statistically representative estimates of the prevalence or incidence of micronutrient deficiencies. The tool uses sentinel data collection and purposive and convenience sampling approaches. Soft copies can be found on www.smarterfutures.net/FORTIMAS.

The primary aims of the proposed FORTIMAS approach are to:

1. Determine if the flour fortification program in a given geographic area covers close to 80% or more of the population over time, based on the quantity of fortified flour produced and imported, and household purchases of fortified flour in sentinel communities.

2. Answer the question, "is the micronutrient status of those who regularly consume sufficient quality fortified flour improving?"

Plenary Session 5: Food fortification legislation and standards

Food Fortification legislation and standards: theory - Quentin Johnson, FFI

An overview of why a country needs food standards, regulations and laws was presented. Laws create the legal framework for both standards and regulations. The presentation provided insights in the development of standards and legislation, how they differ with standards being voluntary while compliance with legislation is mandatory. It is however encouraged that countries develop technical regulations and standards that are based on product performance requirements rather than on design requirements as this creates fewer obstacles to trade. Countries should stipulate the minimum amount of a micronutrient that must be present in a food vehicle (WHO recommendations 2009) rather than a specific process for the addition of that micronutrient. Regulations provide the food control authorities to be able to inspect and monitor the production of fortified foods to a standard. Regulations provide the authorities with the mechanism to enforce the standards through inspection and corrective actions

TABLE: WHO Recommendations 2009

Nutrient	Type of flour (extraction)	Fortificant	Level of nutrient to be added (parts per million) By per capita wheat flour intake (g/day)			
			<75 g/day	75-149 g/day	150-300 g/day	>300 g/day
Iron	Low	NaFeEDTA Sulfate/Fumarate Electrolytic	40 60 NR	40 60 NR	20 30 60	15 20 40
	High	NaFeEDTA	40	40	20	15
Zinc	Low	Zinc Oxide	95	55	40	30
	High	Zinc Oxide	100	100	80	70
Folic Acid	Low or High	Folic Acid	5.0	2.6	1.3	1.0
Vitamin B12	Low or High	Cyancobalamin	0.04	0.02	0.01	0.008
Vitamin A	Low or High	Vitamin A palmitate	5.9	3.0	1.5	1.0

Food Fortification legislation and standards: in practice - Philip Randall, P Cubed

Factories should aim at fortifying the products at the recommended factory level to ensure the product conforms to the regulatory levels throughout the distribution chain. Standards and Regulations are being written (or rather cut and paste) with little or no knowledge of the food production process, its variability, critical control points etc. and even less knowledge of fortification. What the law does not say or take into account: (1) how well can mills mix fortificants, (2) what the intrinsic nutrient content is, (3) how the laboratory is supposed to distinguish between added and intrinsic content when it actually measures total content, (4) how much uncertainty at 95% confidence in laboratory analysis, (5) how the Regulatory minimum and maximums were calculated (sometimes why we even have a maximum), (6) how they determined that the recommended factory level do ensure the product conforms to the regulatory levels throughout the distribution chain, (7) how a sample is to be taken – or what to do if methodology does not meet international standards.

Day 2: Plenary Sessions

Plenary Session 6: Fortification in practice: production and distribution

Milling technology for cereals - Filip Van Bockstaele, Ghent University

To be able to process cereals into edible products, they need to be milled to produce flour or meal. In this presentation, the wheat and maize grain were discussed and their quality characteristics. The milling process itself was presented, and the different steps in the milling process were discussed: reception of the grain, storage, cleaning, conditioning, milling (roller milling and hammer milling) and the end product characteristics.

Flour fortification at the mill – Premix and feeders - Quentin Johnson, FFI – Philip Randall

This presentation goes into detail on the process of fortifying flour in a mill. Information was presented about the premix, possible fortificants in the premix, premix feeders and costs of fortification. Best practices regarding premixes and premix feeders are discussed and possible problems are indicated. Especially attention was given to the fact that premix feeders can work gravimetrically or volumetrically.

Discussion:

When the premix has a shelf life of 9 months, and is only used after 8 months (end shelf life), is this a problem? The shelf life period of the premix does not influence the shelf life period of the flour, as it only indicates the premix retains its guaranteed stability and specifications during the indicated shelf life period. After the expiry date, it can still comply but it cannot be guaranteed (depending on storage conditions). If premix has expired, you may let it have re-certificated. Always do FIFO (first in – first out).

Plenary Session 7: Quality assurance in the milling industry

Milling industry quality assurance principles and practices - Philip Randall, P Cubed

Industry processing requires setting up a system of quality assurance and quality control in the company. The basic principles of QA/QC were explained: QA, QC, traceability, GMP. If it cannot be measured, it cannot be controlled. QA/QC principles are applied to the specific case of fortification processes.

Quality control at the mill (general) – Andrew Chintala and Steve Silwizya, National Foods Zambia

Quality control is important for process monitoring and surveillance. Best practices in flour quality control in flour fortification are discussed, including sampling, premix quality, and control tests.

Plenary Session 8: Fortification quality control

Quality control test for iron, vitamin A and folic acid: theory – Filip Van Bockstaele, Ghent University

An overview is provided of standard methodologies for use to determine minerals and vitamins: AES, AAS, ICP en HPLC. Also the spot test is explained for iron and vitamin C qualitative determination.

Chemical assays for fortificants: method validation and examples – Quentin Johnson, Smarter Futures

Methods for determination of micronutrients require a validation before use in routine testing. In this presentation, validation protocols are explained and terminology is introduced: precision, trueness, accuracy, bias, and confidence interval. Examples are shown of quality control data in function of time related to the confidence interval together with interpretation of compliance.

End product quality: baking trials - Filip van Bockstaele, Ghent University

Fortified wheat flour and maize meal are not consumed as such but processed into edible foods. This is necessary to make the starch digestible. Adding a micronutrient premix may cause interactions with the food components resulting in food defects (mostly colour defects). Results are shown of the study of 'fortification of wheat flour and maize meal with different iron compounds: results of a series of baking trials'. Recommendation of how to set up a food quality check and sensory analysis were provided.

Plenary Session 9: National food control systems

Government regulatory monitoring – Mulonda Mate, Ministry of Health Zambia

The government regulatory monitoring system of Zambia was explained in detail, next to the regulations and standards.

Performing audits - Philip Randall, P Cubed

Performing audits is part of industry inspections by the government to check if industry complies with the set regulations and standards. Different types of audits are discussed and best practices in auditing are provided. Using up to date checklists and asking the right information is crucial for performing good audits.

Fortification: evidence based regulatory compliance - Quentin Johnson, FFI

Performing external monitoring needs to meet certain requirements to obtain valid results. In this presentation, information is provided on external monitoring concepts and requirements. First, the issue of sampling is discussed, as sampling is a main cause for analytical error. Next, requirements and conditions for good chemical assays are discussed.

Day 3: Visits and Q&A session premix suppliers

Mill and government laboratory visits

PARTICIPANTS from GOVERNMENT/NGO's: Visit to African Milling Limited
In 2 groups rotating through the mill, QA/QC laboratory, covering the following areas:

- Premix storage
- Feeder calibration
- Fortification Process
- Check weighing or computer control system
- QA/QC procedures in the laboratory and Premix utilization and reconciliation calculations

PARTICIPANTS from MILLING INDUSTRY/PREMIX SUPPLIERS: Visit to the Zambia Government foods and drugs control laboratory (FDCL), covering the following topics:

- Briefing on government regulatory system
- Facilities and equipment
- Guidelines/ protocols

Both visits include practical demonstrations of spot test, iCheck and other testing methods.

Plenary Session 10: Q&A Premix suppliers

Following premix/technology suppliers introduced themselves and answered questions from the participants: Mühlenchemie, Hexagon, DSM, AkzoNobel (only producer in attendance of sodium iron DTA), Bühler, GFA and the GAIN premix facility. See presentations for more information.

Market Place

Exhibition of materials by partners from public and private sectors, discussion corners, getting acquainted. Industry and organizations (ECSA) presented their material and had discussions with the participants.

Day 4: Working groups and Plenary Session

On the last day of the training, group-working sessions were organized. In the first part of the group sessions, participants joined a group according to their background or profession: (1) production and distribution, (2) national food control systems and (3) standards and technical regulations. The '**profession groups**' had to elect a chairman and secretary to prepare a report/presentation. The task of each working group was to make a brief overview on current status, drawbacks, strengths, weaknesses, improvements and challenges on flour fortification specifically in their field.

In the second part of the group sessions, participants were regrouped to form '**country groups**': 8 groups were formed: Botswana, Lesotho, Malawi, Namibia, Nigeria, Swaziland, Zambia and Zimbabwe. Each country group was formed with participants from the first three working groups by profession. Every country had to summarize the findings from the profession groups specifically for their own country situation and then put together a review and plan for fortification. Also, all countries were provided with the action plans developed by their colleagues from the same countries during the QAQC training workshop held in Harare, Zimbabwe in 2015. Each country was required to review and update those action plans and make a presentation on the plan of activities to be accomplished in the coming year to make food fortification a reality. This was based on the status of the country in the implementation of food fortification and those priority activities that require urgent measures. The presentations focused on 3 elements of food fortification: (i) Food Control Systems, (ii) Standards and Technical Regulations, and (iii) Production and Distribution: Where are we now? Where do we want to go? How are we going to get there?

The reports of the working group can be found here.

Closure of the QA/QC workshop

After the presentation of the working groups, all participants were given a post-test questionnaire.

Mr Mulonda Mate then proceeded with the closing of the workshop. Ms Mercy Chatyoka of National Foods, Zimbabwe spoke on behalf of the participants and expressed her pleasure at having been able to participate in this very useful event. Mr Mate then thanked all the participants, the partners and the organisers for their work, wished them safe travels and closed the meeting. Subsequently participants were sent their certificates of attendance.

Pre- and Post-Test Analysis

The pre- and post-tests were analysed to see if the participants had benefited from the training. Pre- and post-evaluation scores (scale 1-5) were used to rate the level of knowledge and skills on eight topics:

1. WHO consensus statement on flour fortification recommendations
2. Types of iron recommended
3. Millers best practices
4. Premix formulations
5. Quality control
6. Quality assurance
7. National food control
8. Hazard Analysis Critical Control Points (HACCP)

The overall rating of knowledge and skills post-training was 4.2 on a scale of 5, with an average increase of 0.8 as a direct result of the training (difference pre- and post-test). Food inspectors rated their increase of knowledge slightly higher than the other groups, with an average score of +1.0. Most knowledge was gained on the topic of millers' best practices, with an average increase of +1.3. Public health laboratory staff, regulatory personnel and food inspectors rated this topic as their largest improvement. Evaluation was based on 41 participants, who returned both pre- and post-test questionnaires.