REPORT ON THE SYMPOSIUM ENTITLED, "TRADITIONAL FERMENTED FOODS TO PROMOTE FOOD AND NUTRITION SECURITY IN AFRICA," HELD AT CRESTA GOLFVIEW HOTEL, LUSAKA ON TUESDAY, 27TH AUGUST TO WEDNESDAY 28TH AUGUST, 2019

1. PROGRAMME

Tuesday, 27th August 2019

9:00	John Shindano	Welcome remarks – Dean School of Agricultural Sciences University of Zambia
		Remarks from representatives of Chinhoyi University of Tehnology, Université d'Abomey Calavi and Wageningen University
		Official opening - Vice Chancellor of University of Zambia
9:30	Sijmen Schoustra	General introduction to symposium
10:00	Eddy Smid	Principles of food fermentation
10:30	Anita Linnemann	Consumer perspectives in optimizing traditional (fermented) foods
11:00		*break*
11:30	Valentina Materia	Women entrepreneurship in challenged contexts
12:00	Rebecca Lubinda	Entrepreneurship of traditional foods in Zambia
12:30	Barthelemey Honfoga	Overview of food processing enterprises and prospects for developing markets of maize fermented products
13:00		*lunch*
14:00	Elise Talsma	Role of nutrition in fermentation
14:30	Pamela Marinda	Nutritional needs in Zambia
15:00		*break*
15:30	Juliet Mubaiwa & Sakile Kudita	Mahewu processing and pro-vitamin A enrichment strategies
16:00	Yann Madode	Science for development in Akpan processing research
16:30	Discussion	
17:00	John Shindano	Closing remarks day 1
		drinks

Wednesday, 28th August 2019

9:00	John Shindano	Introduction
9:30	Sijmen Schoustra	Pre-WOTRO project work on microbial ecology and evolution
10:00	Anneloes Groenenboom	Microbial ecology and evolution in Mabisi
10:30	Bernard Moonga	The art of Mabisi processing in Zambia
11:00		*Break*
11:30	Sydney Phiri	Spontaneous fermentation in Munkoyo
12:00	Justin Chileshe	Nutritional aspects of Mabisi and Munkoyo
12:30	Eddy/Anita/Sijmen	Results on selected student projects
13:00		*Lunch*
14:00	PACRA representative	Nagoya protocol and patenting in relation to Mabisi and Munkoyo research
14:30	Nachimuka Cheepa/ Cynthia Siamupa	Impact of project to activities of Heifer International
15:00		*Break*

15:30	Dingiswayo Shawa /Anthony Muyenyembe	Certification of Mabisi and Munkoyo by ZABS – what is needed
16:00	George Kembo	Fermented foods and nutritional assessment in Zimbabwe
16:30	John Shindano	Discussion
17:00	John Shindano	Dean: Closing remarks
		Drinks

2. DELIBERATIONS HELD ON TUESDAY 27TH AUGUST, 2019

2.1. WELCOME REMARKS AND INTRODUCTIONS

The symposium commenced at 09.18h. The chairperson of the opening session welcomed all the participants present. He informed participants that it was the aim of the symposium to share with them key findings of the research project which began four years prior to the symposium. He further asked participants to actively engage in the discussions as their input would be used to find ways of commercializing the fermented products as the next step to the project. Each participant was asked to give a brief introduction of themselves and these names are listed in Annex 1.

2.2. OPENING REMARKS

The Acting Dean, School of Agricultural Sciences in his opening remarks gave a summary of the activities of the School. He welcomed all the collaborating partners and stakeholders, especially those coming from the Netherlands, Zimbabwe, Benin and all the other stakeholders from different parts of Zambia. At the end of his speech, the Acting Dean declared the workshop officially open and wished the participants God's blessings.

2.3. VICE CHANCELLOR'S REMARKS

The Acting Vice Chancellor of the University of Zambia in his speech welcomed all participants present and gave special recognition to stakeholders and partners who represented the entire value chain of fermented foods. The Acting Vice Chancellor explained that the project entitled, "Traditional Fermented Foods to Promote Food and Nutrition Security in Africa" was aimed at optimizing the value chain of fermented foods. He pointed put some of the key findings of the research and further announced that all four PhD students that were funded under this project had successfully handed in their theses for consideration to graduate.

2.4. REMARKS FROM REPRESENTATIVES OF CHINHOYI UNIVERSITY OF TECHNOLOGY (ZIMBABWE), UNIVERSITE D'ABOMEY CALAVI (BENIN) AND WAGENINGEN UNIVERSITY (NETHERLANDS)

Representatives from the different institutions of learning from Zimbabwe, Benin and the Netherlands gave their remarks. The two African Universities were actively involved in the project with Wageningen University. The representative from Chinhoyi University promised

to execute the findings of the project which would help to achieve food and nutrition security for Zimbabwe. Universite d'Abomey Calavi also showed keen interest in the findings of the research and demonstrated the active involvement of the university with Wageningen university on the project. Wageningen university was pleased to work with all key stakeholders and justified the need for having this kind of research as its impact would contribute to achieving food security.

2.4.1. Question and Answer Session 1 emerging from the opening remarks and introduction to the symposium

1. A question was raised as to whether the project would roll out the findings of the project by commercializing the products.
    a. Participants were informed that this was the aim of having the symposium to get ideas from the audience on the best ways of achieving commercialization
2. It was observed that the information received from people who typically grew up in the village and knew the typical village way of producing *mabisi* would be different from those that grew up in urban areas. Most of the information that the people from urban areas knew came from information that was passed on to them from others rather than having the real hands on experience from the village. Based on this background, a query was raised on how the researchers planned to harmonize information received from the two different sources.
    a. Agreed that information would always be passed on from the village to those in urban areas through interactions
3. Concern was raised about using the term "traditional" which had the potential to negatively impact on the marketing of the products
    a. A previous study done on consumer perceptions at some of the shopping malls in Lusaka showed that most consumers were more interested in consuming fermented products rather than those on the market which they thought were too artificial. The researchers hoped to convince consumers to buy the traditional products through product tasting before the traditional fermented drinks are sold on the market.
4. It was observed that most women preferred to consume imported or processed beverages such as coke rather than traditionally fermented foods when they went out

for meals with their partners. It was advised that some kind of research be done to determine social acceptance of traditional fermented beverages.

5. Concern was raised about the reported mortalities caused by consuming *munkoyo* made from poisonous roots in some areas of Zambia. The participant wanted to find out if the research was going to find ways of addressing this problem to ensure that all the *munkoyo* produced was safe for consumption.
    a. It was advised that this would be tackled in the sessions presented on the following day
6. It was advised to advertise and sensitize the public on the benefits of consuming *munkoyo* and *mabisi*
7. Informed that many cooperatives throughout the country held block shows where they displayed fermented foods. The research team was advised to visit these block shows which they could use to sensitize the public on the benefits of *munkoyo* and *mabisi*

2.4.2. Consumer perspectives in optimizing traditional (fermented) foods/ Women entrepreneurship in challenged contexts/ Entrepreneurship of traditional fermented foods/ Overview of food processing enterprises and prospects for developing markets of maize fermented products

Presentations were made on consumer perspectives in optimizing traditional (fermented) foods and also on the importance of women entrepreneurship and exploring ways in which traditional foods could be used to achieve this. Different contexts to regarding entrepreneurship were explored. Another presentation focused on different business models and, more importantly, exploring the idea of entrepreneurship of traditional foods in Zambia. Later, a fourth presentation provided an overview of food processing enterprises, particularly maize fermented foods in Benin. After these presentations, a question and answer session was opened and what came out from this session is outlined below.

1. A question was asked on the best approach to use in marketing of fermented products
    a. It was suggested that the best way of doing this was to create products that were very similar to the traditional drinks that the general public was already familiar with. Also, it was outlined that cultural differences existed between countries and therefore it was important for those going into commercialization of the products to have country-specific knowledge of the populations they were targeting.

2. It was observed that commercialization was highly influenced by political factors and these included 1.) the will of the government to apply subsidies on equipment for processing, 2.) the will of the government to reduce taxes, 3.) provision of infrastructure that supported entrepreneurship and 4.) law enforcement/ regulations that supported entrepreneurship. It was suggested that more questions needed to be asked to provide answers to questions such as collective action in the rural areas, contracts that enforced rules, etc. The participant asked how these factors would affect the outcome.

3. A question was asked as to what kind of business model was most appropriate in addressing youth unemployment.
    a. It was suggested that it was important to develop a criterion for focusing on a particular product. However, it was also suggested that more research was required to determine the best mode of approach.

2.4.3. Role of nutrition in fermentation/ Linking nutrition to traditional fermented products

A presentation on the role of nutrition in fermentation was made, after which a presentation on experiences on the nutritional needs in Zambia based on a study that was done in Namwala and Mkushi was also made. The question and answer session that emerged from these presentations is outlined below.

1. A query was raised on how the households were chosen in the study to measure children between 6 to 23 months.
    a. It was explained that growth monitoring centres (GMPs) were used. The children were randomly selected from these GMP centres. Outreach programs were also used to capture children that did not go for GMP.
2. It was asked as to how the researchers managed to control for socio-economic characteristics in their study
    a. It was explained that this was not accounted for in the study
3. It was queried as to whether there were any levels of fermentation where food products became unsafe for consumption
    a. It was explained that as long as a product was sour, with a pH of 4 or lower, it was impossible for pathogens to grow. However, it was emphasized that keeping fermented products for a very long time did affect the taste (became more sour and acidic) despite being safe for consumption.

4. It is common knowledge that *mabisi* and *chibwantu* are highly consumed in the Southern Province of Zambia. Research was done in Namwala and Mkushi where consumption of these products was compared by district. It was found that Namwala had higher consumption levels. A question was raised as to why the researchers decided to include an almost obvious question in terms of consumption in the two districts.
    a. It was responded that the researchers did not want to make assumptions as there had been a lot of migration amongst Provinces, with different people settling in different parts of the country, away from their origins.
5. A question was asked as to what iatrogenic factors were used by the researchers to choose children that attended GMP. Concern was raised as to whether the researchers' data set gave a true picture about what was going on in the community
    a. The researchers used GMP centres as an entry point as it was easier to recruit children from there. It was noted that other variables such as sanitation also affected the nutritional status of the children.
6. It was observed that *munkoyo* was not as nutritious as *mabisi* and therefore it was expected that even its outcomes on malnourished children would not be as good as those observed for *mabisi.* It was asked as to whether the researchers and other interested parties would consider supplementing *munkoyo.*
    a. It was suggested that an intervention study rather than a cross sectional study would be most appropriate to determine this
7. The researchers were asked how they would link interventions made by the government to the results they got. This was asked because it was already known that the government already had some interventions in place and the positive results that the researchers got could have been due to these interventions rather than the introduction of *mabisi* and *munkoyo* to the diets of these children. The researchers were further asked if it was possible to narrow down their targets with the current evidence that was generated on the value of traditional fermented foods.
    a. The researchers explained that their study was based on previous results reported in the 2013/ 2014 Zambia Demographic Health Survey (ZDHS) which indicated that malnutrition was still very high in their target areas despite government interventions.
    b. It was noted that the current changes in price of mealie meal had the potential to shift the use of mealie meal in *munkoyo* production, to the use of other cereals such as sorghum and millet. Researchers and other interested parties therefore

had to consider using these cereals for commercialization. It was emphasized that a more holistic approach was needed to address some of these concerns.

8. A participant asked about the role of institutional context in this project.
    a. It was rsponded that as long as evidence on the benefits of consuming traditional fermented foods was provided, it would become easier to convince the policy makers to improve on road market infrastructure and to come up with regulations and law enforcement.

2.4.4. Mahewu processing and pro-vitamin A enrichment strategies/ Science for development in Akpan processing research

A presentation on mahewu processing in Zimbabwe was made and it highlighted the prospects of enriching fermented foods with pro-vitamin A. Another presentation on the science for the development of *Akpan*, a traditional yogurt-like product that was widely consumed in Benin was also made. The science for development of *Akpan* was well explained. The questions and answers that emerged from this session are outlined below.

1. It was asked whether there was an enriched type of *Mahewu* that was being used for infant feeding in Zimbabwe since this age group required high amounts of nutrients.
    a. It was responded that what was on the market was not enriched but this was part of the research gap that the current project was trying to address, seeing that *mahewu* had great potential as a weaning food for children.
2. A participant wondered whether the researcher considered using bio-fortified maize and other cereals other than maize as the primary ingredient and how this would affect the efficacy of the product after fermentation?
    a. It was responded that the current research focus was centred on the use of extruded powdered *Mahewu*, but the suggestion of using bio-fortified maize and other cereals was something worth exploring.
3. It was asked if there was any market study or research done on how middle and high income sub-sectors of the economy would like to consume *Mahewu*. It was also asked if there was a strategy that had been devised to market this product in the region.
    a. It was responded that one way of doing this was to ban the importation of foreign fermented products, because these products had a high potential to generate income for the local community. It was therefore important to have policies in place that would protect the market of the local product.

b. It was noted that there was a huge market for *Maheu*, both locally (Western Province of Zambia) and outside Zambia (Angola) and therefore it was important that sellers made the product more attractive. This called for a lot of innovation, and one-way of doing this would be to use technologies such as websites where the products could be advertised and if it was appealing to various segments of the population, more people would want to buy them.

4. Concern was raised on the high levels of aflatoxins in *Akpan.* The participant wondered what had been done to deal with this issue and also wanted to find out if it was possible to detect aflatoxins in millet and sorghum?
   a. It was responded that the high aflatoxin levels in the grain were dependent on how they were handled. The researchers noticed that some aflatoxins were destroyed during fermentation. During the production of *Ogui,* the aflatoxins moved into the supernatant which was disposed of because it was likely to contaminate the final product. Also, during the washing process which was done several times, some aflatoxins on the surface of the grain were washed off. It was agreed that it was possible to detect aflatoxins in the grains.
5. It was asked whether it was possible to find aflatoxins in grains such as sorghum and millet the same way that they were found in maize
   a. The response to this was yes, it was possible
6. Having noted that the researcher highlighted unit operations and fermentation as an approach to reducing aflatoxin levels, a participant wondered whether the researcher had tried to establish the extent to which this approach might reduce mycotoxins and whether the approaches were aligned to international guidelines for managing aflatoxin levels
   a. It was responded that not all the fermented products tested positive for presence of aflatoxins. The researcher explained that in a previous study that was done on the production of a fermented food called *Mawe,* it was shown that 90% of the aflatoxins in the raw materials were eliminated due to fermentation. This was the reason why the researchers producing *Akpan* chose to dispose of the supernatant. It was further suggested that if producers were not sure of the quality of their maize, it was important to get rid of the supernatant.
7. A participant wondered whether using sachets for packaging of the *Akpan* was the best option as sachets were not a very stable type of packaging that did not stand (the contents could easily spill over). The participant wanted to know how any left over *Akpan* would be stored.

a. The response to this was that a market survey was done to see how similar products were packaged and consumed and this survey showed that the local people were used to consuming fermented products in sachets and in quantities that allowed the product to be consumed all at once.

2.5. General question and answer session at the end of Day 1

1. It was noted that Zambia's main staple food was maize but most processors only made very few products out of it. Compared with Benin, it was noted that Benin was able to produce over 50 different types of processed maize. The participant challenged Zambians to step up and emulate Benin
2. It was queried as to why the commercial production of traditional fermented foods was still in its infancy stage
    a. It was responded that the linkages between markets, processors and value chains in general needed to be developed in order for this to be achieved
3. It was asked as to whether any market study was done to indicate the likelihood of the Zambian middle class to buy such traditional fermented products. The participant also wondered whether there was any import/ export of traditional fermented foods between Zambia and Zimbabwe since both countries consumed the same types of products.
    a. The audience was informed that the Zimbabwean policy position was to ensure the reduction in importation of products that could be made locally by the Zimbabwean people. The government was protective of its own products
4. It was observed that there was still room for innovation for all the fermented products in order to meet consumer needs. It was advised to create context-specific innovations that would also increase income levels.
5. People were informed that a market for *maheu* already existed as buyers from Angola often travelled to Western Province, Zambia to purchase the product
6. People were further informed that large international companies were slowly fragmenting because many consumers were not very interested in buying identical products. Diversification was increasing among consumers. Many start-up companies did well by advertising their products on websites and delivering their products to the doorsteps of the consumers using online shopping. It was noted that online shopping generally helped these start-up companies to meet their operational needs and also make profits.

The Chairperson of the day made his closing remarks by saying that a lot was needed to be done to understand the different needs of the traditional foods market and that all sectors needed to be include in order to achieve the goals of commercialization. Day 1 was closed at 16.46h.

3. DELIBERATIONS HELD ON WEDNESDAY 28TH AUGUST, 2019

Day 2 started off with welcoming remarks from the Chairperson and a recap from the previous day. This was followed by presentations in the first session.

3.1. Principles of food fermentation/ General principles of microbial ecology and evolution in Mabisi

The principles of fermentation and the benefits of having different probiotics in products were presented. It was explained that probiotics generally increased B-vitamins in products. The presentation that followed outlined the evolution and ecology of microorganisms in *mabisi.* This was followed by a question and answer session outlined below.

1. A participant wondered whether the transfer from foreign countries like the Netherlands was only through PhD training and other types of training or there was also the transfer/ donation of equipment that could be used for the outlines technologies.
    a. It was responded that the transfer of knowledge occurred in symposiums like the one that was being held at the time.
2. A participant wondered whether the private sector in Zambia had been engaged so that they could use some of the starter cultures that had been presented. He wondered whether these companies were able to produce starter cultures.
    a. It was explained that previous research had engaged private companies to produce starter cultures. In the Netherlands, the researchers had hoped to produce defined starter cultures from *mabisi* and *munkoyo* but were unable to because of the Nagoya protocol. The audience was informed that the researchers were working with the government of Zambia at the time of the symposium so that these starter cultures could be developed. The people were also informed that the researchers aimed to make small scale facilities at the University of Zambia which would produce starter cultures for *mabisi* production.

3. A participant wondered whether the genetic information of starter cultures shifted into the fermented products during backslopping. If this was the case, the participant wanted to know if there was a way of ensuring that the initial starter culture was preserved.
    a. The response to this was that it was possible, but if backslopping was done in a very strict environment, there would be very minimal change. It was explained that the process continued to change with genetic drift and this resulted in some slight improvements in the final product. It was pointed out that the more production changes were made, the more changes were seen in the product.
4. A question was asked about the nature of the samples that were collected from Mufulira to Zimba, whether they were raw materials or the final *mabisi* product.
    a. Only the fermented products were collected because at the time of collection, the researcher thought that the modes of processing were the same throughout Zambia. But he eventually found out that geographical location played a big role in the final results.

3.2. Microbial ecology and evolution in *Mabisi*/ The art of *Mabisi* processing in Zambia

Two PhD students that were sponsored by the Project made presentations and gave the results of their findings. A question and answer session that ensued is outlined below.

1. A question was asked about whether the *mabisi* samples collected underwent sensory evaluation.
    a. It was responded that some samples did go through sensory evaluation, particularly in Namwala District, and the panel was able to choose their most preferred *mabisi* in terms of taste and thickness.
2. A question was asked about how the researcher was able to eliminate pathogens such as *Candida* which are naturally present in traditional fermented foods when she reproduced the production of the traditional fermented foods in the laboratory using containers. The participant further asked if it was possible to eliminate the naturally occurring pathogens in the product
    a. It was responded that a diverse microbial community existed in the products and when pathogens were added to the product, most of them did not survive because of the microbial community and the environment. It was explained that it was important to have a hygienic environment during production and produce starter cultures that had antimicrobial properties.

b. The researcher further responded that her research focused on bacteria and not yeasts as the baseline research that was done did not find any yeasts in the local *mabisi* produced in the different parts of Zambia.
c. It was explained that if a pathogen still existed in the final product, it was possible to reconstitute the product, isolate all the good bacteria, sterilize the product and then re-inoculate with the good bacteria, thereby eliminating the pathogen

3. A participant wanted to find out if there were any differences between the laboratory produced *mabisi* and the traditional one. He noted that the laboratory based one was produced using micro-aeration since the researcher used containers which were covered, while the traditional one was made using macro-aeration since the calabashes were usually left open. He asked whether oxygen or other environmental factors could have affected the final product and whether any microorganisms went into the product as a result.
   a. The researcher tried as much as possible to simulate the field experiments but did agree that the conditions in the laboratory were definitely different from those in the field. However, she pointed out that all the six samples in the laboratory were subjected to the same environmental conditions.
4. It was noted that there were two types of backslopping. The first one was where an old product was used to ferment a new one and the second type was where the container that had developed a biofilm was able to transfer the microorganisms to the milk. It was also noted that the type of container influenced the type of biofilm that was produced. For example, if the same container was used, such as a calabash, the type of biofilm produced could still be different depending on whether the surface was rough or smooth due to the attachment properties of the pioneer organisms. The question that arose from this was how did the researcher factor in the differences that arose as a result of different biofilms produced.
   a. The researcher did note that there were two types of backslopping but was not sure whether the differences in the final product were due to the environment or they were due to the biofilms. When the experiment was done in the house in Chibwe, she did take note that the bacteria that she found in the final product were definitely coming from the house where she did the experiment because those that were made in the laboratory were made in a sterile environment using UHT milk. Despite using UHT milk, the fermentation process still began. She mentioned that she did not see too many differences with respect to the biofilms.

5. A question was asked as to whether the researcher considered looking at factors such as fat and fat solids which were all dependent on the breed of the cow and the type of feed they are given. It was mentioned that the *mabisi* produced was dependent on these factors.
    a. It was responded that these factors were not considered because of logistical reasons. A few samples were analyzed and it was found that those farmers who had grazing animals from the plain had similar microbial composition, while those whose animals were fed with concentrate also had similar microbial composition.
6. A question was asked about which type of *mabisi* had the bestselling properties
    a. The tonga type *mabisi* was most popular but consumer preference was highly dependent on acidity. Most of the study subjects preferred *mabisi* that had medium acidity (pH 4.2 – 4.5), while those in Western province preferred the highly acidic type of mabisi (pH 4). Thickness was also considered to be an important aspect.

3.3. Spontaneous fermentation in *munkoyo*/ Nutritional aspects of *mabisi* and *munkoyo*/ Food safety and consumer perception

More PhD presentations were made in the third session of the day and the two PhD students shared the results of their research. A presentation on food safety and consumer perception of traditionally fermented foods across Zambia was also made. The question and answer session that ensued is outlined below.

1. It was noted that the desire for traditional fermented foods in Zambia was high and therefore it was important for the industry to develop packaging that was attractive and hygienic
2. A question was asked as to whether there were any differences in microbial content between the brown (maize porridge burnt off at the bottom during cooking until it turned brown) and the white *munkoyo.*
    a. It was explained that the brown type of *munkoyo* was commonly found in Kiwe but the burning process did not change the microbial content.
3. Concern was raised about the non-poisonous *munkoyo* plant becoming extinct in the coming years, especially if the process was to be commercialized.
    a. It was explained that the next research aimed at identifying the poisonous *munkoyo* plants and also preserving the non-poisonous ones. They also aimed to isolate the components of the poisonous *munkoyo* plant in order to identify what made it poisonous. The audience was informed that there were other alternatives that were used instead of the root and these included flour and sweet potato peel.

4. It was observed that some people went to the bush to harvest roots that were similar, but not the same as the *munkoyo* root. Wondered whether this had an effect on the final product.
    a. It was responded that it was important for people to identify the right root from the wrong one
5. It was asked whether the researcher was able to identify any differences in perception based on the area in which the interviews were conducted
    a. The response was that there were not too many differences when it came to geographical area but there were some differences in perceptions among age groups and also general differences existed between urban and rural areas.
6. A comment was made that people needed to start thinking about industrializing the use of *munkoyo* root rather than people going to the bush to look for it.
7. A participant wanted to find out which children were part of the control group and also find out how the researcher accounted for those children that were still breastfeeding. It was noted that some mothers breastfed their children well, according to recommended guidelines, while others did not. It was asked whether the researcher took this into consideration.
    a. The researcher did not consider breastfeeding because it was difficult to quantify how much breastmilk was being consumed by the infants
8. A participant wondered whether comparing a milk based product (*mabisi*) with a maize based product (*munkoyo*) for nutritional outcomes was justified since it was already a known fact that milk was superior over maize
    a. It was agreed that milk was superior to maize but the researcher wanted to see how much of the nutrients that were considered could be synthesized by the bacteria in both products.
9. It was asked whether the researcher considered the potential of working with Ministry of Health since the F75 and F100 formulae were imported and difficult to source.
    a. It was responded that a PhD student that was starting his work in October would work with the Ministry of Health to produce local foods that would manage malnutrition
10. It was noted that low quality milk had the danger of containing pre-formed toxins in it. It was asked whether this was factored into the research
    a. It was agreed that this was an important factor to consider. It was explained that processors only accepted raw milk that had a certain level of toxins depending on how it was going to be processed (i.e. UHT, pasteurized, etc). Explained that the milk that

was rejected by the processors that was still in the acceptable ranges could be used for *mabisi* production.

11. It was asked whether the researcher was able to accurately mimic the gut conditions when collecting fecal matter
    a. It was explained that a simple batch system was used with controlled temperatures of around 37ºC but this system had limitations and these included the control of pH.
12. A participant wanted to find out whether *mabisi* increased the absorption of nutrients and which specific nutrients these were.
    a. Fat, calcium, B-vitamins, zinc and proteins all increased with the consumption of milk based fermented foods

3.4. Nagoya protocol and patenting in relation to *mabisi* and *munkoyo* research

The process of registering a company in Zambia was explained in detail and the Nagoya protocol which was an agreement made by dignitaries in Japan, 2010 to allow for the fair and equitable sharing of benefits from genetic resources and their utilization was also explained in detail. The question and answer session that followed is outlined below.

1. It was asked whether it was automatic that if someone complied with the act, they were also complying with the Nagoya protocol.
    a. The response to this was that it was since PACRA administered the act
2. A question was asked about how Zambia would trade well with countries such as China and the USA who were not part of the Nagoya protocol
    a. It was responded that those countries that were not part of the Nagoya protocol would eventually be forced to join as they would need it to access genetic resources from countries that were part of the Nagoya protocol.
    b. Informed that the Nagoya protocol was different from the Kyoto protocol which dealt with climate change

3.5. Impact of project on activities of Heifer International

Heifer international, an organization that had been working with the project, showed the participants how the project had impacted on the lives of the communities where they worked. The question and answer session that followed is outlined below.

1. It was noted that the type of feed had an impact on the quality of milk. A participant wanted to find out how it was possible to strike a balance between good feed quality in the local context and trying to make sure that there was zero grazing at the same time.

a. Heifer practiced zero grazing by ensuring that the animals did not go out in the field on their own but instead cut pastures and fed it to the cows. Legumes, grasses and other supplemental crops that were planted were fed to the cows. This balanced diet ensured that the milk produced from these cows was of high quality.

2. It was asked whether there was any improvement in the livelihood of farmers who benefited from Heifer activities where they were given animals to raise.
   a. It was responded that these farmers had significantly multiplied the animals they were given
3. A participant wanted to know what the success rate was like with the farmers and cooperatives that had benefited from Heifer activities. He also wanted to know whether these farmers were able to stand on their own and cope when Heifer withdrew from their areas.
   a. It was responded that most farmers were able to cope even when the project withdrew. Informed that Heifer developed exit strategies by linking the farmers with government departments and they also trained some community members that would eventually also train other community members on the best ways of ensuring that the animals continued to multiply.
4. A question was asked why Heifer had not extended its activities to Western and North Western Provinces
   a. The response was that Heifer was still waiting for more donors in order for them to extend their activities.

3.6. Certification of *mabisi* and *munkoyo* by ZABS – what is needed?/ Traditional fermented foods to promote food and nutrition security in Zimbabwe

A representative from ZABS gave an overview of the role that ZABS played in the certification process and explained that there were currently no standards for *mabisi* and *munkoyo* but hoped that these would be developed in the near future. Also presented was traditional fermented foods to promote food and nutrition security in Zimbabwe. The question and answer session that followed is outlined below.

1. A comment was made that ZABS certification was not being recognized by markets such as South Africa. The participant asked ZABS to make a comment on this
   a. It was responded that this was a challenge because of territorial issues. Each country seemed to have their own certification bodies and explained that the Zambian

certification systems had not yet been accredited. Informed that some MoUs had been signed with countries like Botswana and Namibia which would recognize ZABS certification.

2. A participant congratulated ZABS on tailoring their certification program to SMEs considering that most agribusinesses were SMEs
3. A query was raised on the measures that ZABS had put in place to ensure the integrity of their certification mark on products
    a. ZABS responded that all certification marks were protected under PACRA and therefore anyone who was caught abusing the mark would be punished by law.
4. A question was asked on how long the certification mark was valid once a product was certified
    a. The mark was valid for three years but audits were done by ZABS officials every six months to ensure compliance
5. ZABS was asked about what they were doing about the high levels of antibiotics in milk and if these were checked by the Ministry of Fisheries and Livestock.
    a. ZABS responded that the standards outlined in the CODEX database on antibiotics was used and these were checked for in milk.
6. Asked whether ZABS had put in place a research and development team that would look into developing standards for *munkoyo* root as this was a drink that was widely consumed across the country, while others were consuming the poisonous one which was dangerous.
    a. ZABS hoped to quickly develop a standard but this was highly dependent on whether researchers could find ways of identifying the poisonous root from the safe one.
7. It was asked whether gaps existed between the ZABS standards and other international standards such as the EU, AU, etc.
    a. ZABS did not make standards in isolation of international standards. ZABS only created standards from the beginning if no international standards existed for a particular product
8. Concern was raised that national standards should promote businesses within the country but wondered whether ZABS was really doing that
    a. Responded that the role of ZABS was to facilitate trade

3.7. General question and answer session at the end of Day 2

1. A comment was made that it was a requirement for farmers under the Ministry of Fisheries and Livestock to administer livestock with antibiotics but these had a withdrawal period which needed to be followed in order to avoid excess antibiotic levels in the milk.
2. It was explained that the livestock sector had affected the ozone layer due to high methane production and therefore it was advised to use better quality pasture and forage that produced less methane.
3. A question directed at Heifer asked whether they would have the same amount of enthusiasm if the project on traditional fermented foods was changed to focus on green leafy vegetables instead, as an example.
    a. Most NGOs in the recent past had focussed on vegetables and it was time for people to move away from there. Also, climate change had negatively impacted on the farming of these crops. Increased malnutrition in developing countries also required that more small grains were grown. It was felt that the *mabisi* project was sellable in Zimbabwe because it was a product that was widely consumed and it was healthy. People needed to move away from the consumption of sugar sweetened beverages to more healthy drinks like *maheu*.
4. A comment was made that the researcher who compared the nutritional value of *mabisi* and *munkoyo* should first consider the nutritional content of the soil as it affected the nutritional value of the maize
    a. Responded that this was research that was underway
5. A participant asked for the definition of prebiotics
    a. Bacteria administered in sufficient amounts that bring health benefits to the consumer. They are able to attach to the gut, stimulate an immune response in the gut and help fight pathogens and produce vitamins.

At the end of day 2, a poll on the participants' perception of the workshop was done. The Acting Dean thereafter gave his closing remarks and closed the symposium at 17.25h.

REPORT ON THE THEME/ GROUP DISCUSSIONS HELD ON THURSDAY 29TH AUGUST 2019 AT CRESTA GOLFVIEW HOTEL

The Chairperson welcomed all stakeholders present and implored everyone to participate as it was the aim of the researchers to get feedback from the participants on the best way to roll out the production of *mabisi* and *munkoyo.* Participants were divided into different thematic groups and were allowed to discuss the different themes as outlined below. Key points that emerged from the different groups are outlined below.

1. GROUP 1 : SHELF-LIFE AND PACKAGING OF FERMENTED FOODS

1.1. Questions

- Preservation to improve shelf-life of *mabisi*?
- How do we increase the shelf-life of both *munkoyo* and *mabisi*?
- Consider ways of packaging for *munkoyo/ chibwantu/ mabisi*?
- How can we achieve the safety of *munkoyo* and *mabisi* in order to maintain hygiene?
- Is it that all the *mabisi* is safe for human consumption? If not, why?

1.2. Current ideas on shelf-life

- Fermented products as they are now
- *Mabisi*: continue adding fresh milk every day.
- Taste (acidity) indicates quality and shelf-life
- Trust in the producer from previous experiences, recommendations from other people
- Hygiene of the producer and its environment (Selling environment and the container; processors' hygienic practices of the seller eg. having kids, how she cleans, etc.)
- Traditional *mabisi* can be kept up to 7 days (sometimes one month in a fridge)
- Traditional product is packed in plastic bags, used water bottles or containers
- *Chibwantu* and *munkoyo* are already sold on the market with added preservatives

1.3. Research questions on shelf-life, packaging, storage conditions and time

- How long can we keep the properties (aroma, texture ie. viscosity, taste) of the *mabisi* after production (large and small scale)?
- Can we add preservatives that will not disturb the taste?
- What are the indicators of *mabisi* that has gone bad?

- Which aromatic compounds are related to fresh and spoiled *mabisi*?
- What are the characteristics of good *mabisi / munkoyo* ?
- Under which conditions the *munkoyo* get the bier?
- What are the alternative storage methods for storing *munkoyo* in areas that did not have refrigerators ? (storage of container in a bucket of water)
- How long should the fermented products be stored?

1.3.1. Building trust

- How can an upcoming producer of fermented products build trust in the population? It was responded that he needs to show the traditional root of the product and market the origin of the strains used.

1.3.2. Processing and storage to ensure safety

- Can we produce high quality mabisi using pasteurised milk?
- Under which conditions can the munkoyo roots / incorporated flours be used?
- How does the use of different containers (clay pot, plastic, etc) affect shelf-life?
- What are the proper procedures (temperature range) used for the storage of fermented products?

1.3.3. Good Manufacturing practices at small-scale production

- How can local people still produce mabisi of a high quality and that can be sold for long?
- How can we educate the primary producers in hygienic practices?

1.3.4. Packaging innovations

- What packaging size would fit better with consumer needs?
- Can we come up with affordable and safe packaging?
- What will be useful to add to the label?

1.3.5. Safety of raw materials

- How safe is *mabisi*? (TB, antibiotics, etc.)
- What are the potential risks in the raw material?
- What species diversity and characteristics do the *munkoyo* roots currently used have? Which root produces the best quality *munkoyo*?
- Can one identify from the end-product if the right root has been used?

1.3.6. Proper packaging that brings trust

- A branded, certified and packaged product that is attractive

- Indication that the product is GMO free
- Labelling that shows quality (expiry date, production date, certification tag, producer address, ingredients)
- The type of packaging should fit with the consistency of the product and be convenient (size)

2. GROUP 2: EMERGING ISSUES FROM CURRENT *MUNKOYO* RESEARCH

- Package information on the nutritional and health benefits of *munkoyo* in order to promote its consumption
    - Raw materials vs final product

2.1. Research questions

- Identification/ knowing of the Rhynchosia root species and characterization (plant, microbes, soil, properties of the root).
- Domestication of the *Rhynchosia* root (safe vs toxic, sustainability)
    - How can they be domesticated?
    - Does this affect the associated enzymes and microbes?
    - Which species are easily domesticated?
- Produce *Rhynchosia* root concentrate
- Does substituting the root affect sensory qualities?
- Possibility to come up with starter culture
- Improve nutritional properties of *munkoyo*
    - Fortification – legumes, nuts, premixes
    - Production using orange maize, cassava or small grains (sorghum, millet)
- Influence of raw material on nutritional value of the raw material
    - Breakfast meal, roller meal, *mugayiwa* (whole meal), sorghum, millet, etc
- Extend shelf life of *munkoyo* to improve its distribution chain
- Upscaling and commercialization
    - Production (upscaling and process/ product standardization)
    - Certification
    - Markets
- Entrepreneurship

- How do we ensure that women and youth entrepreneurs are empowered to benefit from this value chain?
- Profitability studies of the *munkoyo* value chain
    - HH, SMEs or large scale production

- Influence of *munkoyo* consumption on health
- NCDs
    - Gut microflora
    - Use of *munkoyo* as a weaning food

3. GROUP 3: USING TRADITIONAL NORMS AND BELIEFS IN MARKETING TRADITIONAL FERMENTED FOODS & BARRIERS AND OPPORTUNITIES

3.1. Cycle 1

3.1.1. Suggestions

- Leverage the organic label to market traditional fermented foods.
- Huge demand for organic foods, so marketing traditional foods as organic foods is a good market penetration strategy.
- Formation of cooperatives and sensitisation of the farmers on the benefits of being part of the cooperatives, e.g. easy to get access to markets, produce the volumes needed and also get funding.
- Need to do a market analysis to identify market needs, product demand and identify penetration strategies.
- Need to maintain the traditional label: production process, preservatives, commercial flavours, small grains (finger millet, sorghum)

3.1.2. Barriers previously faced with marketing of traditional fermented foods

- Consistency in volume, quality (hygienic practices, packaging) and safety.

3.1.3. Barriers and solutions to support production of fermented foods

- Consistency in product availability
- Delayed payment to farmers
- Competing livelihood activities resulting gin love volumes produced

3.1.4. Solution to increase production

- Encourage and facilitate participation of the private sector to formalise the value chain (linking cooperatives to commercial players).

- Encourage buyers to pay farmers on delivery of the product so that farmers can invest back into the business.
- Shorten the value chain and eliminate the middlemen.
- Need for information dissemination (packaging the information) to overcome some, religion, cultural and traditional beliefs
- Involve the local community and government structures to disseminate information and encourage adoption. Use multi-sectoral and multi-disciplinary approach.
- Capacity building (training and basic infrastructure and technology) to increase production in a safe and hygienic way.

3.2. Cycle 2

3.2.1. Suggestions and opportunities to commercialisation

- Fermented foods linked to tradition and cultural norms need to leverage on that when marketing to increase acceptance.
- Tapping into the cultural practice, improve it, e.g. improved processing, preservation, packaging, hygiene, sensitization whilst maintaining the tradition an cultural norms.
- Packaging of the message/advertising the product at the same time letting the community know that besides packaging etc., the product still remain the same.
- Trust is also key as we sensitise the community on the benefits of the product.
- Involve local leadership and government structures in sensitisation programme: multi-sectorial and multi-disciplinary.
- Use cooperatives and local structures as a starting point and also the youths.

3.2.2. Overcoming the Barriers to Increased Production

- Packaging the information to have an impact.
- Involve women in the promotion of the product.
- Lack of infrastructure, capital, technology, seasonal (shortages and overproduction in some seasons leading to inconsistency of quality).
- Formation of cooperatives could help access to finances.
- Farmers earn more from selling fresh milk than fermented milk.
- Information of the benefits of being in a cooperative needed.
- Partnership between farmers, buyers and banks could be a way to sustain the business.
- Improve on the governance of the cooperatives.
- Challenges in milk production: pastures, fencing of the land, diseases, making the feed at farm/cooperative level.

3.3. Cycle 3

- Should be processed and kept in its natural form – no addition of additives, colorants, and flavours.
- The traditional foods are part of culture, customs and legacy, it's part of livelihood, readily available and it's the locally available product.
- Possible to market is as a traditional product through processing the traditional way/process.
- Need to localise production and local own the process/product

3.3.1. Barriers

- Certification of the product to penetrate the market is expensive
- Market is readily available, but how to penetrate this market is a challenge

3.3.2. Overcoming the Barriers to Increased Production

- It is easier to penetrate the market as a cooperative than as an individual.
- Packaging is key, bottles versus selling straight from the milking can**.**

3.3.3. Cooperatives benefits

- Consistent market
- Value addition
- Market monopoly by big commercial processors
- Need for farmers to add value to the milk to avoid the monopoly
- Need to open up the market to Need to improve on the power dynamics in the chain to improve farmers' income.
- Capacity building (infrastructure, Good Manufacturing Practices/Good Hygienic Practices) to improve on the quality and safety of the fermented food products.

3.3.4. Meaning of traditional fermented foods to consumers

3.3.4.1. Characteristics

- Locally made and attached to cultural practices, customs: maintaining the tradition and cultural norms in the production process.
- Processed and kept in its natural form – no addition of additives, colourants, flavours.
- A product the consumers recognise and relate to the product.

3.4. Barriers to increased production and commercialisation of traditional fermented foods

3.4.1. Market monopoly by big commercial processors

- Lack of resources: e.g. infrastructure, capital
- Not being in cooperatives, resulting in limited market access.
- Limited raw material and seasonality, e.g. mukoyo roots
- Limited supply due to low quantities produced.
- Farmers not immediately paid for the milk they supply.
- Low income for farmers due to middlemen lowering the buying price.

3.5. Opportunities for increased production and commercialisation of traditional fermented foods

- Value addition and selling to other markets to improve on the power dynamics in the chain - increased farmers' income.
- Forming cooperatives: increased market access, product quantity, access to bank loans.
- Participation of farmers in the designing of supply contracts
- Capacity building of communities and cooperative, e.g. training, infrastructure.
- Involvement of local leadership in educating communities on benefits of fermented foods.

4. GROUP 5: ENTREPRENEURSHIP

Topic 1: Impact of mabisi on health and livelihoods under entrepreneurship perspectives

Topic 2: Communication and diffusion of the innovation of *mabisi* and *munkoyo*

4.1. Detailed questions

- Is the research project willing to fund sensitisation operations in the community about fermented foods?
- How can we socially market the consumption of *munkoyo* and *mabisi* in urban areas?
- The most preferred *mabisi* according to the survey should be promoted and commercialised by advising the producers to adopt the process to the commercial producers.
- Will this research benefit the community in terms of health and financially and general living standards of the communities?
- Is there a model or package which can help in dissemination of the findings of the communities, how do we share the information?

4.2. Topic 1: Impact of *mabisi* on health and livelihoods under entrepreneurship perspectives

Current mabisi impact on health, finances and sustainable livelihoods;

- Mabisi demand is very high-but the production is the problem.
- The traditional is preferred to the commercial-the selling proposition is the traditional
- Better to focus on upscaling of traditional mabisi to put it on the market
- The results (nutritional in the study) are good as a starting point to promote consumption
- It is associated with healing diarrhoea.

4.3. Hindrances on the impact of *mabisi* on communities

- Some people do not know *mabisi* the benefits and the product itself (because they grew up in the city
- Zambia is not a milk consuming country. How will people appreciate *mabisi* with this in mind? The demand for *mabisi* is different from fresh milk.
- The cost of *mabisi* is expensive.
- Storage facilities for milk at cooperative level.

4.4. Strategies to enhance mabisi impact

To make *mabisi* a business, the following should be done-:

- Standardisation of a mabisi processing start-up centre to coordinate the implementation of this result through ZABS
- Improve on packaging and branding to penetrate the urban market.
- Upscaling of *mabisi* production and make it sustainable and profitable
- Organise producers in cooperative form and
- Provision of infrastructure e.g storage facilities for preservation
- Creating market linkages.
- Formalise *mabisi* production and marketing through PACRA - remove red tap
- To have impact we need sensitisation on benefits of traditional *mabisi*.
- Branding of all types of *mabisi*
- Establish the infrastructural needs to enable value addition for *mabisi* production at community level.
- Increase consumption of *mabisi*
- Increase production to meet the current high demand

- Improve *mabisi* packaging – labelling with nutritional information (stereotypes are there for the elites).
- We have to differentiate *mabisi* from other related products.
- Create partnerships with other NGO's to promote the products.
- Better to focus on upscaling of traditional *mabisi* to put it on the market. What is the effect of working with dairy cooperatives?
- Value addition at the local level
- Include *mabisi* in nutrition feeding schemes and promotions.

4.5. Communication, diffusion and adoption of benefits

- Mindset change is important on sour milk
- Deliberate policy of sensitising people e.g. Use sour milk as first aid (when someone has diarrhoea).
- Radio, television, brochures, leaflets, agriculture field shows at different districts.
- Field days and food expos will be a good means of communication.
- In rural areas-drama groups in local language.
- Advertise using role models promoting the products. This creates more awareness.
- Use lead farmers in communication.
- Talk about generic campaigns on fermented foods.

4.6. What research is required to have entrepreneurial impact of these fermented foods

- Research on the links of *mabisi* and HIV and AIDS. What opportunities does this present?
- How to keep *mabisi* in its natural state – maintaining traditional *mabisi* and find ways of increasing its shelf life.
- Find use for the whey - what opportunities can be produced from whey by-products?
- Sensitisation to the producers to produce more. There is need for research to see if there is a demand for *mabisi.*
- Research on cost of production of different types of *mabisi* and profits associated with each production method.

5. GROUP 6: NUTRITIONAL ASPECTS OF MABISI AND MUNKOYO

5.1. To encourage use of *mabisi* and *munkoyo* as first-aid in treating diarrhea e.g. through the Ministry of Health/TV/Radio

- Understanding the topic:

- Benefit of *mabisi* over raw milk: sensitization with regard to nutrition; excessive consumption of mabisi

- Research perspective:
  - Determine the safety of over-consumption of mabisi
  - Determination of knowledge, attitudes and practices of consumers on cultural aspects, myths and taboos of munkoyo and mabisi consumption
  - Research on link of munkoyo/mabisi with breastmilk of lactating mothers
  - *Mabisi* fortification for management of malnutrition

5.2. What can we do with *mabisi* and *munkoyo* to diversify diets?

- Understanding the topic:
  - How can the communities use fermented beverages to improve diets through diverse ways of consumption?
- Research perspective:
  - How safe and how nutritious are the combinations of *munkoyo* and *mabisi* with other foods and frequency of consumption? How beneficial are the combinations?

5.3. *Mabisi* to be well packaged as weaning food:

- Understanding the topic:
  - As weaning food, *mabisi* needs to be packaged to look attractive, healthier and identifiable as a weaning product bringing out the nutritive values.
- Research perspective:
  - Determine optimal amounts for consumption towards meeting dietary requirements for the different age groups; to be put on the package
  - Determine desired packaging that is affordable, provide long shelf life and preserve taste and flavor; with information on nutrition

5.4. Enforce antibiotic residue checks in milk to have nutritious products

- Understanding the topic:
  - Antibiotics can affect fermenting bacteria and in the end affect the product quality
- Research perspective:

- Determine farmers' knowledge, attitudes and practices with regard to milk quality including antibiotic effects on *mabisi* production.
- Determine effects of antibiotics on *mabisi* production
- What sort of raw material (milk) is considered for production of *mabisi* with regard to composition?

- Understanding the topic:
  - Distinction between dairy animals and local animals for milk (effect on *mabisi* production)
  - Quality of milk with regard to grades of the milk for production of *mabisi* (pH, bacterial count)
- Research perspective:
  - Would any milk from any cattle breed be convenient for production of good *mabisi*?

6. QUESTIONS ARISING FROM GROUP PRESENTATIONS

6.1. Submissions on shelf-life and packaging of fermented foods

1. Asked what was meant by having a national product.
   a. The response was that the production of starter culture should be nationalized, beginning with the community before scaling up to national level
2. It was asked how it would be possible to ensure that the knowledge acquired from the locals on production of fermented products was protected so that the local people who knew the original processes benefited. It was also asked if it was the process or the product that needed to be protected (patenting)
   a. Responded that the starter culture produced would have the same bacteria found in the traditionally processed fermented foods. There was need to preserve the originality of the *mabisi* even after commercialization. This meant that when marketing *mabisi*, it would be important to make mention of the fact that strains used were from the traditional processing methods.

6.2. Submissions on research questions for evidence presented on fermented foods

1. Asked whether research could provide evidence of the effect of *munkoyo* on health and nutrition if used as a weaning food.

2. It was asked which branding and marketing strategies would be best for selling traditional fermented foods. It was further asked if these foods should be marketed as organic foods in resource constrained environments.
    a. It was responded that there was need to be more pragmatic, using media to market the products as 'healthy foods'. Also suggested that block shows could be used to market the products at cooperatives. Informed that because of the antibiotics used to produce the raw materials, *mabisi* could not be marketed as organic.
3. It was asked whether it was possible to domesticate the *munkoyo* root and if there was a possibility of producing it as there was a possibility of the root becoming extinct once its production was up scaled.
    a. The response was that there was need to research on the best ways of propagating the root to ensure sustainability or conservation of this root. In addition, once the root was propagated, it would also be easier for ZABS to certify the domesticated plant, ensuring that it was not adulterated.

6.3. Submissions on the meaning of traditional fermented foods to consumers

1. It was suggested that traditional fermented foods should be called, 'Zambian Foods' as opposed to using the 'traditional' term.
2. Informed that it was common practice for middle class people to go to restaurants where only local traditional foods such as *nsima* and other local delicacies were served. These restaurants also sold beverages such as *munkoyo* and *chibwantu*. Outlined that there was already an available market for fermented products and what was important was to preserve or maintain the traditional processing methods.

6.4. Submissions on Entrepreneurship

1. A participant asked whether it was a verified fact that *mabisi* cured diarrhoea.
    a. It was responded that it was not a proven fact but more research needed to be done in this area. There was also need to understand the type of diarrhoea that was linked to the consumption of fermented food (*mabisi*). The people were informed that the treatment of diarrhoea with *mabisi* was used in the treatment of severe acute malnutrition (SAM) in children to balance the microbiota in the gastrointestinal tract (GIT) which could have been washed out by the diarrhoea. This helped to arrest or slow down the diarrhoea.

6.5. Submissions on nutritional aspects of *Munkoyo* and *Mabisi*

1. A question was asked on what was meant by the phrase 'over-consumption of *mabisi*.' It was also asked how much was considered as too much.
2. A query was raised on whether goat's milk should be considered in the production of *mabisi*
3. A comment was made that at local level, there were competing needs for milk, i.e. it was sold to earn an income rather than being used to feed young children.

6.6. Submissions on shelf-life, safety and packaging

1. It was suggested that product information should be displayed including the level of production (household/ industrial). This was important because it affected quality of the product. For example, at household level, there were more concerns regarding hygiene and sanitation.
2. It was asked how the shelf-life of traditional fermented foods could be assessed
    a. The response was that the addition of fresh milk to *mabisi* helped to prolong its shelf-life. For *munkoyo*, adding fresh *munkoyo* that had not yet fermented could increase the shelf-life of the product but this was dependent on consumer preferences. Some consumers preferred more alcoholic/ sour tastes than others
3. It was suggested that packaging should be designed in different sizes to cater for the needs of different consumers

CLOSING REMARKS

The project coordinator made his closing remarks and thanked each of the participants for their invaluable input to the project. He informed them that the information provided would be used to roll out the next steps of the project, which included the commercialization of *mabisi* and *munkoyo.*

The workshop was closed at 16.10 h.

Prepared by: Taonga Chirwa-Moonga (MS); Lukonde Mwelwa-Zgambo (MPH)

ANNEX 1

1. LIST OF ATTENDANTS – 28 AUGUST 2019 (DAY 1)

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