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Probiotics, Health and Nutrition

Western Heads East

2015

Yogurt Production & Nutrition Research [2015]

Kathleen Walsh

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WESTERN HEADS EAST FINAL REPORT 2015

Intern's name	First name: Kathleen Last name: Walsh
Intern's program, level and year	Program: Bachelor in Medical Science with Scholars Electives Level: Undergraduate Year: 3
Intern's age and gender	Age: 21 Gender: F
Location of Internship	Country: Kenya City: Juja
Dates of internship	Arrival in country: Feb 24, 2015 Departure: July 7, 2015

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GENERAL FEEDBACK: Western Heads East Questionnaire

Section I: Internship Comments

- 1) **Summary of Expected Results Prior to internship (100 words). Goals to be achieved upon implementation of internship**
- 2) **Actual results achieved during the internship (up to 400 words): List the key short term results achieved during internship and long term outcomes of internship including those related to gender issues. (e.g. needs-based assessment, policy paper, good practice manual, guidelines, workshop, conference, program evaluation, survey, etc).**
- 3) **Variance between expected results and actual results, if any (up to 200 words): Explain variances between expected and actual results, if applicable. Variances are normal given changing contexts/situations.**
See reports for each goal
- 4) **Success stories (up to 200 words): What was the most successful aspect or element of your internship? Why was this aspect or element such a success?**
The most successful aspect of my internship was conducting quality control tests for each batch of probiotic yogurt and uji made. It was successful because I had the knowledge, supplies and space to conduct regular testing. I was also well prepared before coming to Kenya due to training with Shannon Sener in Dr. Reid's lab.
- 5) **Personal impact of your internship (up to 150 words): How has this internship changed your views of the world, of developing countries as well as your outlook on a different culture? How has this internship affected you at the personal level and/or changed you?**
The internship gave me a lot of time to think about my personal goals and priorities, and reflect on my strengths and weaknesses. It also gave me a greater sense of self confidence in who I am and my abilities. The internship also taught me how much of an influence (both positive and negative) Western culture has on developing nations, such as Kenya. I realized that there are some things, such as the values of trust, management and acceptance, which the Western world can teach to developing nations. I also recognized that the Western world negatives influences developing nations in many ways, for example Westernized advertising and Western normalized illicit drugs, alcohol and large sums of money, and popularize expensive, processed food products (ex. Coca Cola). Developing countries, such as Kenya have a lot to contribute to the global community, and instead of imposing change we should help to nurture their strengths when outside assistance is sought.
- 6) **How has this internship influenced your future career path?**
It has confirmed that I would like to continue to pursue a career in rural medicine. Additionally it has sparked my interest in seeking collaboration with Kenyan individuals to solve similar access to healthcare issues in rural Canada and Kenya.
- 7) **Key lessons learned regarding the priority theme addressed by your internship (e.g food security, production and marketing of probiotic yogurt) (up to 300 words): What do you know now about the production and selling of probiotic yogurt that you did not know prior to your internship?**

What are the links between environmental sustainability and the priority theme (where applicable)?

I know how to make probiotic yogurt and other fermented products, and I know a great deal about probiotics as indicated in my reports.

8) Recommendations for future interns: What were the main challenges with regards to this internship and what might be done differently the next time?

Recommendations for future interns

- Observe and understand the culture before commenting or implementing projects
- Get to know the people you are working with through informal settings (ex. meals, church) and learn what motivates the people you are working with
- Do not expect a lot of ground support
- Be flexible with your goals and expectations, and go with the flow
- Get continuous input from locals and do things in partner with long term inhabitants to ensure sustainability
- Ensure electronics are charged at all times and keep at flashlight in an accessible location at all times
- Stay positive and avoid negative “group think”

Section II: Public Engagement (NOT COMPLETED YET)

Summary of the public engagement activities and results in Canada to increase the level of awareness and understanding of international development issues among Canadians (up to 400 words):

Section III: Evaluation

Which of the following tools did you develop or activities did you perform? (you may check multiple boxes)

Collect survey and data Conduct research Develop training materials

Organize/deliver workshop(s)/ Training Develop new business practices

Prepare policy documents and reports Prepare proposals Conduct advocacy

Assist with networking Other

The internship provided you with the opportunity to strengthen which of the following skills?

Organizational Communications (incl. cross-cultural) Networking

Language Other

Please rate each of the following statements (1= disagree, 2= agree or 3= strongly agree)

I completed pre-departure training and felt well prepared for this internship	1	2	3
I have increased my level of knowledge regarding food security, probiotic yogurt and/or sustainable economic, business growth	1	2	3
I increased my understanding of development issues	1	2	3
I was able to make a positive contribution to the needs of the women’s group	1	2	3
I expect that the work I did is sustainable and will be continued by others after I leave/ or have spin off effects	1	2	3
I have increased my level of cross-cultural understanding as a results of the internship	1	2	3
I have enhanced capacity to engage in development	1	2	3

The internship was in line with my field of study	1	2	3
The internship was in line with my career aspirations	1	2	3
The internship will increase my employability	1	2	3
Overall I am satisfied with the internship	1	2	3
Would you recommend the WHE program to others?	<input type="checkbox"/> Yes <input type="checkbox"/> No		

RESEARCH ITEM 1: Visit kitchen and school in Embu County with Nicholas Nduti to observe and assist with study on school children at risk of aflatoxin poisoning.

I met with Nicholas in March to discuss his research. The purpose of Nicholas’ study was to determine if NN20 or GR1 could effectively decrease the levels of aflatoxin M1 in children in Embu County. A probiotic yogurt kitchen was set up at the Embu Agriculture Training College (ATC) and provided the probiotic and non-probiotic yogurt for Nicholas’ study. Baseline urine samples from all children were collected prior to the study and subsequent samples were collected every Friday throughout the study. After samples were collected they were stored in large tubes in a deep freezer that was connected to the Kenyan power and a backup generator. Samples were sent to Canada via a courier and portions were kept in Kenya for ELISA testing.

I met with Everlin at Embu University Agriculture Training College (ATC), a few weeks after meeting Nicholas, to compare probiotic yogurt production at the ATC to JKUAT. While both the ATC and JKUAT operate as training facilities, JKUAT is considerably larger than ATC with a greater number of staff and larger yogurt sales. It was found that their milk was considerably cheaper than milk supplied to JKUAT (Embu = University milk - 40KSH/L, ATC milk = 35KSH/L, outside milk = 50KSH/L whereas JKUAT = Outside milk (Julius) - 55KSH/L). To thicken their milk ATC used cornstarch which is cheaper than the skimmed milk powdered used at JKUAT. To incubate their yogurt they stored batches in a locally sourced wooden basket (500KSH) whereas JKUAT stores yogurt in a large incubator. Similar to JKUAT they do not use any preservatives and they purchase their 250mL bottles from General Plastics.

RESEARCH ITEM 2: Determine characteristics of clientele receiving the yogurt, and the sustainability of the kitchens.

Characteristics of clientele to assess: Amount of maize and peanuts ingested per week, levels of malnourishment, HIV incidence, malaria incidence, drugs for other conditions, kids stunted or suffering from chronic diarrhea, pregnant, eating corn that may be contaminated by aflatoxins, eating fish that may have excessive heavy metals, exposed to high toxic pesticides (not for malaria nets)?

The Kenyan government collects data for < 5 years old (MOH 705A) and > 5 years (MOH 705B) and under 40 different categories (see table 1).

I visited the Nyamaraga Health Clinic in Migori County on March 5, 2015 and collected statistics from the records officer on duty. The clinic has a **catchment population of 19 912** and sees approximate 13 938 patients per year. The top 10 outpatients illnesses treated at the clinic are listed in Table 3. Exposure to aflatoxins in maize, heavy metal in fish and pesticides were not a problem in this area, but malnutrition was the thirteenth most common outpatient illness with approximately 2 individuals, normally under the age of 5, per months treated. HIV is the fourth most common illness treated at the clinic. While Migori County has the fourth highest rate of HIV in Kenya at 13.4% (see Table 2), the Nyamaraga clinic has a slightly higher prevalence with **16.9% of their enrolled clients infected with HIV**. Screening for HIV is conducted regularly and **200-350 clients are screened each month** based on kit availability, and approximately 10 test positive each month. Of the clients enrolled at the clinic with HIV, approximately **45.2% of them receive treatment**. The remaining individuals who are not being treated have failed to follow up, are enrolled at other clinics or are assumed dead. Of the HIV clients being treated, **67.4% of them are receiving antiretroviral (ARV) medication**. The remaining clients are taking cotrimoxazole. The number of females receiving ARVs is double the number of males receiving ARVs.

I visited the records office in the JKUAT Hospital Juja, Kiambu County on March 19. The hospital is open 7 days a week and 24 hours a day, and most clients to the hospital are students or dependents of JKUAT staff members. Approximate **200 outpatients are treated each day** and types of diseases treated were considerably different than those treated the Nyamaraga clinic (see Table 4). I was unable to collect statistics on HIV because I did not have ethics approval, but I know Kiambu County has relatively low rates of HIV at 4.4%. I was also found out that HIV testing is free at JKUAT and approximately **200 are tested for HIV each month** and approximately **3/200 test positive**.

Sustainability of kitchens to assess: How is probiotic sustained? Are women receiving an income? Who is buying the yogurt? What happens when the study ends? How is product packaged? Are protocols written up? How are protocols passed on? Would there be interest in collaboration with WHE at JKUAT (discuss with Pamela)?

The Migori community displayed interest in the installation of a community kitchen. Public health officers seemed receptive to the idea and when yogurt has been sold at events in Migori (mostly funerals and school) people have indicated they liked the yogurt. Pamela had originally suggested a building beside the health clinic as a potential kitchen location (see Figure 1) but it does not have

running water and it appears quite small. Later Pamela suggested a site in Migori Town for the kitchen (see Figure 2) that had electricity and running water. The rent for the second site is 11 000 KSH per month, which is expensive but it is in a good location and is a tidy building. The cost of milk is also considerably cheaper which could make the product cheaper. However, I have a number of concerns that should be addressed before further embarking on setting up a kitchen in Migori:

- the product is too expensive for the most needy to purchase
- funds are lacking to start and maintain the kitchen
- I do not see anyone taking consistent leadership of the kitchen
- Accountability of funds has been an issue in previously kitchens and unless a specific individual at JKUAT takes leadership I believe it will also be an issue here
- It is too far to transport a liquid GR1 mother culture to
- Language differences might make it difficult for future interns to contribute
- Possibly inconsistent water and electricity
- Too small of a business to make profits

In regards to the setup of a kitchen at JKUAT and having JKUAT act as a mother culture distribution centre, I do not advise establishing either at JKUAT for the following reasons:

- funds are lacking to start and maintain the kitchen
- milk is expensive
- market (ex. campus) is already saturated with similar products (ex. High Treat probiotic yogurt)
- lack of leadership
- Lack of control
- Lack of continuous capital
- Difficult to make mother culture
- Lack of skill set to make the mother culture
- Lack of storage for mother culture before distribution
- Difficult to distribute mother culture to rural areas due to lack of vehicle refrigeration and expense of regular travel

Table 1: Categories for which statistics were collected in Kenyan healthcare facilities (data retrieved from Nyamagara Health Clinic in Migori County)

Accidents (ex. fractures)	Congenital anomalies	Infectious hepatitis	Plague
Anemia	Dental disorders	Intestinal worms	Pneumonia
Bilharzia	Diabetes	Malnutrition	Poisoning
Bites (ex. animal)	Diarrhea	Measles	Poliomyelitis (AFP)
Brucellosis	Dis of the skin (ex. wounds, abscess)	Meningococcal meningitis	Sexual assault
Burns	Dranunculosis	Mental disorders	Tuberculosis
Chicken pox	Dysentery	Mumps	Typhoid fever
Cholera	Ear infections	Neonatal tetanus	Urinary tract infection
Clinical malaria	Epilepsy	New AIDS cases	Viral haemorrhagic fever
Confirmed malaria	Eye infections	Other dis of respiratory system (ex. tonsillitis)	Yellow fever

Table 2: HIV prevalence in Kenya by county, 2012 (data retrieved from UNAIDS.org)

County	Adult Prevalence (%)	County	Adult Prevalence (%)	County	Adult Prevalence (%)
Baringo	4.2	Kisumu	18.7	Narok	4.9
Bomet	3.5	Kitui	4.8	Nyamira	6.9
Bungoma	3.5	Kwale	6.2	Nyandarua	3.9
Busia	7.1	Laikipia	4.1	Nyeri	4.4
Elgeyo	3.8	Lamu	1.3	Samburu	5.1
Embu	3.7	Machakos	4.7	Siaya	17.8
Garissa	2.6	Makueni	5.6	Taita Taveta	6.4
Homa Bay	27.1	Mandera	1.3	Tana River	2
Isiolo	3.8	Marsabit	1	Tharaka Nithi	5.1
Kajiado	5	Meru	3.3	Trans Nzoia	7.2
Kakamega	5.6	Migori	13.4	Turkana	9.9
Kericho	4.4	Mombasa	11.1	Uasin Gishu	4.9
Kiambu	4.4	Murang'a	5.2	Vihiga	6
Kilifi	3.7	Nairobi	8.6	Wajir	0.2
Kirinyaga	4	Nakuru	5.6	West Pokot	2.4
Kisii	8.9	Nandi	4.8		

Table 3: Top 10 outpatient illnesses treated at Nyamaraga Health Clinic in 2015

1. Malaria
2. RTI
3. Skin diseases
4. HIV
5. TB (97% also HIV infected)
6. Pneumonia
7. Typhoid fever
8. Diarrheal (prevalent for children under the age of 5)
9. Injuries (assault, accidents, breaks, cuts)
10. UTI

Table 4: Top 10 outpatient illnesses treated at JKUAT Hospital in 2014

1. Diseases resp
2. Diseases of skin
3. Dental
4. Diarrhea
5. UTI
6. Rheumatism
7. Accidents
8. Eye infection
9. Clinical malaria
10. Hypertension



Figure 1: Potential site 1 for yogurt kitchen in Nyamagara beside Health Clinic



Figure 2: Potential site 2 for yogurt kitchen in Migori town

RESEARCH ITEM 3: Journal - Ferment cereal with the Yoba sachet contents and determine if fermentation can be achieved.

ABSTRACT

Probiotics are live bacteria that when consumed in adequate amounts can confer health benefits to the consumer. Studies have shown that probiotics, such as *Lactobacillus rhamnosus* GG, can be beneficial in treatment and prevention of gastrointestinal diseases. Due to the prevalence of gastrointestinal diseases in East Africa, efforts are currently being made to increase access to probiotics in this region. Uji is a traditional, fermented, cereal based beverage consumed in Kenya, and due to its popularity in this country it has the potential of being good media to administer probiotics to the Kenyans. Probiotic uji was made using *Lactobacillus rhamnosus* GG and different types of flours. Quality control and sensory tests were conducted to determine whether uji is able to sustain acceptable populations of the probiotic, and whether probiotic uji differs from non-probiotic in appearance, flavor, texture, temperature and overall acceptability. Quality control testing indicated that uji is able to sustain appropriate levels of probiotic bacteria, and sensory testing showed that probiotic uji did not differ from non-probiotic uji in appearance, flavor, texture, temperature or overall acceptability.

INTRODUCTION

Probiotics are live bacteria than when consumed in adequate amounts can confer health benefits to the consumer. There are numerous types of probiotics, and one of the most documented strains is *Lactobacillus rhamnosus* GG (1). Probiotics, such as *L. rhamnosus* GG, have been shown to be beneficial for numerous conditions including the treatment and prevention of gastrointestinal diseases. At this time probiotic products are widely available in the western world where gastrointestinal health is generally good, but are less widely available in under developed regions, such as East Africa, where poor hygienic conditions, malnutrition, and acute and chronic enteric infections frequently lead to complex diarrheal disorders. Organizations such as Yoba for Life aim to increase access to probiotic products in Africa through the commercialization of *Lactobacillus rhamnosus* GG (1).

In 2014, representatives from Yoba for Life and probiotic researchers from around the world attended a workshop on capacity-building for African microbiome and probiotic research in Nairobi, Kenya. At the workshop they discussed ways to make probiotics accessible to 500,000-1,000,000 new East African beneficiaries within five years (2). Previously yogurt has been used to administer probiotics to East African populations (3), but if probiotics are to be made accessible to a broader range of individuals there must be a greater diversity of probiotic products. In Africa, there are a number of fermented products which are traditionally consumed (4, 5, 6). One such product is uji, which is a hot, fermented beverage regularly consumed for breakfast by Kenyan children. Due to its popularity in Kenya, and particularly rural Kenya, uji has the potential to be a good media to administer probiotics to this population.

Traditionally, uji is made from one of four flours (maize, cassava, sorghum, finger millet) or a combination of multiple flours. Maize is a corn-like plant that is high in dietary fibre, magnesium and phosphorus (7), and is considered Africa's most important staple (8). Cassava, or *Manihot esculenta*, is a

woody shrub that is a valuable source of iron, calcium, protein and vitamins A and C (9). Unlike maize, cassava is highly drought tolerant and is Africa's second most important food staple (8). Sorghum, or *Sorghum bicolor*, is also used to make uji and it is a type of grain. Finger millet, or *Eleusine coracana*, is another type of cereal used for uji production. It is particularly advantageous because its seeds are attacked less frequently by insects and mould than other types of grains, and it is a valuable source of methionine, which is an amino acid that is lacking in the diet of many people in the developing world who have a grain based diet (10).

Uji can be consumed fermented or unfermented, but fermented uji is more beneficial as the fermentation process produces flavor enhancing compounds, useful enzymes and essential amino acids, and some microorganisms have been found to produce antimicrobial products that lead to safe and long storing of foods (11). Fermented uji can be prepared in three ways – spontaneous fermentation, back slopping or the addition of a starter culture. Uji can be prepared spontaneously by allowing unpasteurized flour to ferment at warm temperatures. Uji can be prepared by back slopping by incubating pasteurized uji with uji that had previously been fermented. Lastly, fermented uji can be prepared by incubating flour with a standardized starter culture (12). After the flour has been fermented the mixture is pasteurized and fresh or fermented milk is added. Uji is usually served as a hot beverage with sugar.

This report examines whether uji made from sorghum, maize or finger millet can support probiotic populations, and if probiotic uji differs from non-probiotic uji in appearance, flavor, texture, temperature or overall acceptability.

METHODS

Uji Preparation

Uji was prepared at the Jomo Kenyatta University of Agriculture and Technology (JKUAT) diary workshop via starter culture fermentation. Water was warm on a gas burner and one or a combination of Soko brand maize, Golden brand sorghum or Wambi brand finger millet flour was added. Each type of flour was purchased from Uchumi's, a local grocery store. Water was gradually added to the mixture as the porridge thickened until it reached boiling. After boiling, the uji was cooled to 45C and 1g of *Lactobacillus rhamnosus* GG-1 (Yoba for Life sachet) was added for every litre of uji according to directions on the sachet. Both probiotic and non-probiotic uji were incubated with a pot of boiling water for 16-20 hours.

Quality Control Testing

Quality control testing was conducted in the JKUAT General Microbiology lab. Samples of uji were diluted using PBS and were plated on MRS agar vancomycin plates. Three 10uL drops were plated for each concentration 10E-09, 10E-08, 10E-07 and 10E-06. Plates were then incubated and the number of colonies was counted 24 hours later. The average CFU/ml was established for each sample. Drops that contained less than 3 or more than 30 colonies were excluded in average calculations.

Hedonic Sensory Testing

Hedonic Sensory testing was conducted at the JKUAT diary workshop on June 23. Twenty-one JKUAT staff and students of varying genders and ages were randomly selected from the park near the workshop. All individuals were provided with a sensory score card and were instructed to taste the uji and rate the appearance, flavor, texture, temperature and overall acceptability on a scale 1-9 (1=extremely dislike, and 9=extremely like). Samples were distributed in ice cream cups and participants sipped the uji from the cups. The probiotic uji was served at 22.7°C and the non-probiotic uji was served at 26.2°C. A Tuskey's HSD multi comparison t-test was used to compare means of ratings for each characteristic.

RESULTS

Results indicated that maize, sorghum and finger millet flour can successfully maintain populations of *L. rhamnibous GG1* at levels greater than or equal to 10E09 colony forming units per millilitre (CFU/mL). Furthermore, maize and sorghum flour can maintain high levels of the bacteria for over three weeks when refrigerated (see Table 1). Results of the sensory test showed that probiotic uji was not significantly different than non-probiotic uji for appearance, texture, flavor, temperature or overall acceptability (see Table 2). In the comments section of the score cards 85% of participants indicated the uji should have been sweetened and 46% indicated the uji should have been heated. One individual compared drinking cold uji to drinking cold coffee.

DISCUSSION

Based on the results of the quality control tests, uji made from maize, sorghum or finger millet flour are good mediums for probiotic growth as they can maintain high bacterial counts for over three weeks. Additionally, probiotic uji does not differ from probiotic uji in appearance, flavor, texture, temperature or overall acceptability. However, comments on the sensory test score cards indicated most JKUAT staff and students enjoy consuming uji hot. Since the bacteria will die above 45°C temperatures, it is difficult to store and serve probiotic uji at a high temperature. If it is assumed that opinions for uji of the JKUAT staff and students are representative of the general Kenyan population, it would be difficult to convince the Kenyan population to consume the uji at a temperature that is lower than that used in traditional preparation. Thus uji is not an ideal method to administer probiotics to Kenyans. Future study should compare sensory preferences and concentrations of bacteria in hot and cold uji, and sweetened and unsweetened uji. Species of probiotics that can survive at higher temperatures should also be examined.

ACKNOWLEDGEMENTS

Special thanks to the Fotec staff for helping me make the yogurt and conduct the sensory tests, and another thank you to Jennifer and Eluid Wafulu who allowed me to use their lab when I conducted quality control tests.

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APPENDICES

Table 1: Quality control tests for uji containing *Lactobacillus rhamnous* GG-1

Production date	Incubate time (h)	Analysis date	Probiotic	Sample name	CFU/mL	pH
14 Apr 2015	16	17 April 2015	Yoba	Maize	3.72E+08	
				Sorghum	6.65E+09	
				Maize + sorghum	1.50E+10	
		24 April 2015	Yoba	Maize	7.37E+09	
				Sorghum	2.66E+09	
				Maize + sorghum	6.90E+10	
30 April	Yoba	Maize	1.888E+10			

		2015		Sorghum	3.28E+09	
				Maize + sorghum	1.36E+09	
			None	Maize	0	
				Sorghum	0	
22 June 2015	20	25 June 2015	Yoba	Finger millet	>1.0E+11 TMTC at [10 ⁻⁹]	4.06
			None	Finger millet	0	5.85

Table 2: Mean rating (on scale of 1-9) for sensory test comparing non-probiotic and probiotic finger millet uji (prepared 22 June 2015)

Characteristic	Sample	Mean
Appearance	Non pro	7.76 ± 1.09 a
	Probiotic	7.95 ± 1.16 a
Flavor	Non pro	5.76 ± 1.58 a
	Probiotic	5.76 ± 2.43 a
Texture	Non pro	7.29 ± 1.42 a
	Probiotic	6.86 ± 1.96 a
Temperature	Non pro (26.2°C)	4.00 ± 2.00 a
	Probiotic (22.7°C)	3.86 ± 1.90 a
Overall acceptability	Non pro	6.61 ± 1.50 a
	Probiotic	6.42 ± 1.72 a

Note: For each characteristic, means in each row followed by the same letter are not significantly different ($P < 0.05$) according to Tuskey's HSD test.

RESEARCH ITEM 4: Journal - Identify sources of micronutrient-rich plants and flavors that can add value to the fermented product. Conduct quality control and sensory tests of different flavours.

ABSTRACT

Yogurt is a type of fermented milk that is traditionally made and consumed in Kenya. The value of yogurt can be improved by the addition of probiotics, flavoring and thickness adjustments. The first part of the study examined the flavor preferences of JKUAT staff and students for various fruits in *Lactobacillus rhamnous* GR-1 (Fiti) probiotic yogurt. The second and third parts of the study determined whether JKUAT staff and students preferred *Lactobacillus rhamnous* GG-1 (Yoba for Life) probiotic yogurt with or without skimmed milk powder, and whether they preferred *Lactobacillus rhamnous* GG-1 (Yoba for Life) probiotic yogurt with SMP or JKUAT Enterprise's High Treat probiotic yogurt. Results indicated staff and students liked sugar sweetened yogurt compared to fruit addition, they preferred yogurt with SMP and they preferred Yoba yogurt over High Treat yogurt.

INTRODUCTION

Africa has a long history of consuming fermented foods. Fermentation of milk and grain is particularly popular throughout Kenya. Fermentation can increase shelf life, enhanced nutrition qualities and improves a product's taste and texture. However, due to increase Western influence in recent years many Kenyans no longer know how to make traditional fermented foods, and are unaware of their health benefits, thus efforts are now being made by organizations such as Western Heads East and Yoba for Life to re-popularize fermented foods, such as yogurt, in Kenya (1, 2).

According to legislation, yogurt is classified as fermented milk in which "fermentation takes place with protosymbiotic cultures of *S. thermophilus* and *L. delbrueckii subsp. bulgaricus*" (3). Different types of yogurt are usually classified according to their physical state in their package, their fat and calorie content and whether or not fruit or flavor is added. The physical characteristics of yogurt can be categorized as either set, stirred or drinkable. Set yogurt is when fermentation takes place inside the package, stirred yogurt is when the gel is broken, cooled, and packaged following the coagulation and product solidifies again with an increase in viscosity after packaging, and drinkable yogurt is when the gel is broken and maintains the liquid consistency (3).

The quality of yogurt can be assessed using laboratory, texture and sensory evaluations. High quality yogurt has a firm body, smooth texture and an acidic taste. Yogurt consistency can be improved by using thickeners which increase water retention and viscosity. The most popular thickeners are corn starch and skimmed milk powder (SMP). SMP is of higher quality than cornstarch but is it also more expensive, thus most yogurt companies use cornstarch, or a mixture of cornstarch and SMP to thicken their yogurt. Yogurt acidity can be increased by lengthening the fermentation time (3).

Yogurt has benefits of both milk and fermented products, but its nutritional qualities can be further improved by the addition of probiotic bacteria. Probiotics are live bacteria that when consumed in adequate amounts, beneficially affect the consumer by improving intestinal balance and promoting

other health benefits. Many of the bacteria considered probiotic are lactic acid bacteria and are useful as probiotics because they are able to withstand the harsh digestive system and colonize in the gastrointestinal tract. The colonization of the probiotic in the gastrointestinal tract prevents the colonization by harmful bacteria that can cause illness. Probiotics have been shown to play a role in boosting the immune system, regulating the digestive system, alleviating infectious diseases, lowering cholesterol, lessening lactose intolerance, and prevent or reduce diarrhea and constipation (4), as well as urinary tract infections (5).

This study looked at ways to improve the taste, texture and consistency of yogurt. The first part of the study examined how the addition of different flavors affects Fiti yogurt's appearance, consistency, flavor, texture and overall acceptability. An earlier survey conducted in Oyugis in 2010 indicated "mango, pineapple, avocado are among the top 3 fruit pieces to have in yoghurt (6). In the second part of the study differences in yogurt thickness due to SMP were compared. In the final part of the study Yoba yogurt made at JKUAT was compared to High Treat probiotic yogurt made by the on campus competitor JKUAT Enterprises.

METHODS

Yogurt preparation

Yogurt was prepared in the JKUAT diary workshop. All pots and utensils were cleaned and sterilized prior to production. Cow milk, received from Embu County, was strained for impurities and pasteurized. Milk was then cooled to 45C and the Yoba for Life sachet was incubated at 45C for 6-8 hours. After incubation the yogurt was stored in a refrigerator. For part one, on the date of sensory testing fruits were bought at Uchumi's supermarket. Each fruit was peeled and chopped, and bananas were mashed. Fruit and strawberry flavoring were added to the yogurt just prior to tasting. For part two and three, SMP was added to half the yogurt prior to pasteurization.

Quality Control Testing

Quality control testing was conducted in the JKUAT General Microbiology lab. Samples of yogurt were diluted using PBS and were plated on MRS agar vancomycin plates. Three 10uL drops were plated for each concentration 10E-09, 10E-08, 10E-07 and 10E-06. Plates were then incubated and the number of colonies was counted 24 hours later. The average CFU/ml was established for each sample. Drops that contained less than 3 or more than 30 colonies were excluded in average calculations.

Hedonic Sensory Testing

Hedonic Sensory testing was conducted at the JKUAT diary workshop on June 23. Fifteen JKUAT staff and students of varying genders and ages were randomly selected from the park near the workshop. Individuals ranged in age from 20 to over 30 years old. The mean age was 22, the mode was 20 and the median was 21. All individuals were provided with a sensory score card and were instructed to taste the yogurt and rate the appearance, flavor, texture, temperature and overall acceptability on a scale 1-9 (1=extremely dislike, and 9=extremely like). Samples were distributed in ice cream cups and

participants sipped the yogurt from the cups. A Tukey's HSD multi comparison t-test was used to compare means of ratings for each characteristic.

RESULTS

In part one of the study, results indicated that the addition of fruit, sugar or artificial flavoring did not affect the number of CFU/mL for the Fiti probiotic (see Table 1). According to sensory testing the appearance of plain, sugar and artificial strawberry were rated the significantly higher than the other flavors and banana was rated significantly lower ($P < 0.05$). For consistency, sugar was rated the highest but it was not significantly different than plain or artificial strawberry, and banana was rated the lowest but it was not significantly different than avocado or mango ($P < 0.05$). For flavor, plain, avocado, mango and artificial strawberry were rated significantly higher than banana and sugar, and banana and sugar were not significantly different than each other ($P < 0.05$). For texture, sugar was rated the highest but it was not significantly different than plain or artificial strawberry, and mango was rated the lowest but it was not significantly different than avocado, banana and artificial strawberry ($P < 0.05$). For overall acceptability, sugar was rated the highest but was not significantly different than banana, and all the other flavors were not significantly different from each other (see Table 2).

In part two of the study, results indicated that the addition of SMP did not affect the number of CFU/mL for the Yoba probiotic (see Table 1). According to sensory testing the appearance and flavor of Yoba yogurt with and without SMP were not significantly different, but Yoba yogurt with SMP was rated significantly higher for texture, thickness and overall acceptability (see Table 3). In part three of the study, according to sensory testing the appearance, texture and thickness of Yoba and High Treat yogurt were not significantly different, but Yoba yogurt was rated significantly higher for flavor and overall acceptability (see Table 4).

DISCUSSION

Based on the sensory evaluations it appears that JKUAT staff and students prefer yogurt that is sweet tasting, has a high viscosity and a smooth, consistent texture. Sensory evaluations also indicate that JKUAT staff and staff like Yoba yogurt better than our on-campus competitor. These results can be used to improve the yogurt product. It is recommended that the yogurt be sweetened with sugar and continue to be thickened with SMP despite the additional cost. Future studies should compare Fit versus Yoba probiotic yogurt, and yogurt thickened with SMP versus cornstarch. Studies should also examine how the addition moringa powder and uji flour to yogurt affects quality control and sensory test results.

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APPENDICES

Table 1: Mean colony forming units per millilitre (CFU/mL) for quality control tests of yogurt containing *Lactobacillus* GR-1 (Fiti) or *Lactobacillus* GG-1 (Yoba)

Production date	Analysis date	Probiotic	Contents of sample	Mean (CFU/mL)
26 Mar 2015	31 Mar 2015	Yoba	No sugar no vanilla yogurt	3.00E+06
			No sugar yes vanilla yogurt	3.00E+06
13 Apr 2015	16 Apr 2015	Yoba	Mother culture plain yogurt	1.31E+09
		Fiti	Mother 1L – few grains added to 1L milk and incubated overnight	5.50E+04
17 Apr 2015	22 Apr 2015	Yoba	mother spoilt	2.20E+10
		Fiti	Mother 20mL - few grains added to 20mL milk and incubated overnight	3.08E+09
20 Apr 2015	23 Apr 2015	Fiti	Yogurt spoilt - 20mL mother was added to 1L milk and incubated overnight	1.40E+09
		Fiti	Yogurt plain - made from 1L mother (13/4/15) that did not have sufficient CFU	3.20E+05
20 Apr 2015	23 Apr 2015	Fiti	Plain	3.20E+05
			Avocado	2.38E+05
			Banana	1.13E+06
			Mango	2.62E+05
			Sugar	2.52E+05
			Artificial strawberry	2.60E+05
30 Jun 2015	2 Jul 2015	Yoba	No SMP	1.38E+09

Table 2: Mean rating (on scale of 1-9) for sensory test comparing Fiti yogurt flavored plain, avocado, banana, mango, sugar or strawberry (prepared 20 April 2015)

Characteristic	Fiti Sample	Mean
Appearance	Plain	8.6 ± 0.83 <i>a</i>
	Avocado	6.73 ± 1.67 <i>b</i>
	Banana	4.86 ± 2.36 <i>c</i>
	Mango	6.86 ± 1.06 <i>b</i>
	Sugar	8.47 ± 0.83 <i>a</i>
	Artificial strawberry	8.6 ± 0.74 <i>a</i>
Consistency	Plain	7.09 ± 0.93 <i>ac</i>
	Avocado	6.53 ± 1.68 <i>bcd</i>
	Banana	5.73 ± 2.60 <i>b</i>
	Mango	6.00 ± 1.36 <i>b</i>
	Sugar	8.47 ± 0.74 <i>a</i>
	Artificial strawberry	7.80 ± 1.01 <i>ad</i>
Flavor	Plain	3.47 ± 2.42 <i>a</i>
	Avocado	2.87 ± 2.07 <i>a</i>
	Banana	7.27 ± 1.83 <i>b</i>
	Mango	3.73 ± 1.99 <i>a</i>
	Sugar	8.6 ± 0.83 <i>b</i>
	Artificial strawberry	4.8 ± 2.65 <i>a</i>
Texture	Plain	7.53 ± 1.36 <i>bde</i>
	Avocado	6.33 ± 2.06 <i>ad</i>
	Banana	6.00 ± 2.24 <i>ae</i>
	Mango	5.40 ± 1.68 <i>a</i>
	Sugar	8.73 ± 0.59 <i>b</i>
	Artificial strawberry	7.13 ± 1.64 <i>ab</i>
Overall acceptability	Plain	5.73 ± 1.33 <i>a</i>
	Avocado	5.07 ± 2.28 <i>a</i>
	Banana	6.67 ± 2.32 <i>ab</i>
	Mango	4.93 ± 1.91 <i>a</i>
	Sugar	8.67 ± 0.49 <i>b</i>
	Artificial strawberry	6.33 ± 2.32 <i>a</i>

Note: For each characteristic, means in each row followed by the same letter are not significantly different ($P < 0.05$) according to Tuskey's HSD test.

Table 3: Mean rating (on scale of 1-9) for sensory test comparing vanilla Yoba yogurt with skimmed milk powder (SMP) to vanilla Yoba yogurt without SMP (prepared 30 June 2015)

Characteristic	Yoba Sample	Mean
Appearance	SMP	7.67 ± 0.97 a
	No SMP	7.29 ± 0.90 a
Flavor	SMP	7.55 ± 1.23 a
	No SMP	7.24 ± 1.34 a
Texture	SMP	7.86 ± 0.91 a
	No SMP	6.71 ± 1.49 b
Thickness	SMP	8.00 ± 0.95 a
	No SMP	6.61 ± 1.96 b
Overall acceptability	SMP	8.20 ± 0.70 a
	No SMP	7.50 ± 1.00 b

Note: For each characteristic, means in each row followed by the same letter are not significantly different ($P < 0.05$) according to Tuskey's HSD test.

Table 4: Mean rating (on scale of 1-9) for sensory test comparing strawberry Yoba yogurt with skimmed milk powder to JKUATES High Treat strawberry probiotic yogurt (prepared 30 June 2015)

Characteristic	Yoba Sample	Mean
Appearance	Yoba	7.00 ± 1.32 a
	High Treat	6.45 ± 1.46 a
Flavor	Yoba	7.35 ± 1.00 a
	High Treat	5.59 ± 2.09 b
Texture	Yoba	7.69 ± 1.20 a
	High Treat	6.94 ± 1.68 a
Thickness	Yoba	7.65 ± 0.79 a
	High Treat	7.18 ± 1.55 a
Overall acceptability	Yoba	7.70 ± 0.85 a
	High Treat	6.17 ± 1.85 b

Note: For each characteristic, means in each row followed by the same letter are not significantly different ($P < 0.05$) according to Tuskey's HSD test.

RESEARCH ITEM 5: Assess how easy it is for students at JKUAT to view, read and interpret the instructions on sachets to create probiotic yogurt and cereal.

Probiotic yogurt and uji were made with the Yoba sachets on numerous occasions. I found the instructions on the package very straightforward, and easy to follow. More importantly the JKUAT employees at the dairy workshop and the JKUAT nutrition students also found the process easy to complete. There were not any particular steps in which any individuals had trouble.

WHE ITEM 1, 2 and 3: Assist with yogurt production and set up of kitchen in JKUAT. Culture GR1 bacterial cultures and implement quality control testing of Probiotic yoghurt as learned in Dr. Reid's lab. Create log book to document and monitor regular testing to ensure viability and proper levels of the probiotic bacteria in the yoghurt

The following are my contributions to the set up and operation of a yogurt kitchen at JKUAT:

1. Yogurt and probiotic culture production

- a. *Made yogurt with the JKUAT Fotec staff:* I assisted Fotec staff with making and packaging their yogurt, and they helped me make and packaging my yogurt approximately once every two weeks.
- b. *Production ledger:* Created a product ledger to keep track of yogurt sales.
- c. *Attempted to culture Fiti Probiotic:* I went through the process of culturing the GR1 bacteria with the MRS broth powder that was already in the lab, however these culture could not be used to make edible yogurt since the MRS was used by a variety of students and there was a high risk of contamination. I was unable to purchase new MRS broth due to my inability to access funds and slow internal processes of the university.
- d. *Contacted Yoba for Life:* Due to expense of buying new lab equipment for mother culture preparation, the lack of skills set to make the mother culture at JKUAT, lack of storage space, risk of contamination and inappropriateness of providing the culture to potential rural kitchens. As a result, I contacted Yoba for Life (in Amsterdam) to inquire of cost and feasibility of purchasing Yoba for Life sachets until Fiti sachets are available. Yoba is able to provide thousands of sachets at \$50US per sachet (each sachet makes 50-100L of yogurt), and can ship them to Kenya if we can find a reliable courier.

2. Quality control

- a. *Conducted regular quality control testing:* Conducted regular quality control tests in the JKUAT general microbiology lab using the procedure displayed to me in Dr. Reid's lab for yogurt made using Fiti and Yoba probiotic strains. The Yoba sachets consistently made probiotic yogurt with acceptable quantities of bacteria (greater than $1.0E08$).
- b. *Create quality control ledger:* Sophie helped me create a formula on excel that will automatically calculate average CFU/mL. The excel chart also acts as a quality control ledger.
- c. *Taught Phyllis how to conduct quality control test:* Physically did the quality control process with Phyllis Ndanu.

3. JKUAT kitchen set up

- a. *Quotations and suppliers for kitchen items:* created a list of supplies required for new yogurt kitchen, contacted suppliers and received quotations for required items. From this I created a budget so that supplies could be purchased as soon as funds became available. I created two versions – one for mother culture (with lab supplies) and one for sachets. I assisted with making and ordering 20 000 labels (2KSH per label) and 27 700 bottles (~5.94KSH per bottle).
- b. *Opening and closing checklists:* Created protocols and signage for future kitchen

- c. *Hired and orientated Fiti project manager Phyllis*: created a job description, interviewed applicants and selected Phyllis Ndanu to act as the Fiti project manager. After hiring, I provided her with a detailed orientation of the project and what we had been working on.
- d. *Sought donations in Canada*: Reached out to organizations in my home town to donate to the Western Heads East project, spoke with media outlets, and followed up with those you gave donations.
- e. *Spoke with government officials to sponsor new kitchens*: Pamela and I met with various individuals to discuss providing funds to start yogurt kitchens in other parts of Kenya. In April we met with the Woman's representative of Homa Bay County and she promised to sponsor three kitchens in her community.
- f. *Updated handbook*: I continue to work of a revised Fiti manual specific for Kenya and JKUAT specifically that will contain all the information that is currently on the Owl website and more.

4. Selling and market yogurt

- a. *Received KEBS approval for yogurt*: Prepared the Fiti yogurt sample and assisted with submitting the application for certification from the Kenyan Bureau of Standards so the product could be sold in supermarkets. KEBS certification was granted and all bottles can now have the KEBS sticker.
- b. *Sold yogurt in rural areas*: Travelled with Pamela to her rural village in Migori and distributed/ sold yogurt at schools and funerals.
- c. *Sold yogurt on campus*: sold ~ 70 bottles on campus one day at 50KSH per bottles. Students and staff indicated they liked the product and would buy it again (this was before JKUATES).
- d. *Probiotic info poster*: create probiotic information poster
- e. *Production and sale ledger*: Sophie and I created a ledger to to keep track of yogurt produced and sold

5. Feasibility report and set up strategies

- a. *Ivey business students*: Indicated that it is difficult to 1) operate at a small scale and 2) hire
- b. *Sophie Wang*: indicated that the mother culture method is not feasible at this time and we should use the Yoba sachets to make the probiotic yogurt
- c. *Sustainability issues for JKUAT and rural kitchens*: see GOAL 2
- d. *Strategy for JKUAT and rural kitchens*: I created strategies for the JKUAT and rural kitchen set up and operation

6. Set up multi-faceted program in Migori to address needs of the community

Pamela had expressed interest in starting projects in her rural area in addition to the yogurt kitchen. I looked into setting up connections between schools in Canada and Kenya, and distributing reusable sanitary pads (Afripads). During my research I learned about the challenges many previous programs had faced (ex. lack of consistency, conflicting expectations, lack of funds, lack of local leadership, corruption). I realized that as much as I could organize something myself, I would not be able to ensure its sustainability from Canada so I directed my focus back to research and setting up the JKUAT yogurt kitchen.

ADDITIONAL GOAL: Case study - Challenges working and researching in Kenya

ABSTRACT

Western Heads East is a volunteer internship program offered by the University of Western Ontario. The program aims to empower woman and increase access to probiotic products in East Africa, by establishing probiotic yogurt kitchens in many areas of East Africa, which are operated by local women. Since the program's initiation in 2002, dozens of undergraduate, graduate and post graduate students have volunteered with the program in Kenya, Tanzania, Rwanda and Uganda. The program has encountered many challenges in the past while establishing these yogurt kitchens. In the new phase of the project, new kitchens are to be established in various regions of Kenya. While trying to establish this kitchen a number of barriers were encountered that made progress difficult. Issues such as lack of funds, inconsistent leadership and tribalism have affected the program's success in Kenya but are not unique to Western Heads East. Despite the challenges there are a number of ways in which these barriers can be overcome to maximize project effectiveness.

INTRODUCTION

Kenya is an East African country neighbouring Tanzania, Uganda, South Sudan, Ethiopia and Somalia. According to UNICEF, 46% of the Kenyan population lives below the poverty line, and a large portion of the population do not have access to basic services, such as health care, education, water and sanitation (1). In 2015, the Fragile State Index (previously called the Failed State Index) ranked Kenya as the 21st most fragile country in the world (2), and since the index was established in 2005 Kenya's score has consistency worsened (3). Poverty in Kenya is thought to be fueled by a variety of issues including unemployment, child labor, the HIV/AIDS epidemic, and a poor educational system (4), and the overall success of Kenya has further been limited by the large number of refugees, terrorism, internal corruption and severe weather patterns (such as drought).

Countries such as Kenya receive a great deal of support from the international community. Aid is provided by many parties and comes in many forms. Humanitarian aid is provided in response to emergencies and is short term in nature, whereas developmental aid is provided for long term developmental projects (5). When governments provide aid directly to the government of another country it is called bilateral aid. Bilateral aid is the largest source of aid received by a country. In fact, Kenya received the equivalent of 7% of its gross national income as bilateral aid in 2012, with the greatest portions going towards health and population (30%), humanitarian aid (19%), and economic infrastructure (19%) (6).

A smaller portion of aid received by a country comes from non-governmental (NGOs), such as Red Cross, CARE International, and Heifer International. These organizations often facilitate smaller projects with more specific goals. Currently there is no online record that indicates the number of international NGOs operational in Kenya, but according to the Worldwide NGO Directory, over 400 registered NGOs are active in Kenya (7), and are involved in variety of projects.

In recent years there has been debate regarding the effectiveness of foreign aid for countries such as Kenya. While there are many people that believe that foreign aid improves developing nations, other

people believe that foreign aid does more harm than good. Currently there is little data supporting either view point or that indicates what type of aid is most effective (5), but most people agree that aid is not perfect and can be improved.

There are a number of items that decrease the effectiveness of foreign aid. For example, the way in which aid is allocated is often unpredictable which reduces the ability of recipients to incorporate aid funds into spending plans and budgets. Additionally, aid funds are often tied to certain conditions which limit how the aid can be used. Furthermore, lack of coordination between aid organizations results in projects being duplicated and unnecessary spending. Also, recent trends indicate the number of aid organizations is increasing, but the size of organizations and projects is decreasing. It has been shown that this shrinkage may increase the success of small, short term goals, but decreases long term development and sustainability (5).

While there are many problems with aid organizations in general, each specific organization has strengths and weaknesses, and the regions in which an organization operates also impacts their effectiveness. Nonetheless, organizations can reflect on their operations and circumstances, and make changes increase efficacy.

CASE PRESENTATION

The Western Heads East program is a volunteer internship program offered by the University of Western Ontario. The program aims to empower woman and increase access to probiotic products in East Africa, to do this probiotic yogurt kitchens have been established in many areas of East Africa, and these kitchens are operated by local women. Since the program's initiation in 2002, dozens of undergraduate, graduate and post graduate students have volunteered with the program in in Kenya, Tanzania, Rwanda and Uganda.

The program has encountered many challenges in the past while establishing these yogurt kitchens. In the new phase of the project, new kitchens are to be established in various regions of Kenya and these kitchens are to be managed by Jomo Kenyatta University of Agriculture and Technology (JKUAT). In 2014, two interns were sent to JKUAT to lay the groundwork for setting up kitchens. In 2015, four different interns were sent to the university, with the intention to work with JKUAT staff and students to start a yogurt kitchen on campus. While trying to establish this kitchen a number of barriers were encountered that made progress difficult.

CHALLENGES

The major challenges that decreased the effectiveness of the Western Heads East project in Kenya:

- 1) *Inconsistent internet, electricity and water:* In many parts of Kenya there is no access to internet, electricity or clean water, and even in regions where they are accessible, the supply is inconsistent. The unpredictability of each of these items makes them unreliable and makes it difficult to plan ahead and complete tasks timely and effectively.

- 2) *Lack of funds and limited resources:* As with many charities, the lack of funds and lack of access to funds made it difficult to get meaningful work done. For example, money was required to buy equipment and raw material for the kitchen so as to make yogurt. Since funds were not accessible (and were not large enough) items to complete the project were unable to be bought.
- 3) *Inconsistent leadership and lack of project ownership:* Due to the nature of many NGOs, they often have a high staff turnover rate. Often staff members are not able to see their project to completion and new staff members want to 'put their stamp on something'. The problem with this, it "This lack of ownership, coupled with rewards for new ideas, reduces the incentive to use proven ideas or lessons learned elsewhere" (8). Western Heads East project has a similar problem with high turnover rate since their work on the ground is primarily led by student interns that are only there 3-6 months. Strong, long term leadership should be established on the ground to implement long term goals, and small, short term tasks should be distributed to visiting interns.
- 4) *Not learning from previous feedback:* In 2012 the Overseas Development Institute identified "difficulties in learning and communication between and across development organisations" (8). It is essential, particularly in an organization with high turnover, that there is strong communication between individuals entering and leaving the organization. Furthermore, evaluations on organization should be conducted regularly, and should include whether recommendations from previous evaluations were indeed acted upon. This would minimize repeated mistakes and would increase project flow.
- 5) *Corruption:* According to Google, corruption is a "dishonest or fraudulent conduct by those in power, typically involving bribery." Corruption is so embedded in the Kenyan society; there are a number of protocols in place in attempt to limit corruption. Many of the systems in Kenya appear very centralized which means that for anything to be accomplished they must go through a central person. These protocols can dramatically slow down the rate that tasks can be completed.
- 6) *Tribalism:* Kenya has seven main ethnic groups – Kikuyu (22%), Luhya (14%), Luo (13%), Kalenjin (12%), Kamba (11%), Kisii (6%), and Meru (6%). These ethnic groups can be further sub divided into 42 distinct tribes, each with their own traditions, histories, languages and territories (9). Traditionally, relations between certain tribes have been better than others, and this can affect cooperation efforts on projects throughout the entire country.
- 7) *Cultural differences:* While Canada and Kenya are alike in many aspects, the way each approach business is very different and this can lead to frustrations for both parties. For example, in the Kenyan culture business is done very informally, whereas in Canada the preference is to make deals and brainstorm ideas in meetings with a structured agenda. Connected to the business informality is the relaxed Kenyan culture. Speech and walking paces are much slower in Kenya in comparison to Canada, and it is not uncommon for individuals to be a couple of hours late for an appointment. Another difference is the importance of hierarchy in the Kenyan culture. Seniority is very much valued in Kenya and it is not customary to question people in authority. As Canadians we are taught from a young age to think critically about tasks and not always follow the status quo.

This can make work relations difficult particularly if there are disagreements in how a task should be completed.

- 8) *Conflicting goals and lack of direction*: Being that Kenya and Canada are at very different stages of development it is only expected that partners in each country would differ in their goals and project expectations. However, if priorities differ greater and if a common goal is not clearly established, it can be difficult to find sustainable solutions that meet the needs of all of the parties involved. This can hinder the progress of a project and decrease its likelihood of success (5).

RECOMMENDATIONS

As described above, Western Heads East, like other developmental organizations, has a number of challenges that prevents it from achieving its goals effectively. In “Does Foreign Aid Really Work? An Updated Assessment,” Riddell examines the problems with foreign aid in general and presents a number of solutions to the current challenges in foreign aid (see Figure 1)(5). Some of the recommendations are which would address the challenges within the Western Heads East program in Kenya include deepening knowledge of local contexts, ensuring short-term uses of aid are supportive of long-term development goals, seeking input from both the donor and recipient side in regards to course of action, and good quality evaluations with specific recommendations that include whether and how such reports are used. Additionally, there must be consistent leadership on the ground in Kenya, clear communication regarding project goals, and use of evidence based decision making (5).

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APPENDICES

Figure 1: Recommendations “Does Foreign Aid Really Work? An Updated Assessment” by RC Riddell

- 1) Deepening knowledge of local contexts
- 2) Ensuring short-term uses of aid are supportive of long-term development goals
- 3) Linking all aid more closely to overall developing country goals and processes
- 4) Prioritising help to build local capacities for recipients to coordinate aid better
- 5) Learning lessons – moving from rhetoric to reality
- 6) Rethinking how to help the poor in middle income countries
- 7) Reducing volatility in aid at the country level
- 8) Encouraging budget support by addressing donor-country political concerns
- 9) Rethinking ways of communicating about aid